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Abstracts

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Priv.-Doz. Dr. Georg Delle Karth

Tagungssekretär:
Univ.-Prof. Dr. Daniel Scherr

BEST BASIC ABSTRACTS

Increased [18F]FDG uptake in the myocardial infarction area highlights the "molecular glucose steal phenomenon" evaluated by single nuclei RNA-sequencing.

Lukovic D.[1], Pavo I.[1], Mester-Tonczar J.[1], Einzinger P.[2], Zlabinger K.[1], Kastner N.[1], Spannbauer A.[1], Traxler-Weidenauer D.[1], Pavo N.[1], Goliasch G.[1], Michel-Behnke I.[1], Winkler J.[1], Pavone-Gyöngyösi M.[1]

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Introduction: The precise evaluation of viable myocardium after acute myocardial infarction (AMI) holds critical prognostic value for patient management. We have previously reported increased metabolism in the infarcted area with decreased contractility and increased late enhancement (LE) (metabolism/contractility mismatch) assessed through combined [18F]FDG-PET and cardiac MRI (CMR) imaging with LE three days after experimental rAMI. To explore the molecular mechanisms of this observation, we employed single-nucleus RNA sequencing (sn-RNAseq), focusing on the differential gene expression and pathway activation involved in the metabolism/contractility mismatch.

Methods: Three days after porcine closed-chest reperfused AMI, and combined [18F]FDG-PET and CMR imaging, myocardial samples from the infarcted area of the animals exhibiting "match" and "mismatch" (Figure) metabolism/contraction were stored and subjected to sn-RNAseq. Sn-RNA-seq libraries were sequenced on the Illumina NovaSeq 6000 platform by the Biomedical Sequencing Facility at the Research Center for Molecular Medicine (CeMM). Downstream analysis identified nuclei clusters using the Seurat function FindClusters, following visualization of the results applying Uniform Manifold Approximation and Projection. Pathway enrichment analysis was performed in each nuclei cluster by employing the PathfindR package.

Results: Animals exhibiting a metabolism/contractility mismatch three days post-AMI manifested more severe impairments in left ventricular ejection fraction (LVEF) and exhibited a larger infarct size compared to those with a matched metabolism/contractility profile (Figure). Sn-RNA-seq analysis revealed distinct alterations in HIF-1alpha signaling, glucose metabolism pathways, and pro-inflammatory pathways within fibroblast, lymphocytes, and cardiomyocyte subpopulations within the Mismatch group. Transcriptional profiling unveiled higher glucose metabolism pathway activation, paralleled by robust inflammatory response, termed "molecular glucose steal," by highly activated inflammatory cells (monocytes and macrophages).

Conclusion: Our translational study revealed higher glucose utilization in the inflammatory cells migrating into the severely hypoxic myocardial area, stealing the energy-source glucose from the ischemic and non-ischemic myocytes, contributing to adverse ventricular remodeling after AMI. Our finding underscore the prognostic value of combined PET/CMR imaging during the subacute phase of reperfused AMI.

Malondialdehyde-specific natural IgM inhibit toll-like receptor 4 and peptidyl-arginine deiminase 4-dependent NETosis triggered by coronary extracellular vesicles of myocardial infarction patients

Ondracek A.[1], Afonyushkin T.[2], Aszlan A.[1], Taqi S. [2], Koller T.[2], Artner T.[1], Porsch F.[2], Sharma S. [1], Scherz T.[1], Hofbauer T.[1], Ozsvar-Kozma M.[2], Seidl V.[1], Beitzke D.[3], Testori C.[4], Lang I.[1], Binder C.[2]

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Introduction: Neutrophil extracellular traps (NETs) are critical mediators of thromboinflammation during acute myocardial infarction (AMI). However, triggers and signalling pathways of NETosis in AMI remain incompletely understood. Levels of extracellular vesicles (EV) carrying oxidation-specific epitopes (OSE) originating from lipid peroxidation are increased at the culprit site in AMI. Importantly, natural IgM antibodies with specificity for OSE, such as malondialdehyde (MDA), have been

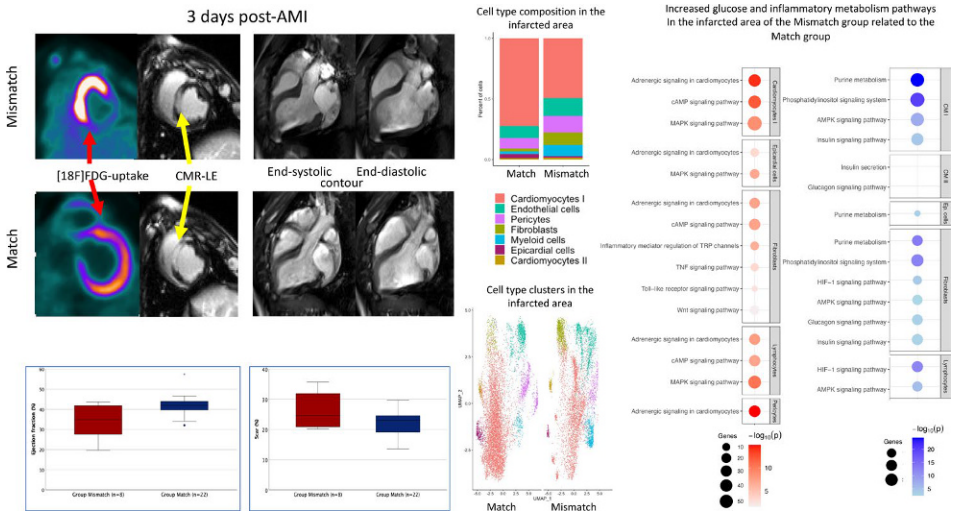

Fig. 1

shown to modulate functional effects of EV, and are associated with reduced cardiovascular risk. We investigated the stimulatory capacity of EV on neutrophil effector functions and specifically targeted key mediators of NET formation using pharmacological inhibitors and atheroprotective natural IgM to inhibit this process.

Methods: Patients were included after diagnosis of ST-segment elevation myocardial infarction and blood was aspirated from the culprit site and peripheral arterial site (n = 28) during primary percutaneous coronary intervention (pPCI). Myocardial function was documented by cardiac magnetic resonance imaging 4 ± 2 days and 195 ± 15 days after pPCI. EV were isolated from cell culture supernatants and culprit site plasma for neutrophil stimulation in vitro. Pharmacological inhibitors were used to map NET signalling pathways of EV. Isolated EV were used for neutrophil stimulation in a murine injection model in the presence of the MDA-specific IgM LR04 or an isotype control. NET formation and other neutrophil functions were assessed by flow cytometry, ELISA and fluorescence microscopy.

Results: Levels of NET surrogate markers and CD45+ MDA+ EV were higher at the culprit site than in the peripheral circulation. EV generated by LPS-activated THP-1 monocytic cells induced in vitro NET formation, release of neutrophil elastase and IL-8, and degranulation of MPO and NGAL in primary human neutrophils, but not reactive oxygen species. Toll-like receptor 4 (TLR4) and peptidyl-arginine deiminase 4 (PAD4) were identified as key mediators of NET formation induced by in vitro-generated EV and EV isolated from the culprit site of AMI patients. Notably, the effect of all tested inhibitors was not uniform across other neutrophil effector functions induced by EV. Functionally, the MDA-specific monoclonal IgM antibody LR04, but not an isotype control, inhibited the ability of patient-derived and in vitro-generated EV to trigger release of NETs in primary human neutrophils and in mice. Titres of MDA-specific IgM antibodies were inversely associated with the NET marker citH3 in blood of AMI patients. Finally, we found that the concentration of CD45+ MDA+ EV per protective MDA-specific IgM at the culprit site showed an inverse association with left ventricular ejection fraction 72 hours and 6 months after AMI.

Conclusion: We show that EV can trigger several neutrophil effector functions. EV-induced NET formation is TLR4- and PAD4-dependent and can be inhibited by OSE-specific natural IgM potentially influencing cardiovascular outcomes after an acute event.

Assessing Platelet Non-coding RNAs in the PACMAN-AMI Trial

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Introduction: Platelets are enriched in a variety of non-coding RNAs (ncRNAs) such as microRNAs (miRNAs), YRNAs, circular RNAs (circRNAs) and long-non-coding RNAs (lncRNAs). Upon platelet activation, platelets shed ncRNAs into the circulation. The PACMAN-AMI trial is a randomized, double-blind trial comparing alirocumab versus placebo in acute myocardial infarction (AMI) patients undergoing percutaneous coronary intervention. We have previously shown that alirocumab does not affect plasma ncRNA levels in the PACMAN-AMI trial [1]. We now perform longitudinal comparisons to assess the ncRNA response to long-term antiplatelet therapy. Moreover, we assess the compartmentalisation of circulating platelet-derived ncRNAs.

Methods: Plasma from 264 patients was collected upon admission to hospital for AMI (baseline) and dual antiplatelet therapy (DAPT) initiation; as well as 4 weeks and 52 weeks thereafter. We measured seven miRNAs, four YRNAs, two circRNAs, one lncRNA and one messenger RNA (mRNA) by reverse transcription quantitative polymerase chain reactions (RT-qPCR). To assess the compartmentalization of platelet-derived ncRNAs, we resuspended platelets from healthy donors in Tyrode's HEPES buffer and stimulated them ex vivo to generate plasma-free platelet releasates. In these releasates, we assessed carriers of ncRNAs using three distinct methodologies: ultracentrifugation (UC) to separate large extracellular vesicles (EVs), small EVs and EV-depleted supernatants; size-exclusion chromatography (SEC) to separate EV and protein fractions based on molecular size; and finally, treatment with proteinase (proteinase K) or detergent (Triton X-100) to selectively degrade proteins or EVs, respectively.

Results: Plasma levels of cardiomyocyte-derived miR-208b and miR-133a were elevated at time of AMI. The inflammation-associated miR-150 was elevated at week 4. Only few platelet-derived miRNAs (miR-223 and miR-197) were reduced at week 4. Almost all platelet-derived ncRNAs, however, showed a marked reduction at week 52. We then assessed ncRNA compartmentalization in plasma-free platelet releasates. Following UC, EV fractions contained predominantly circRNAs, lncRNAs and mRNA, while miRNAs and YRNAs were detected in EV-depleted supernatants. Similarly, SEC confirmed the presence of circRNAs, lncRNAs and mRNA in EV-containing fractions, while miRNAs and YRNAs emerged in protein-rich fractions. Finally, degradation assays revealed that proteinase selectively degraded all miRNAs, yet exhibited no effect on any circRNA, lncRNA or mRNA. Conversely, detergent led to degradation of all circRNAs, lncRNAs and mRNA, but leaving miRNAs unaffected. Intriguingly, all YRNAs, apart from RNY5, demonstrated resistance to both detergent and proteinase. Thus, in line with the UC and SEC results, the degradation assays corroborated the distinct compartmentalization of ncRNAs in plasma.

Conclusion: In this study we performed the largest longitudinal assessment of platelet-derived ncRNA levels post AMI to date. We included novel classes of ncRNAs (lncRNAs, circRNAs) which have not been investigated in this context previously. We show that plasma levels of most platelet-derived ncRNAs decrease in AMI patients after long-term DAPT (52 weeks), but not in the post-acute phase (4 weeks), where cardiovascular risk remains high. We also demonstrate that platelet ncRNAs are bound to different carriers: while small ncRNAs (miRNAs and YRNAs) are found within protein-rich fractions, circRNAs, lncRNAs and mRNA are contained within EVs. An improved understanding of how ncRNAs are compartmentalized after being shed from platelets could help in developing assays that target platelet-derived ncRNAs more specifically among the pool of other ncRNAs contained in plasma.

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Evidence for cardiomyocyte dysfunction in mouse model of cancer-induced cachexia in mice

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Introduction: Cachexia, a debilitating syndrome characterized by muscle wasting, energy depletion, and chronic inflammation, poses a significant threat to cancer patients, often exacerbating morbidity and mortality rates. Mounting evidence suggests that beyond its well-documented effects on skeletal muscle, cachexia may also impact cardiac structure and function, potentially leading to a condition known as cancer-associated cardiomyopathy. While previous studies have highlighted the association between cachexia, cancer, and changes in heart weight, the specific alterations in cardiac function remain inadequately understood.

Methods: Colon-26 adenocarcinoma (C26; cachexia) or shIL-6 (C26 shIL-6; cancer) cells were injected subcutaneously into the flank of adult male BALB/c mice (9–11 weeks old), while control mice received PBS injections. After twenty days, cardiac function was assessed through transthoracic echocardiography, invasive hemodynamic measurements, and ex vivo isolated working heart methods. Additionally, intracellular Ca2+ transient and force-calcium relationships were analysed in isolated ventricular cardiomyocytes (CMs). Cancer or cancer-cachexia-related inflammation in the myocardium was evaluated using flow cytometry, while cardiac fibrosis and capillary density were examined through immunohistochemistry. Finally, label-free LC-MS/MS proteomics and redox proteomics analyses were conducted on left ventricular (LV) tissue. Cardiac metabolism and energy profiles were evaluated using various biochemical assays.

Results: Despite comparable tumor sizes, the C26 group exhibited significant loss of subcutaneous fat and skeletal muscle ($p < 0.05$), indicating cachexia. Both tumor-bearing groups displayed LV systolic dysfunction, with cachectic mice showing more pronounced diastolic dysfunction. Sarcomere dysfunction, evidenced by reduced maximum calcium-activated tension and increased calcium sensitivity, was observed in tumor-bearing mice compared to controls ($p < 0.05$). Intracellular Ca2+ transients were markedly elevated exclusively in CMs from cachectic mice ($p < 0.01$). While there were no differences in cardiac inflammation and fibrosis, capillary density was significantly increased in tumor-bearing mice ($p < 0.001$). Furthermore, comprehensive analysis of the cardiac proteome revealed significant differences between controls and cancer mice (over 50 proteins up- or downregulated), with notable variations in redox proteomics between the two cancer groups ($p < 0.05$). Additionally, the C26 group exhibited a significant reduction in body weight ($p < 0.01$ vs C26 shIL-6), with both cancer groups displaying altered cardiac metabolism, including increased glycolysis and reduced fatty acid oxidation, alongside decreased ATP content and electron transport chain activity compared to controls.

Conclusion: In summary, LV dysfunction in cancer mice is primarily linked to sarcomere dysfunction, while abnor-

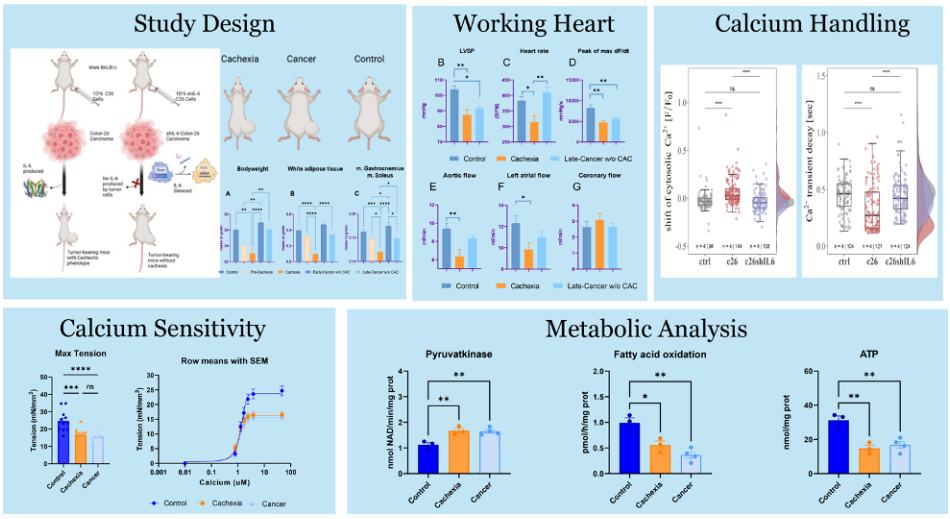

Fig. 1

mal intracellular Ca2+ handling is unique to cachectic mice. These functional changes are independent of myocardial fibrosis and inflammation, shedding new light on how cancer and cancer-cachexia affect the cardiovascular system. Our findings highlight that sarcomere dysfunction is a key contributor to LV dysfunction in cancer mice, while altered intracellular Ca2+ handling is specific to cachectic mice. Both cancer and cachexia seem to promote a metabolic shift from fatty acid oxidation to glycolysis. These functional alterations occur independently of myocardial fibrosis and inflammation, offering fresh insights into the cardiovascular impact of cancer and cancer-cachexia.

Neutrophil extracellular traps, deoxyribonuclease and fibrosis in thoracic aortic aneurysm

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Introduction: Albeit relatively rare, thoracic aortic aneurysm (TAA) is a severe cardiovascular disease. While timely diagnosis improves overall prognosis of patients, many remain asymptomatic; hence, they are not diagnosed, accounting for increased risk of acute aortic events. Irrespective of TAA localization, inflammation-mediated cystic degeneration of the aortic wall medial layer is a hallmark feature. During TAA formation, aortic tissue is infiltrated by neutrophils, which can form neutrophil extracellular traps (NETs). These NETs have pro-inflammatory and pro-thrombotic properties and promote progression of various diseases. Recently, NETs and abdominal aortic aneurysm (AAA) have been linked, while their effects on TAA development and progression remain unclear. Elaborating on a subject previously touched upon by our group [1], we aimed to characterize NETs and NET-specific markers in tissue and plasma samples of TAA patients.

Methods: We included 171 patients suffering of either ascending aortic aneurysm (n = 153) or Type A dissection (n = 18). Healthy subjects were recruited as controls (n = 135) during routine healthcare check-ups. Ascending aorta samples of patients (n = 48) and of aortic disease-free controls (n = 8) were collected and analyzed using Trichrome staining; NET burden was quantified in the medial layer of TAA samples using immunofluorescence. Plasma NET surrogate markers double-stranded (ds)DNA, myeloperoxidase (MPO), neutrophil elastase (NE), citrullinated histone H3 (citH3), DNase activity and other inflammatory molecules, including matrix-metalloproteinases (MMPs), were measured using a fluorescence-based assay and ELISAs, respectively. mRNA expression was assessed using qPCR.

Results: Median patient age was 65, and most were male (68.4%). Cardiovascular risk factors were common, including hypertension (77.8%), hyperlipidemia (57.9%), coronary artery disease (26.3%), and diabetes (18.7%). TAA patients were older with high BMIs and impaired kidney function. Trichrome staining revealed abundant fibrotic material in TAA, with elevated amounts of aortic fibrotic material compared to controls (47.99% vs. 38.94%, $p = 0.001$). Furthermore, fibrotic material increased with the CRP concentration ($rs = 0.415$). Using immunofluorescence, we found higher NET expression in diseased tissue (0.87 [0.3, 1.85] vs. 0.15 [0.03, 0.22]%, $p = 0.0017$). This increase was primarily driven by the dissection patients (1.76 [0.89, 2.83]%, $p = 0.0037$). Coronary artery disease patients had high NET burden (2.33 [1.13, 3.9] vs. 0.76 [0.21, 1.84]%, $p = 0.042$), whereas diabetic patients presented reduced NET depositions (0.3 [0.11, 1.14] vs. 1.19 [0.51, 2.33]%, $p = 0.005$). While plasma MPO levels were elevated in the TAA cohort [1], DNase activity was decreased (4.16 [2.66, 6.24] vs. 6.06 [4.25, 8.11] mU/mL, $p < 0.001$). Plasma levels of MMP2 were increased (250.36 [190.24, 351.32] vs. 218.85 [171.32, 263.87] ng/mL, $p = 0.004$). MMP2 correlated with aging ($rs = 0.262$) and aneurysm diameter ($rs = -0.299$). qPCR analysis of mRNA expressions in TAA samples revealed upregulations of the genes for TNFα ($p = 0.033$) and CD45 ($p = 0.003$), compared to tissue samples collected from aortic disease-free controls.

Conclusion: Aortic fibrosis is increased at the aneurysm site. Our data suggest that inflammatory mechanisms involving TNFα and leucocytes (CD45+) could be responsible for the deterioration of the aortic wall. Furthermore, increased local NET-burden is indicative of activated neutrophils in the aortic media. TAA patients present increased MPO levels and suppressed DNase activity in venous blood, accounting for higher neutrophil turnover and dsDNA accumulation. Increased systemic MMP2 levels denote its role in the TAA formation. Patient characteristics such as age and underlying comorbidities may interfere with the inflammatory cascades revolving around NETosis and consecutive aneurysm development. Our findings could enable further research targeting NETs and inflammation in TAA, possibly finding novel therapies capable of mitigating aneurysm development.

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BEST CLINICAL ABSTRACTS

Dapagliflozin in Patients with Heart Failure and Previous Myocardial Infarction: A Participant-level Pooled Analysis of DAPA-HF and DELIVER

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Introduction: Patients with heart failure (HF) and history of myocardial infarction (MI) are facing an elevated risk of disease progression and clinical events. Whether SGLT2 inhibitors may modify clinical trajectory in such individuals remains incompletely understood.

Methods: The DAPA-HF and DELIVER trials compared dapagliflozin with placebo in patients with symptomatic HF with left ventricular ejection fraction (LVEF) ≤40% and >40%, respectively. In this pooled participant-level analysis, we assessed efficacy and safety outcomes by history of MI. The primary outcome in both trials was the composite of cardiovascular death or worsening HF.

Results: Of the total of 11,007 patients, 3,731 (34%) had a prior MI and were at higher risk of the primary outcome across the spectrum of LVEF in covariate-adjusted models (HR 1.12 [95% CI 1.02–1.24]; Left Panel). Dapagliflozin reduced the risk of the primary outcome to a similar extent in patients with (HR 0.83 [95% CI 0.72-0.96]) and without prior MI (HR 0.76 [95% CI 0.68-0.85]; Pinteraction = 0.36), with consistent benefits on key secondary outcomes as well (Right Panel). Serious adverse events did not occur more frequently with dapagliflozin, irrespective of prior MI.

Conclusion: History of MI confers increased risks of adverse cardiovascular outcomes in patients with HF across the LVEF spectrum, even among those with preserved ejection fraction. Dapagliflozin consistently and safely reduces the risk of cardiovascular death or worsening HF, regardless of previous MI.

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Tricuspid regurgitation in atrial fibrillation: correlation to left atrial myopathy and improvement post ablation

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Introduction: Atrial fibrillation (AF) closely correlates to left atrial (LA) myopathy, which in turn can cause functional mitral regurgitation (FMR). The correlation of LA myopathy to tricuspid regurgitation (TR) is still unknown. Data on the dynamic change of TR post AF ablation is still limited. Therefore we sought to investigate the correlation of LA myopathy to TR and furthermore if TR can be improved by AF ablation

Methods: Consecutive patients presenting for first time AF ablation were prospectively enrolled. All patients underwent transthoracic echocardiography at baseline as well as 6 months after the ablation procedure. TR was graded as follows: mini-

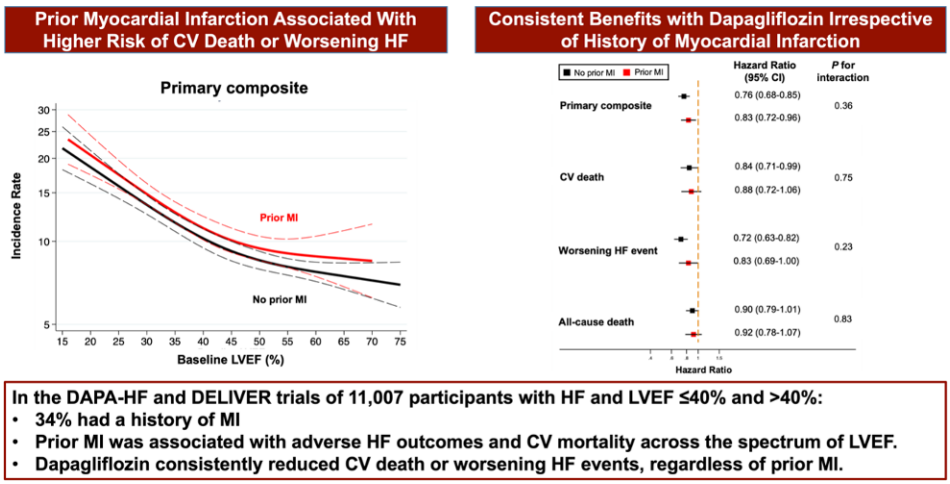

Fig. 1

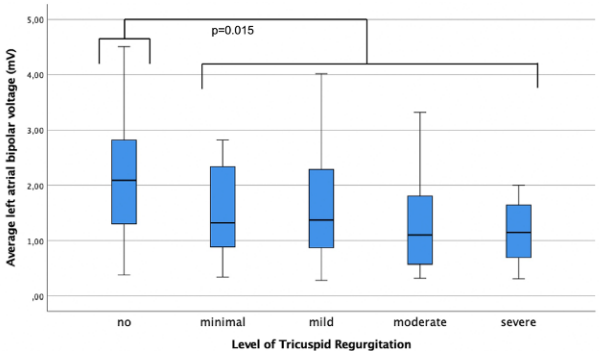

Fig. 1

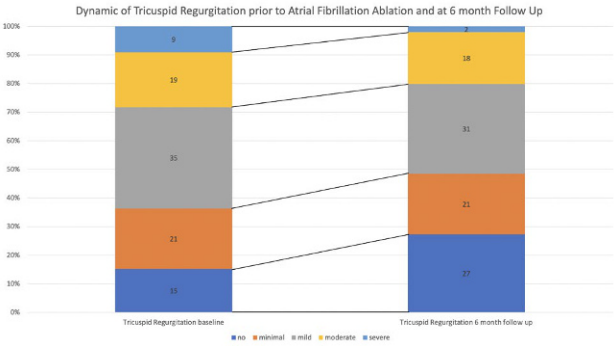

Fig. 2

mal, mild, moderate and severe (I-IV). All study participants underwent high density bipolar voltagemaps prior to AF ablation to characterize the presence of atrial myopathy.

Results: Our final study cohort consisted of 143 patients (age 64 ± 11 years, 47% female, 48% persistent AF). 15% had no, 21% minimal, 35% mild, 19% moderate and 9% severe TR, respectively. High density maps with 1325 ± 736 mapping points and with an average bipolar voltage of 1.58 ± 0.89 mV were created. A significant decline of average LA bipolar voltage is obvious, when comparing patients without TR to any grade of TR ($p = 0.015$) (Fig. 1), however there is no significant difference in LA bipolar voltage, when comparing different TR severity levels (Fig. 1). After a follow up of 6 months a significant improvement of TR was observed ($p < 0.001$) with a median level of improvement by one grade. 27% had no, 21% minimal, 31% mild, 18% moderate and 2% severe TR, respectively. (Fig. 2)

Conclusion: In patients presenting for AF ablation TR closely correlates with LA myopathy according to decreased levels of LA bipolar voltage. AF ablation results in highly significant TR level improvement.

Atrial functional and ventricular functional mitral regurgitation: definitions, epidemiology, and prognostic implications

Koschatko S., Heitzinger G., Spinka G., Dannenberg V., Koschutnik M., Donà C., Jantsch C., Halavina K., Hemetsberger R., Nitsche C., Demirel C., Hengstenberg C., Goliasch G., Bartko P.

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Introduction: Severe functional mitral regurgitation (fMR) can be divided into two subgroups: fMR of atrial (AfMR) and fMR of ventricular origin (VfMR). Studies on AfMR are scarce and inconsistent, lacking a uniform definition of AfMR. Hence, little is known about its epidemiology, morphological features, associated risk profiles, and prognostic implications. The objective of this study was to develop and test a uniform definition of fMR based on the morphological correlate and to describe demographic characteristics, detail entity-specific morphological features and to investigate the associated prognostic impact.

Methods: 13052 patients with severe fMR and those at risk of severe fMR (comprising mild and moderate fMR) were included. Based on the ratio of left atrial volume (LA) to left ventricular end-diastolic volume (LVEDV), those with severe fMR (n = 1163) were divided into AfMR and VfMR. The median of this ratio was used for allocation. Therefore, a LA/LVEDV ratio ≤ 0.56 indicated predominantly ventricular eccentric remodelling, whereas a ratio > 0.56 indicated predominantly atrial remodelling.

Results: AfMR was more frequently observed in female patients and peak age was a decade later, compared to VfMR. AfMR was the predominant fMR subtype in patients with heart failure with preserved (76%) and mildly reduced ejection fraction (61%), but a significant proportion could be observed

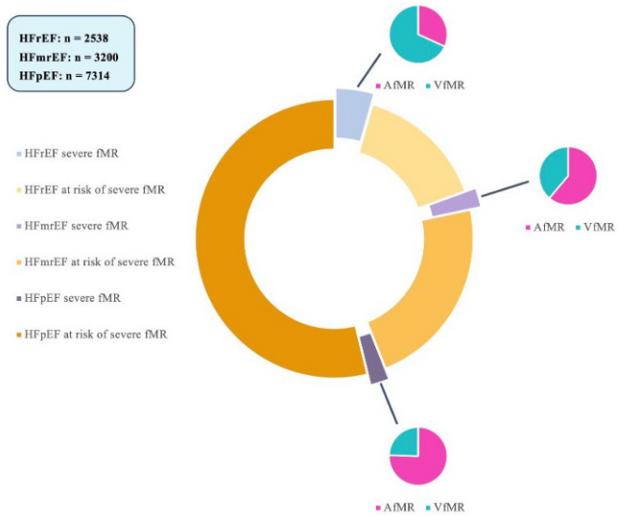

Fig. 1 Prevalence of fMR in patients with HF, stratified by subtype of HF and severity of fMR.

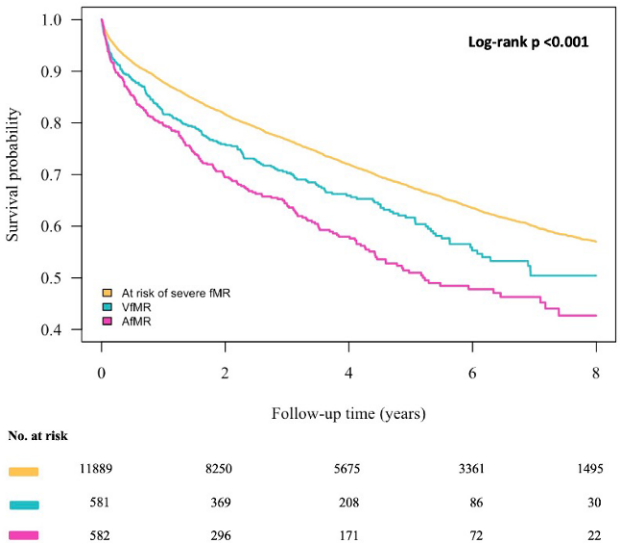

Fig. 2 Kaplan-Meier analysis comparing patients with HF and at risk of severe fMR, VfMR and AfMR.

even in patients with heart failure with reduced ejection fraction (32%). Severe fMR was associated with excess mortality for both entities: VfMR HR 1.31 [95% CI: 1.14–1.50], p < 0.001, with a more pronounced impact in patients with AfMR HR 1.68 [95% CI: 1.47–1.91], p < 0.001; AfMR vs. VfMR: HR 1.27 [95% CI: 1.06–1.54], p = 0.011. The association between severe fMR and excess mortality persisted even after multivariate adjustment. In both entities, ischaemic heart disease was common and resulted in a significant increase of mortality (VfMR: HR 1.67 [95% CI: 1.40–1.98], p for interaction<0.001; AfMR: HR 2.10 [95% CI: 1.75–2.52], p for interaction = 0.006).

Conclusion: Based on the entity-specific morphological correlate, severe fMR can be classified into AfMR and VfMR. AfMR occurs across the entire HF spectrum, is more frequently observed in elderly and female patients, and exhibits a worse prognosis than VfMR. The presence of ischaemic heart disease is associated with a near doubling of mortality in both subgroups of severe fMR.

Electrophysiological findings in Redo procedures after Pulmonary vein isolation with pulsed field ablation

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Introduction: Current data indicate similar success rates for PVI using pulsed electric field compared to thermal methods. However, reliable data and knowledge on recurrent arrhythmias and electrophysiological findings during redo procedures remain scarce.

Methods: We conducted a retrospective analysis of each redo procedure in patients, who underwent PEF PVI for ablation of symptomatic atrial fibrillation (AF) during the index procedure. Data were collected from the medical information system and the electroanatomical mapping system (EMS). All redo procedures were performed using radiofrequency. Left atrial (LA) maps were obtained before and after the redo ablation procedure. In cases where veins were reconnected, they were reablated. If further arrhythmias could be initiated subsequently, further ablation was carried out based on the type and cause of the respective arrythmia. Statistical analysis was performed using Microsoft Excel. Non-normally distributed quantitative data are presented as median and interquartile range (25th to 75th percentile), while qualitative data are presented as percentages.

Results: During a median follow up period of 225 (44–398) days, 47 out of 282 patients (17%) had arrhythmia recurrence, with a median time to recurrence of 4 (3–6) months. A total of 28 patients received redo procedures so far. Recurrent arrhythmia was AF in 68%, whereas 25% of the patients had documented atypical flutter (71% mitral isthmus dependant, 43% roof-dependant). In 14% AF and CTI-dependant typical flutter was evident and two patients had rhythmic narrow complex tachycardia documented before the redo procedure. In one patient, we detected a reentry around the right pulmonary veins, for which we performed a wide antral ablation of the otherwise not reconnected right pulmonary veins. 55/118 (47%) veins were reconnected at the redo procedure (0/1/2/3/4 reconnected vein(s): 11%/18%/36%/32%/3%). LSPV (n = 14), RSPV (n = 12) and RIPV (n = 19) were reconnected the most frequently at the anterior aspect (79%/83%/84%), LIPV (n = 10) at the inferior and posterior aspect (100%/90%). All reconnected veins could be successfully reablated. Additional ablation strategies were posterior wall (PW) isolation (25%), mitral isthmus line (14%), roof line (18%) and inferior line (4%). One case required reablation

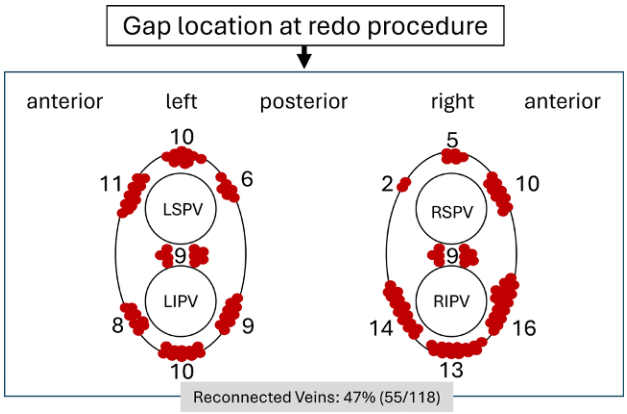

Fig. 1

of the PW despite isolation during the index procedure. Additionally, in 25% of cases, the CTI was isolated within the redo procedure. No complications occurred during the redo procedures. 76% of patients remained free from arrhythmias after a median observational period of 136 (65–255) days.

Conclusion: As PVI remains the cornerstone of AF catheter ablation, it is of utmost importance to decrease the chance of PVI reconnections in PEF ablation. Therefore, ongoing analysis of redo procedures is essential to adjust the ablation approach.

Arterial stiffness characterization of patients with different ACS-causing plaque morphologies quantified by optical coherence tomography

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Introduction: Optical coherence tomography (OCT) has refined acute coronary syndrome (ACS)-management by enabling in-depth characterization of culprit lesions. Differentiating between plaques with ruptured (RFC) and intact fibrous cap (IFC) has shaped clinical decision making. However, the systemic vascular changes associated with different plaque morphologies remain unexplored. The aim of this study was to investigate arterial stiffness among different ACS-causing plaque morphologies (RFC vs. IFC) and its prognostic value post-ACS.

Methods: We conducted a secondary analysis of a prospective registry study, including patients who underwent OCT-characterization of the ACS-causing culprit lesion and received arterial stiffness assessment 90 days post-index event. The association between arterial stiffness parameters, such as pulse wave velocity (PWV), aortic pulse pressure (APP), heart rate-corrected augmentation index (AIx@75) and plaque morphologies was assessed using logistic regression, adjusted for age, sex, hypertension, presence of diabetes mellitus, smoking status, LDL-C and discharge medications (ACE-inhibitors/ARBs, beta blockers, calcium-channel blockers and diuretics). A multiparameter model additionally included intima-media-thickness and all arterial stiffness metrics. Cox regression, further adjusted for stroke history, prior percutaneous coronary intervention or stable coronary artery disease and Killip class, evaluated the link between arterial stiffness parameters and major adverse cardiovascular events plus (MACE+).

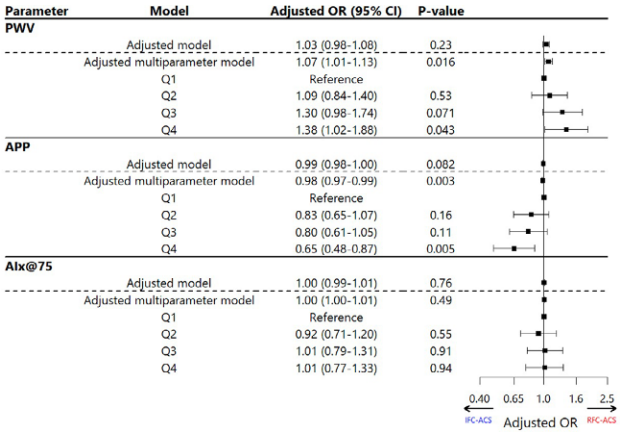

Fig. 1 Forest plot of arterial stiffness parameters and their association with RFC-/IFC-ACS

Results: In total, 110 patients with arterial stiffness and OCT data were included. Of these, 78 (70.9%) patients had RFC-ACS and 32 (29.1%) IFC-ACS. The median age was 61.5 years and 80.0% of patients were male. Patients with RFC-ACS had significantly higher PWV (8.35 vs. 7.50 m/s, p = 0.015) compared to IFC-ACS. Both groups received similar regimens of antihypertensive, diuretic and lipid-lowering pharmacological therapy at discharge (p > 0.1). After multivariable adjustment, increased PWV (4th Quartile [Q4] vs. 1st Quartile [Q1] Adjusted Hazard Ratio [aHR]: 1.38 [95% Confidence Interval (CI) 1.02–1.88], p = 0.043) was associated with RFC- while high APP was significantly associated with IFC-ACS as the underlying plaque morphology (Q4 vs. Q1 aHR: 0.65 [95% CI 0.48-0.87], p = 0.005) (Fig. 1). Furthermore, per one-unit increment in APP we observed a 10% increase in risk for MACE+ in patients with RFC-ACS (aHR: 1.10 [95% CI 1.02–1.19], p = 0.016) but not IFC-ACS (aHR: 0.95 [95% CI 0.82–1.11], p = 0.54). No risk modification with increases in PWV and AIx@75 were observed, regardless of underlying plaque pathology (p > 0.05).

Conclusion: There are distinct differences in arterial stiffness between patients with RFC- and IFC-ACS. These results underscore the value of a patient-specific approach that integrates invasive and non-invasive vascular characterization for identifying high-risk individuals and guiding therapy to enhance clinical outcomes.

Hepatic Tissue Alterations in ST-Elevation Myocardial Infarction: Determinants and Prognostic Implications

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Introduction: The presence and clinical significance of hepatic tissue alterations as assessed by cardiac magnetic resonance (CMR) imaging in patients with ST-segment elevation myocardial infarction (STEMI) are unclear. This study aimed to investigate associations of hepatic T1 patterns with myocardial tissue damage and clinical outcomes in patients suffering from acute STEMI.

Methods: We analyzed 485 STEMI patients treated with primary percutaneous coronary intervention (PCI) who were enrolled in the prospective MARINA-STEMI study (NCT04113356). Myocardial function and left and right ventricular (RV) infarct characteristics were assessed by CMR within the first week after STEMI. Hepatic T1 times were evaluated from standard cardiac T1 maps at baseline and 4 months after infarction.

Results: Median native hepatic T1 times were 591 ms (IQR: 548–634) at baseline and decreased to 560 ms (IQR: 528–588) at 4 months (p < 0.001). Hepatic T1 times at baseline were independently associated with female sex (β 0.185, p < 0.001), diabetes mellitus (β −0.094, p = 0.042), microvascular obstruction (MVO)(β 0.150, p = 0.015) and RV infarction (β 0.128, p = 0.006). At 4 months, hepatic T1 times were independently associated with female sex (β 0.112, p = 0.020), multivessel disease (β 0.103, p = 0.021) and RV infarction (β 0.157, p < 0.001). Higher hepatic T1 times at 4 months were independently associated with major adverse cardiovascular events.

Conclusion: Hepatic tissue alterations as determined by CMR T1 mapping were associated with female sex, diabetes mellitus, multivessel disease, MVO and RV infarction. These alterations can persist into the chronic phase after STEMI and are independently associated worse clinical outcome.

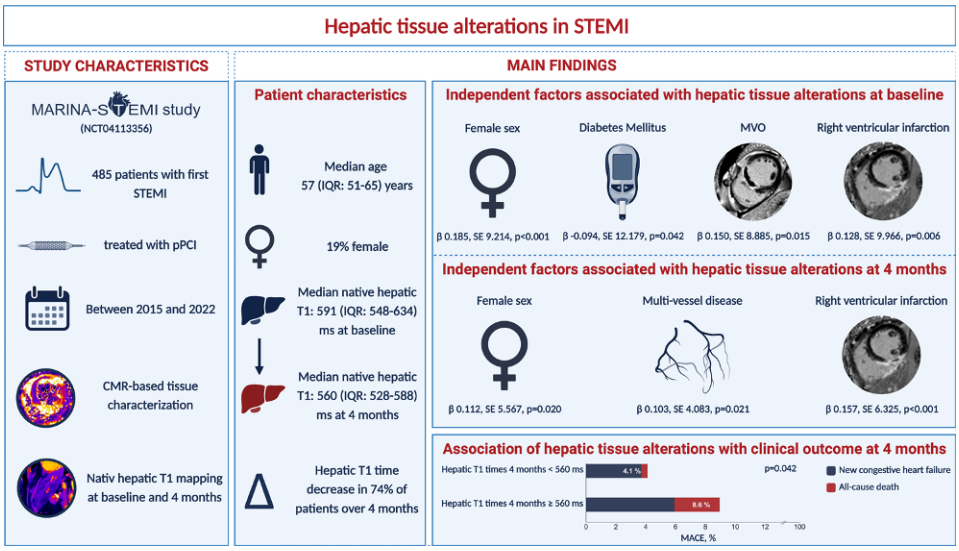

Fig. 1 Central Illustration

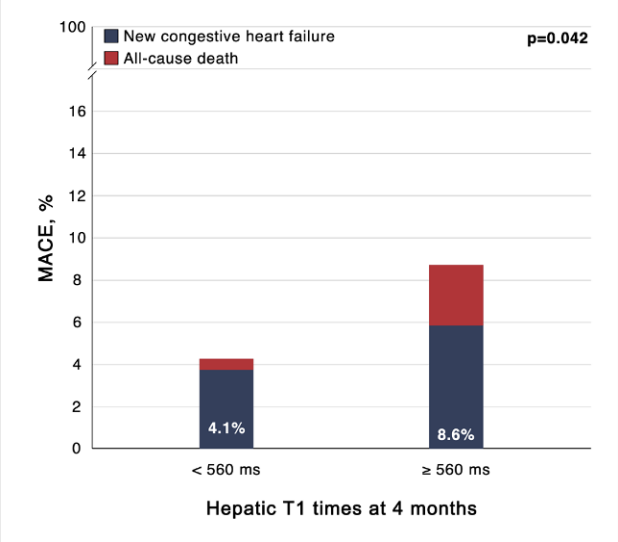

Fig. 2

BEST CLINICAL CASES

Sudden cardiac arrest as first presentation of an accessory pathway during pregnancy in a 34-year old patient

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Introduction: Sudden cardiac arrest (SCA) in pregnancy is rare while the risk of SCA during pregnancy is higher in the presence of an underlying cardiomyopathy. A thorough work-up including an electrophysiological study (EPS) might be necessary to make a diagnosis and for risk stratification.

Methods: This is a clinical case report of a 34-year old patient experiencing SCA whilst being 28 weeks pregnant. Due to immediate cardiopulmonary resuscitation she and her unborn child survived with a favorable outcome and without neurological sequelae. The delivery of her unborn baby was postponed to avoid a preterm birth. ECG, a transthoracic echocardiogram and a cardiac MRI showed inconspicous findings. Her past medical history revealed cystic fibrosis in an otherwise fit patient with no family history of cardiovascular diseases or SCA. An EPS was scheduled after the planned cesarian section at week 37 of her pregnancy. She was discharged with a wearable cardioverter defibrillator and followed up as an outpatient.

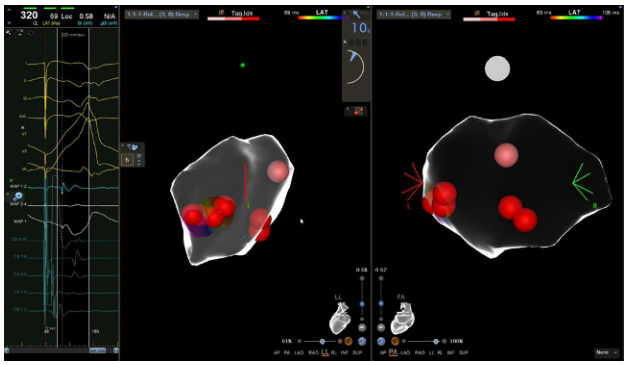

Fig. 1 3D MAP of ablation site

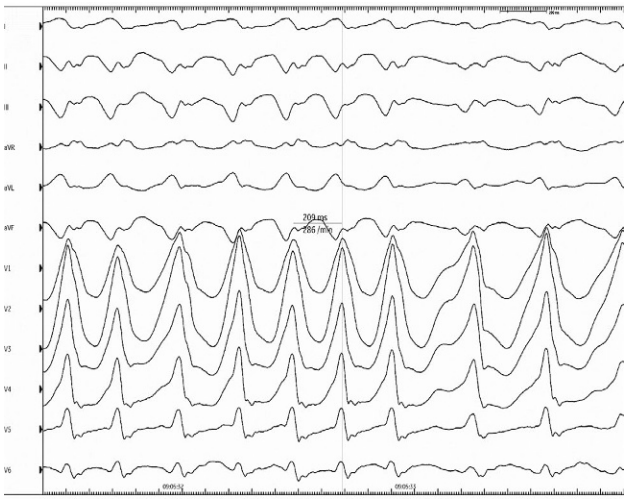

Fig. 2 Pre-excited atrial fibrillation with a SPERRI of 209 ms

Results: The EPS revealed a left lateral accessory pathway with high-risk conduction properties (accessory pathway effective refractory period<200 ms) and spontaneous pre-excited atrial fibrillation (shortest pre-excited RR interval in AF 209 ms). The accessory pathway was successfully ablated via a transseptal access. After completing further investigations to rule out any underlying cardiomyopathy or primary electrical disease as well genetic abnormalities, she was discharged without an ICD.

Conclusion: This case report represents SCA arrest as first presentation of a malignant left-lateral accessory pathway during the third trimester of pregnancy in a 34-year old patient. SCA in pregnancy is rare and needs a multidisciplinary therapeutic and diagnostic approach. This case report enhances the diagnostic and therapeutic importance of EPS during SCA work-up.

Navigating the Uncharted Waters: A Rare Odyssey through Diagnosis and Surgical Endeavors in Cardiac Paraganglioma

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Introduction: Paragangliomas, originating predominantly from chromaffin cells of the sympathetic nervous system, are uncommon neuroendocrine tumors. While commonly found in the adrenal glands, their occurrence around and within the heart is exceedingly rare. The distinctive nature of cardiac paragangliomas poses diagnostic challenges due to their elusive clinical manifestations and the scarcity of documented cases. Comprehending the behavior, prognosis, and optimal management of paragangliomas in the cardiac context is vital for infor-

med decision-making and effective treatment strategies. This background lays the foundation for delving into a specific case involving a cardiac paraganglioma, highlighting the complexities associated with diagnosis and management of this rare cardiac tumor.

Methods: A 62-year-old man presented in late 2023 to the internal medicine emergency department of a university hospital due to chronic cough and progressive exertional dyspnea. There were no relevant pre-existing conditions, ongoing medications, or allergies. A comprehensive echocardiography revealed, in addition to a approximately 1 cm pericardial effusion, a mass measuring approximately 7 cm in the interatrial septum. Further investigation of the tumor's nature led to hospital admission.

Results: Transesophageal echocardiography and additional non–gated computed tomography of the chest with intravenous contrast confirmed a malignant-appearing mass in the right atrium infiltrating the pericardium and the interatrial septum. Based on the radiological morphology of the tumorous process, differential diagnoses of a cardiac angiosarcoma or a paraganglioma were considered. Extended cardiac magnetic resonance imaging revealed a highly vascularized and centrally necrotic structure primarily originating from the pericardium, leading to a complete compression of the superior vena cava close to the atrium with colleteral circulation. For definitive diagnosis and detection of potential distant metastasis, both FDG-PET-CT and DOPA-PET-CT diagnostics were performed. Both PET-CT scans indicated neoplastic uptake in the right atrium with significant central necrosis, along with uptake in a lymph node near the pulmonary artery root. DOPA-PET-CT revealed additional uptake in another mediastinal lymph node. In conjunction with excessively elevated dopamine and 3-methoxy-tyramine levels in the 24-hour urine collection, the provisional diagnosis of a paraganglioma was confirmed. An interdisciplinary tumor conference involving cardiac surgery, cardiology, oncology, anesthesiology, radiology, and nuclear medicine recommended surgical tumor resection.

Conclusion: Preoperatively, the patient was pharmacologically prepared primarily with alpha-blockers, supplemented with beta-blockers a few days before the surgery. Tumor resection was performed under extracorporeal circulation and cardioplegia in mid-January 2024. Besides tumor resection, subtotal resection of the right and left atria and reconstruction of the superior vena cava using bovine pericardial patch plasty were necessary. The tumor's blood supply was mainly provided by the coronary arteries and their branches. In the absence of involvement of the AV valve apparatus and sufficient distance of the AV valves from the resection margins, no valvular reconstruction measures were required. Additionally, mediastinal lymph node bundles were removed and histopathologically examined. Immunohistochemistry of the excised tumor revealed robust co-expression of Chromogranin-A, Synaptophysin, and CD56, along with partial expression of S100. The same immunohistochemical profile was observed in 1 out of 7 removed lymph nodes, suggesting an additional lymph node metastasis of the completely resected paraganglioma. A postoperative DOPA-PET-CT examination is scheduled for mid-April 2024. Subsequent to this, the further course of action (Watch-and-Wait, radionuclide therapy, chemotherapy, molecular-targeted therapy, or immunotherapy) will be determined.

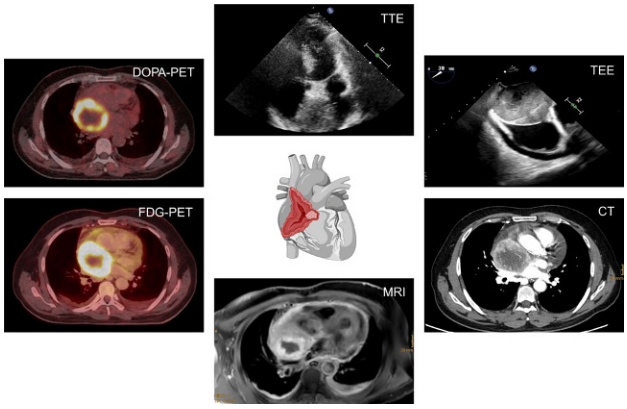

Fig. 1 Circle of Diagnosis

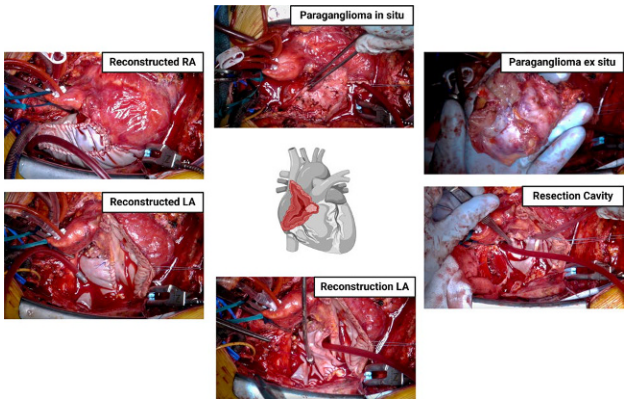

Fig. 2 Circle of Surgery

Thrombocythemia-associated Ticagrelor-non responder status after ECMO-supported primary PCI in STEMI

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Introduction: After percutaneous coronary intervention (PCI) in STEMI patients, the primary objective is to balance thrombosis prevention with minimizing bleeding risks. This includes the careful surveillance of antiplatelet therapy, particularly in light of resistance to antiplatelet medications. Thrombocythemia, another side effect in resuscitated STEMI patients, poses additional thrombotic risk. Simultaneously, modern risk scores based on extensive databases for primary prevention still seem to miss certain cohorts especially with familial history not based on familial hypercholesterinemia. This case report aims to emphasize a comprehensive approach to better identify and manage high-risk patients and thereby highlight the holistic care of coronary artery disease.

Methods: A 49-year-old male with a normal body mass index, presented with an acute ST-elevation myocardial infarction (STEMI) in the ECG leads II, III, aVF, and V1-V3. Cardiovascular risk factors include mild hyperlipidemia, mild untreated hypertension, and a positive family history of cardiovascular disease, including a brother with a heart attack at 42 years and his mother. Past medical history included abdominal trauma with splenectomy and left nephrectomy following a car accident 30 years ago. Coronary angiography revealed right coronary artery (RCA) occlusion and severe coronary three vessel disease. During the intervention, the patient developed cardiogenic shock with refractory ventricular fibrillation, necessitating a 65-minute LUCAS resuscitation and veno-arterial extracorporeal membrane oxygenation (ECMO) support. The culprit

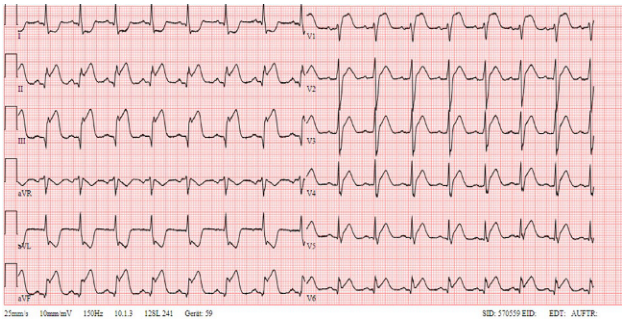

Fig. 1 Initial ECG demonstrating ST elevation in inferior leads and V1-V3

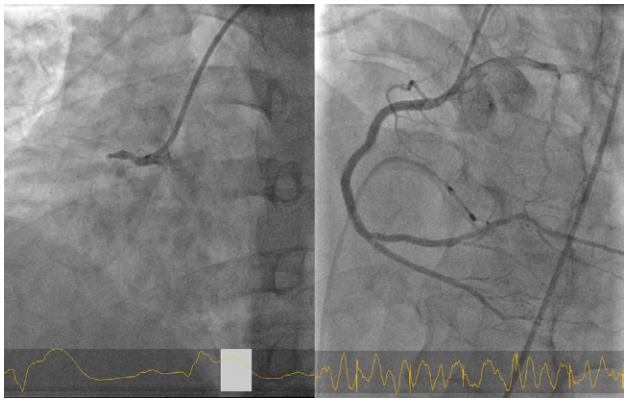

Fig. 2 Coronary angiogram showing (a) 100% acute proximal occlusion of the RCA in RAO cranial view (b) TIMI III flow in reopened RCA in RAO cranial view

lesion was treated with dual drug-eluting stent (DES) implantation following establishment of a Cangrelor perfusor.

Results: LDL was elevated at 150 mg/dl, whereas Lp(a) was very low with 4 mg/L. Interestingly, there was a continuous increase in platelet count, reaching over 1,100,000/µl. Abdominal sonogram and JAK 2 testing showed unremarkable results. Considering the complex situation, Multiplate testing was performed to evaluate platelet aggregation. It indicated Ticagrelor resistance, leading to a switch from Ticagrelor to Prasugrel due to inadequate antiplatelet response. Repeated platelet function testing resulted in an adequate response to the new antiplatelet regimen. Elective coronary angiography performed four weeks later revealed optimal stent positioning and integrity in the RCA. Moreover, a total of seven drug-eluting stents (DES) were placed in the left main (LM), left anterior descending artery (LAD) including a diagonal branch and left circumflex artery (LCX). The thrombocytes were within the normal range again, without specific treatment.

Conclusion: With widespread clinical use, the incidence of Ticagrelor resistance seems to gain importance (1). In combination with thrombocytosis, that has been described to have the potential to lead to thrombotic total coronary occlusions itself (2), the patient was at an extremely high risk of a secondary event. While PCI remains the cornerstone of STEMI management, earlier detection of severe coronary artery disease could allow a more tailored revascularization strategy with primary or secondary surgical intervention potentially leading to better long-term outcomes in patients with a high SYNTAX-Score (3). Considering that a significant portion of STEMI patients present with multivessel coronary disease, there also exists an imperative to recognize patients at risk a priori to prevent adverse events. Modern risk scores based on extensive databases aim to predict cardiovascular risk in supposedly healthy individuals. However, there still seems to be a subset of patients who are not correctly classified, especially with familial history. New polygenic risk scores seem to be a first step in these endeavors. For familial risk, Guidelines mainly focus on familial hypercholesterinemia. Other methods for quantification in patients not fulfilling criteria for primary hypercholesterinemia and low lipoprotein A are desirable.

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Variant cardiac transthyretin amyloidosis presenting as hypertrophic cardiomyopathy with left ventricular outflow tract obstruction

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Introduction: In August 2021 a 67-year-old male patient was referred for congestive heart failure in the presence of left ventricular hypertrophy (LVH) with exertional dyspnoea (New York Heart Association; NYHA class II) and angina pectoris (Canadian Cardiovascular Society; CCS class II) progressing during the last months. He presented with operated bilateral carpal tunnel syndrome. In clinical examination no cardiac murmur was noted at rest. Cardiovascular risk factors comprised arterial hypertension with an office blood pressure of 177/79 mmHg. Premedication included Bisoprolol 1.25 mg, Amlodipine 5 mg and Candesartan 4 mg. Levels of both, N-terminal prohormone of brain natriuretic peptide (NT-proBNP) and high sensitivity cardiac troponin T (hsTropT), were elevated (119 pg/mL and 28 pg/mL, respectively), while serum creatinine was normal (0.93 mg/dL). The 12-lead electrocardiogram (ECG) showed sinus bradycardia, left anterior hemiblock without Sokolow-Lyon index indicating low voltage or LVH. Transthoracic echocardiography revealed a maximum septal wall thickness of 20 mm with a sigmoid septal hypertrophy phenotype. An incomplete systolic anterior motion (SAM) was observed at rest and during Valsalva manoeuvre, with a resting left ventricular outflow tract (LVOT) gradient of 36 mmHg (Fig. 1). Forced provocation using the squat-to-stand manoeuvre induced complete SAM and significant left ventricular outflow tract obstruction (LVOTO), with a peak LVOT gradient of 64 mmHg.

Methods: Cardiac magnetic resonance imaging (cMRI) revealed transmural diffuse late gadolinium enhancement (LGE) at the posterolateral basis as well as subendocardial anterolateral LGE that was initially interpreted as compatible with hypertrophic cardiomyopathy (HCM) or postischemic pattern. Additional mapping sequences were not performed initially.

No arrhythmia was detected in Holter ECG. Using the European Society of Cardiology HCM sudden cardiac death (SCD) risk calculator, an SCD risk of 1.89% was calculated yielding no indication for primary prophylactic implantable cardiac defibrillator (ICD). Six minutes walking distance was 445 meters. Initially no genetic testing was performed, because the patient is childless, and family history was not indicative for hereditary cardiovascular disease. Hypertrophic obstructive cardiomyopathy was diagnosed. Bisoprolol was escalated and coronary angiography was planned, and the patient was informed about the possibility of septal reduction therapy. The coronary angiography revealed a coronary artery disease and implantation of two drug eluting stents in the left anterior descending artery and right coronary artery was performed. Due to the development of symptomatic bradycardia, the maximally tolerated Bisoprolol dose remained at 1.25 mg daily. After the intervention, the patient no longer had angina pectoris or symptoms of heart failure. However 6 minutes walking distance did not improve (435 m), because of progredient numbness in his legs.

Results: In echocardiography, the provocable gradient was still present. Since the patient was asymptomatic at this point, Amlodipine and Candesartan were eliminated, due to their preload and afterload lowering effect. We decided to not extend pharmacological or septal reducing therapy options. Due to neurologically confirmed progredient polyneuropathy additional testing for a mutation of the transthyretin gene (TTR) was examined and showed a pathogenic variant. In addition 99mTc-DPD bone scintigraphy revealed a myocardial radiotracer uptake (Perugini Score 3). Neither serum nor urine immunofixation electrophoresis could provide any evidence of present monoclonal paraproteins. The cardiac MRI was repeated, showing unchanged LGE with a complex combination of different LGE patterns, including a not typical appearance of an ischemic scar also compatible with amyloidosis. Additional T1 and extracellular volume (ECV) maps revealed a baso-apical gradient of elevated native T1 and markedly elevated ECV, typically found in cardiac amyloidosis (Fig. 2). Polyneuropathy (PNP) stage II due to transthyretin amyloidosis (ATTR) with cardiac involvement was confirmed and interdisciplinary disease management including a small interfering ribonucleinacid (siRNA) silencer therapy with Vutrisiran was initiated. He remains in cardiac asymptomatic and neurological stable condition under regular annual follow-up in the cardiac as well as in the neurological outpatient clinic.

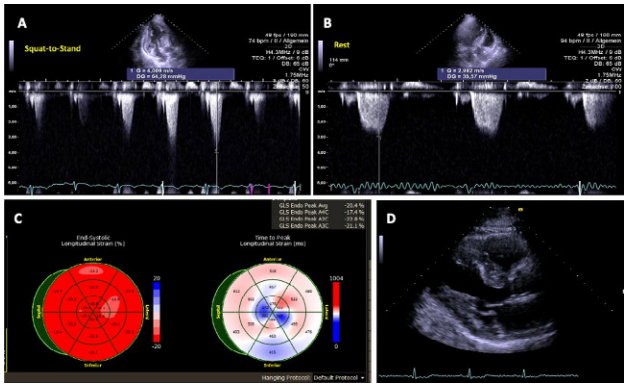

Fig. 1 Echocardiography showed hypertrophy of the left ventricle with a maximum diameter of the left ventricular septum of 20 mm (D). Left ventricular ejection fraction was 77% without significant apical sparing (C), a resting gradient of 36 mmHg (B) with no change during valsalva manoeuvre, and a gradient of 64 mmHg at squat-to-stand manoeuvre (A)

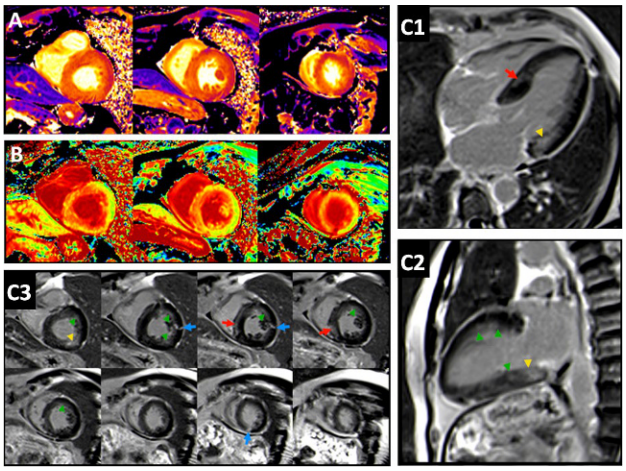

Fig. 2 Cardiac magnet resonance imaging (cMRI). Native T1 maps (A) and extracellular volume (ECV) maps (B) in a basal, midventricular and apical slice. Mean native myocardial T1 time per slice from base to apex was 1328, 1313 and 1285 ms (z-score 2.8, 2.4 and 1.6) and corresponding ECV was 36, 34 and 35%. Late gadolinium enhancement (LGE) (Flash, PSIR) in a 4-chamber-view (C1), 2-chamber-view (C2) and short axis stack from basal to apical (C3). Indistinct subendocardial LGE in the basal segments (green arrowheads) with hazy LGE especially in the basal inferolateral segment (yellow arrowheads), patchy midmyocardial septal LGE (red arrows), few small almost transmural foci of LGE in the lateral and inferior wall (blue arrows)

Conclusion: Up to 70% of patients with hypertrophic cardiomyopathies present with LVOTO (1). While LVOTO may occur in up to 4% of patients with light chain amyloidosis (AL) (2), cardiac ATTR amyloidosis is classically non-obstructive and there is only one documented case reporting LVOTO in ATTR amyloidosis (3). However, the present case report suggests that LVOTO is compatible with variant transthyretin amyloidosis (ATTRv). While cardiac imaging pointed the way towards sarcomeric hypertrophic cardiomyopathy, the coexisting red flags initiated reevaluation of the diagnosis suggesting cardiac amyloidosis as a potential cause. Specific treatments for cardiac amyloidosis are only effective at improving cardiovascular outcomes at early stages and therefore early diagnosis is crucial (4, 5). It remains controversial, which medical treatment option is optimal if patients with cardiac amyloidosis develop symptomatic LVOTO. Even though alcohol septal ablation would be feasible (6), it is unknown whether patients with cardiac amyloidosis and LVOTO will benefit from septal reduction therapy. Effect of cardiac myosin inhibitors are also unknown. In conclusion, awareness of the potential coexistence of cardiac amyloidosis and LVOTO may permit more accurate diagnosis, particularly at early stages of amyloid disease, when more treatment options exist.

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Ventrikuläre Arrhythmien bei neuaufgetretenem, reversiblen Brugada-Syndrom nach Tyrosinkinaseinhibition – Fallbericht einer lebensbedrohlichen Komplikation in der Krebstherapie

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Einleitung: Das Brugada-Syndrom ist eine angeborene arrhythmogene Erkrankung des Herzens mit erhöhtem Risiko für einen plötzlichen Herztod. [1] Charakteristisch ist ein spontanes Typ 1 Brugadamuster im 12-Kanal EKG. Typische Triggerfaktoren sind Fieber oder eine medikamentöse Natriumkanalinhibition, welche zu typischen EKG Veränderungen und konsekutiven malignen ventrikulären Tachykardien (VT) bis hin zum plötzlichen Herztod führen können. Einzelne Fallberichte haben über das Auftreten eines Brugada Typ 1 EKGs unter Therapie mit Tyrosinkinaseinhibitoren (TKI) berichtet. [2]

Methoden: Hier präsentieren wir den Fall eines Patienten mit reversibler TKI-bedingter Brugada-Phänokopie und assoziierten lebensbedrohlichen ventrikulären Rhythmusstörungen.

Resultate: Ein 57-jähriger Patient wurde mit dem Notarzt an die Intensivstation mit der Ankündigung eines akuten ST-Hebungsinfarktes und rezidivierenden Synkopen in den letzten zwei Tagen transferiert. Als Grunderkrankung lag bei dem Patienten ein Bronchuskarzinom mit rezenter Einleitung einer Therapie mit dem Tyrosinkinaseinhibtor Entrectinib vor. Das erste intramural aufgezeichnete EKG zeigte einen Brugada Typ 1 Phänotyp (Abb. 1). Der Patient entwickelte in weiterer Folge einen lebensbedrohlichen elektrischen Sturm mit rezidivierenden, hämodynamisch instabilen VTs und multiplen notwendigen Defibrillationen. Erst unter Einleitung einer Isoproterenoltherapie konnte eine rhythmogene Stabilisierung erreicht werden. Die TKI Therapie wurde in weiterer Folge beendet. Bereits am Folgetag zeigte sich eine Rückbildung des EKG-Phänotyps. Anamnestisch erfolgte 5 Tage vor Auftreten des Ereignisses die Einleitung der Entrectinibtherapie, welche in der Regel nach eben dieser Zeitspanne eine steady-state Konzentration erreicht. Im weiteren Verlauf zeigten sich die EKG Veränderungen schließlich vollständig rückgebildet und der Patient nach Ausschleichen der Isoproterenoltherapie rhythmologisch stabil. Ein nachfolgend durchgeführter Ajmalintest blieb negativ, eine Kardio-MRT wurde von Seiten des Patienten abgelehnt. Im rhythmologischen 12-Monats Follow-up kam es unter Ereignisrekorderüberwachung zu keinem neuerlichen Auftreten von relevanten Arrhythmien oder Synkopen.

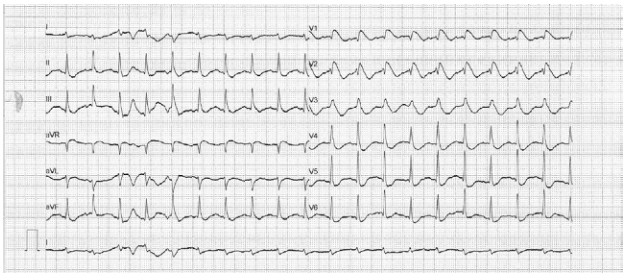

Abb. 1 EKG bei Aufnahme: Brugada Typ 1 EKG unter Entrectinibtherapie

Schlussfolgerungen: Der Einsatz von TKI bei onkologischen Patienten/-innen kann zu reversiblen, brugadatypischen EKG Veränderungen mit damit assoziierten lebensbedrohlichen ventrikulären Arrhythmien führen. Isoproterenol kann hierbei zur rhythmologischen Akutstabillisierung eingesetzt werden. Weitere Studien sind notwendig, um den Zusammenhang zwischen dem Brugada-Syndrom und einer Tyrosinkinaseinhibition aufzuklären.

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A case series of eight amateur athletes: Exercise induced pre-/syncope during the Zurich Marathon 2023

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Introduction: Marathon running poses unique cardiovascular challenges, sometimes leading to syncopal episodes. We present a case series of athletes who experienced pre-/syncope during the Zurich Marathon 2023, accompanied by elevated cardiac biomarkers.

Methods: Eight athletes (2 females, 6 males) aged 21 to 35 years, with pre-/syncope and various additional diverse symptoms such as dizziness and palpitations during the (half-) marathon, were admitted to two emergency departments in Zurich, Switzerland. Clinical evaluations included ECG, echocardiog-

raphy, telemetry, coronary computed tomography (CT) scans, and cardiac biomarker assessments.

Results: High-sensitive Troponin T (hs-cTnT) was elevated in all cases at initial assessment and returned to normal at follow-up. All athletes that received CT scans had normal coronary and brain CT results. None of the eight athletes had underlying cardiovascular disease. Renal function normalized post-admission, and neurological symptoms resolved within hours. Creatinine levels indicated transient acute kidney injury. A common feature was inexperience in running, inadequate race preparation, particularly regarding fluid, electrolyte, and carbohydrate intake, along with pacing issues and lack of coping strategies with heat.

Conclusion: From a clinician perspective, the case series highlights the challenge in management of patients with a pre-/syncopal event during strenuous exercise and elevated cardiac biomarkers. Diverse initial symptoms prompted tailored investigations. Adequate training, medical assessments, and awareness of syncope triggers are essential for marathon participants. Caution and pacing strategies are crucial, especially among novices in competitive running. This information is pertinent given the growing popularity of marathon events and prompts a standardized diagnostic approach after these events

A case report: Pulmonary embolism complicated by a transient thrombus across a persisting foramen ovale

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Introduction: Pulmonary embolism is the third most common cardiovascular disease after heart attacks and strokes. As highlighted in the 2019 ESC guidelines, the diagnosis, assessment and treatment of pulmonary embolism has changed due to increased knowledge and better data [1]. Nevertheless, the individual risk assessment of each patient is essential. Optimal decision-making and treatment still requires the best interdisciplinary collaboration, especially in complex cases.

Methods: This case presents the clinical progression of a previously healthy 72-year-old woman who arrived at a peripheral hospital complaining of worsening shortness of breath and unilateral leg swelling after a bus trip for several hours. The clinical presentation led to a CT scan revealing bilateral pulmonary embolism complicated by a thrombus across a patent foramen ovale. Upon consultation with the department of cardiology, she was promptly admitted to our hospital. Further examination via transesophageal echocardiography showed an extensive intracardiac thrombus through the patent foramen ovale and reaching the mitral valve. Assessment of her clinical condition yielded a PESI score of class III (92 points) and a NEWS score of seven points, indicating an intermediate-high risk of pulmonary embolism. After admission in the hospital, her vital signs were as followed: heart rate 88/min, oxygen saturation 87% without supplemental oxygen, 93% with 2-3 l/min supplemental oxygen, systolic blood pressure 117 mmHg, and respiratory rate 22/min.

Results: Following of an interdisciplinary evaluation among our pulmonary embolism team, surgical embolectomy was chosen as the optimal treatment strategy. Preoperative CT scans excluded coronary artery disease. During cooling on cardiopulmonary bypass, cardioplegic cardiac arrest was initiated, facilitating the removal of the thrombus from the left atrium. Bilateral thrombectomy was performed during deep hypothermic circulatory arrest. Intraoperative ST-segment elevations in leads II, III, and aVF, likely due to embolization, prompted the bypass surgery of the right coronary artery, effectively resolving the observed ECG changes and wall motion abnormalities on echocardiography. Postoperatively, the patient faced challenges with prolonged weaning, renal failure, and a lung infection. This lead to a two-week stay in the ICU. Following a 20-day hospitalization period on the normal ward, she was transferred to her primary care hospital for further management. After an additional week the patient was discharged.

Conclusion: In summary, this case highlights the importance of rapid transfer to specialized centers that have the necessary expertise to treat complex pulmonary embolism cases. The establishment of a multidisciplinary pulmonary embolism treatment team is essential for timely and effective treatment decisions. This case underlines the important role of specialized care and collaboration in optimizing patient outcomes in cases of complex pulmonary embolism.

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Fulminant nivolumab-induced myocarditis presenting as 3rd degree atrioventricular block – A case report

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Introduction: A 74-year-old male patient presented in our emergency department with vertigo and fatigue for the past 2 days. Due to a malignant melanoma, he was treated with nivolumab, an immune checkpoint inhibitor that binds to and inhibits programmed cell death protein 1 (PD1)– receptor. The first dose was administered 2 weeks prior to the onset of symptoms.

Methods: At arrival the vital parameters showed low blood pressure (55/30 mmHg), a heart rate of 22 per minute, peripheral sO2 of 95%, and the body temperature was 36.3 °C. Furthermore, in the clinical exam a ptosis was noted. The ECG showed a third-degree atrioventricular block and a left bundle branch block. The initial blood chemistry revealed drastically elevated high-sensitivity troponin T (8925 pg/ml, reference value < 14 pg/ml), B-type natriuretic peptide (5282 pg/ml, reference value < 125 pg/ml), creatine kinase (11401 U/L, reference value < 170 U/l), myoglobin (13266 ng/mL, reference value < 80 ng/ml), creatinine (2.42 mg/dl, reference value < 1.2 mg/dl) and C-reactive protein (76.9 mg/l, reference value < 5 mg/l). Echocardiography was unremarkable.

Results: After initial hemodynamic stabilization using isoprenaline a 2-chamber-pacemaker was implanted. Due to the typical triade of myositis, myocarditis, myasthenia gravis like symptoms (ptosis) the diagnosis of an immune checkpoint inhibitor therapy induced myocarditis was established. Immunosuppressive therapy with methylprednisolone (1 g/d) was initiated and the patient transferred to the intensive care

unit. Further, endomyocardial biopsy was performed and histology revealed an acute lymphocytic myocarditis. The suspected myasthenia gravis was confirmed by elevated acetylcholine-receptor antibodies and was treated with mestinone. Due to persisting symptoms, persistently elevated cardiac enzymes and markers of myolysis, the therapy was stepwise escalated to mycophenolate mofetil (2×1 g/d) and further to abatacept (1500 mg at day 0,5,14, 21), a modulator of T-cell co-stimulation. Subsequently, symptoms resolved, and biomarkers for cardiac and muscle injury dropped substantially. The patient was discharged after nearly 4 weeks. Follow-up visits in our outpatient department showed a further fall in cardiac enzymes. The patient was feeling better with no residual symptoms.

Conclusion: ICI-induced myocarditis is a rare but feared and severe adverse effect of potent immune-checkpoint-inhibitors affecting 1–2% of patients treated with such therapies. Patients suffering from ICI-induced myocarditis often present with high degree atrioventricular blocks, bundle branch blocks, or other arrhythmias, as well as neuromuscular symptoms. Clear recommendations are still missing with the optimal treatment regimens currently being evaluated. Typical clinical/laboratory chemical features, and malignancies in the medical history treated with ICI should raise suspicion and trigger immediate immunosuppressive therapy. Here, we present a case of fulminant cortisone-refractory ICI-induced myocarditis, myositis and myasthenia gravis which was successfully treated with abatacept

BESTE POSTER 1

1-1

Selection for transcatheter versus surgical aortic valve replacement and mid-term survival by age groups: results of the AUTHEARTVISIT Study

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Introduction: Transcatheter aortic valve implantation (TAVI) in patients with severe, symptomatic aortic stenosis is increasingly used in middle-aged and low-risk patients. We analyzed mid-term mortality and morbidity of different age groups from a large, population-based cohort study that

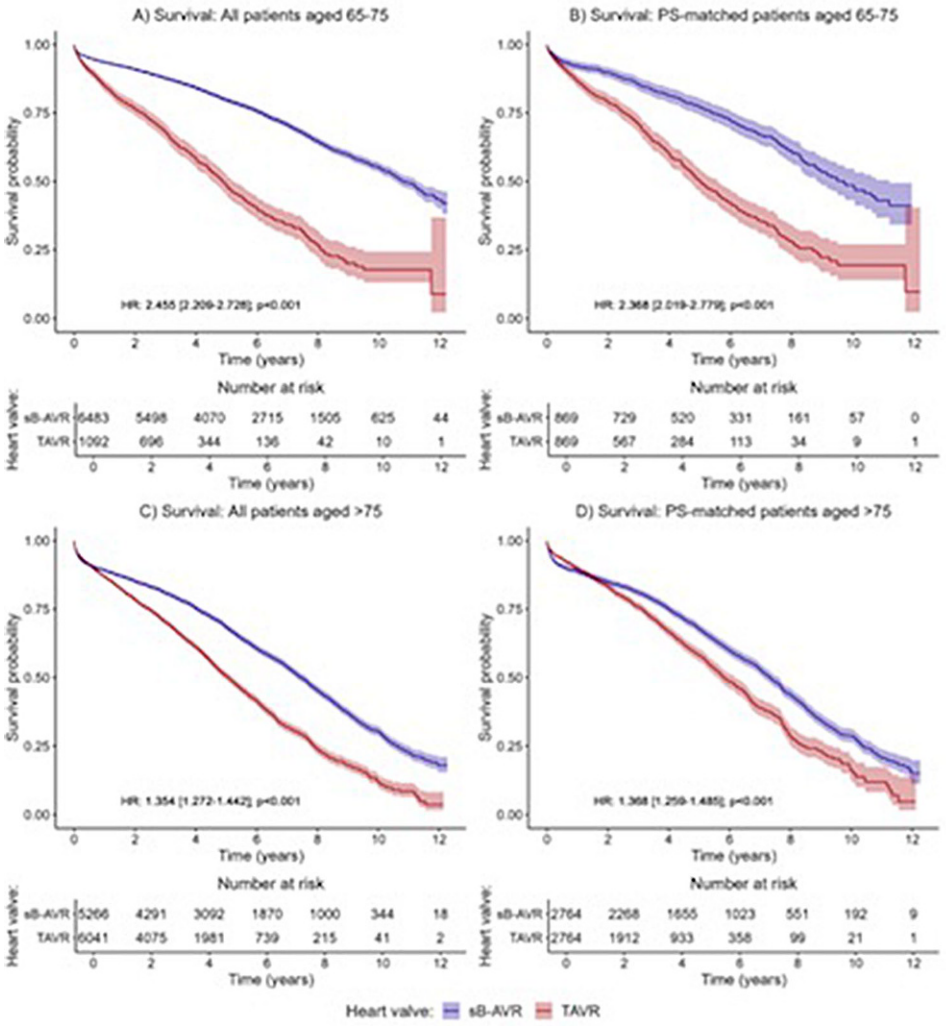

Fig. 1 Kaplan-Meier curves and 95% Confidence intervals (or overall survival for subgroups of patients ages 65-75 years in the (A) overall cohort and (B) PSM groups and those age >75 years in the (C) overall cohort and (D) PSM groups

included patients undergoing aortic valve replacement (AVR) for severe aortic stenosis using a surgically implanted bioprosthesis (sB-AVR) or TAVI.

Methods: Individual data from the Austrian Insurance funds from 2010–2020 were analyzed. The primary outcome was all-cause mortality, assessed in the overall and propensity score–matched populations. Secondary outcomes included reoperation and cardiovascular events. Separate analyses were performed for individuals aged 65 to 75 years and for patients older than 75 years.

Results: From January 2010 through December 2020, a total of 18 882 patients underwent sB-AVR (n = 11 749; 62.2%) or TAVI (n = 7133; 37.8%); median follow-up was 4.0 (interquartile range 2.1–6.5) years (maximum 12.3 years). The risk of all-cause mortality was higher with TAVI compared with sB-AVR: hazard ratio (HR) 1.552, 95% confidence interval (CI) 1.469–1.640, p < 0.001; propensity score–matched HR 1.510, 1.403–1.625, p < 0.001. Estimated median survival was 8.8 years (95% CI 8.6–9.1) with sB-AVR vs 5 years (4.9–5.2) with TAVI. Estimated 5-year survival probability in the propensity score matched population was 0.690 (0.674–0.707) and 0.560 (0.540–0.582), with sB-AVR vs 0.409 (0.378–0.444) with TAVI respectively. Other predictors of mortality were age, sex, previous heart failure, diabetes, and chronic kidney disease. The excess in mortality of patients selected for TAVI as compared with sB-AVR was even more prominent in patients aged between 65 and 75 years (Figure A, B; HR 2.455, 95% CI 2.209–2.728, p < 0.001). This effect was also observed in the propensity score–matched groups (HR 2.368, 2.019–2.779, p < 0.001; Figure B, D).

Conclusion: In this mid term follow-up, selection for TAVI was significantly associated with higher all-cause mortality compared with sB-AVR in patients ≥ 65 years with severe, symptomatic aortic stenosis. The beneficial effect on mortality in patients selected for sB-AVR was even more prominent in the age group between 65 and 75 years.

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1-2

Intermediate term results after minimally invasive aortic valve replacement with rapid deployment valves versus transfemoral transcatheter aortic valve replacement: a propensity matched analysis in 366 patients

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Introduction: Guidelines recommend transfemoral transcatheter aortic valve implantation (TF-TAVI) for patients with aortic stenosis above the age of 75a, irrespective of surgical risk. These patients were considered a prime target for minimally invasive aortic valve replacement (MIS-AVR) with rapid-deployment valves (1). This study compared both procedures regarding survival and valve-related adverse events.

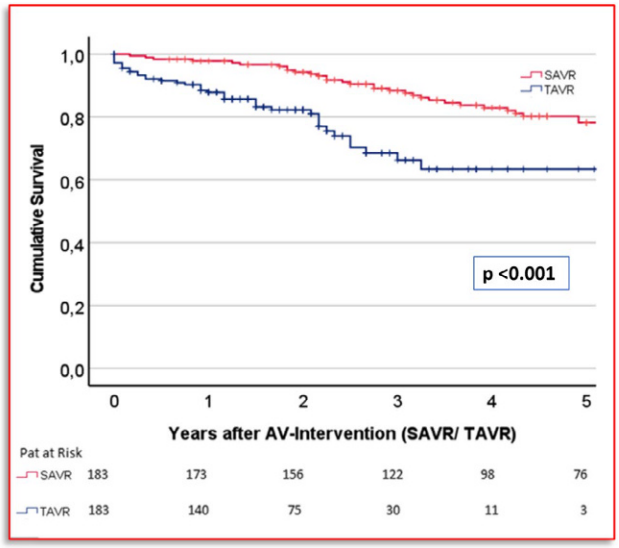

Fig. 1 Kaplan Meier plot for survival after aortic valve intervention showing significantly decreased survival after transfemoral TAVR

Matching parameters	Unmatched cohort (n=926)			Matched cohort (n=366)		
	MIS-AVR (n=400)	TF-TAVI (n=526)	P-value	MIS-AVR (n=183)	TF-TAVI (n=183)	P-value
Age (years)	72.6±7.4	80.1±7.2	<0.01	76±7.2	77±7.5	0.24
Sex (male)	201 (50.3%)	267 (50.9%)	0.86	92 (50.3%)	88 (48.1%)	0.68
EuroSCORE II (%)	2.0±1.6	5.6±5.8	<0.01	2.6±2.1	2.8±1.7	0.40
BMI (kg/m²)	28.2±5.3	27.3±5.4	<0.01	27.6±5.0	27.8±5.4	0.40
Creatinine (mg/dl)	1.0±0.4	1.3±0.9	<0.01	1.0±0.39	1.1±0.84	0.51
Hypertension (%)	339 (84.8%)	474 (90.3%)	0.011	158 (86.4%)	162 (88.5%)	0.53
Diabetes (%)	99 (24.8%)	158 (30.1%)	0.07	49 (26.8%)	49 (26.8%)	1.0
Dyslipidemia (%)	235 (58.8%)	426 (81.1%)	<0.01	131 (71.6%)	132 (72.1%)	0.91
Periph. Vascular Disease (%)	18 (4.5%)	56 (10.6%)	<0.01	9 (4.9%)	11 (6%)	0.65
Smoking status	70 (17.5%)	135 (25.7%)	0.003	36 (19.7%)	37 (20.2%)	0.90
Atrial Fibrillation (%)	53 (13.3%)	189 (36%)	<0.01	40 (21.9%)	43 (23.5%)	0.71
Prior MI (%)	17 (4.3%)	41 (7.8%)	0.027	9 (4.9%)	10 (5.5%)	0.81
Prior PCI (%)	33 (8.2%)	139 (26.5%)	<0.01	22 (12%)	35 (19.1%)	0.06
Prior Stroke (%)	62 (15.5%)	56 (10.6%)	0.029	23 (12.6%)	23 (12.6%)	1.0
Previous Pacemaker Implantation (%)	18 (4.5%)	71 (13.5%)	<0.001	15 (8.2%)	14 (7.7%)	0.85
Chronical lung disease (%)	63 (15.8%)	97 (18.5%)	0.277	29 (15.8%)	30 (16.4%)	0.89
Dialysis (%)	3 (0.8%)	15 (2.9%)	0.022	2 (1.1%)	3 (1.6%)	0.65
Porcellain Aorta (%)	0	45 (9.2%)	<0.01	0	0	1.0

Fig. 2 Patient characteristics of unmatched and matched cohorts startified after type of aortic valve intervention

Methods: Between 04/2011 and 06/2022, 926 patients received either isolated MIS-SAVR with a rapid-deployment (RD) valve (n = 400) or TF-TAVR (n = 526) at a single center. A propensity score was created with 30 parameters including demographics, comorbidities, surgical risk and anatomical features. Following exact matching after maximum propensity score difference, the final cohort (n = 366) included 183 matched pairs. Adverse events were classified after the EACTS/STS/AATS guidelines for reporting morbidity and mortality after valve interventions (2). Descriptive methods were applied to characterize the study cohort and a log-rank test was performed to compare survival between groups. A multivariate cox regression model was created to identify risk parameters for mortality.

Results: The mean follow-up was 39 ± 30 months for survival and 35 ± 30 months for adverse events. The 30-day mortality was 0% (MIS-SAVR) and 3.3% (n = 6, TF-TAVI, p = 0.013), respectively. Perioperative Stroke was observed in 2.7% (n = 5, MIS-SAVR) vs 2.1% (n = 4, TF-TAVI, p = 0.74) and overall embolization events were observed in 6% (n = 11, MIS-AVR) vs 4.9% (n = 9, TF-TAVI, p = 0.66). Moderate to severe non-structural valve dysfunction was observed in 3.8% of MIS-AVR (n = 7, of which were 3 severe) vs 13.2% of TF-TAVI (n = 24, of which 3were severe, p = 0.003).

New Pacemaker Implantation occurred in 7.7% (n = 14 MIS-SAVR) vs 14.8% (n = 27, TF-TAVI, p = 0.026). Aortic valve re-intervention was observed in 3.3% (n = 6, MIS-SAVR) vs 1.6% (n = 3, TF-TAVR, p = 0.315). More patients in the SAVR group received transfusions, however, the mean number of transfusions did not differ significantly between groups (p = 0.54). Overall survival at 1-year and 3-years follow-up were 98% and 88% for MIS-SAVR group and 88% and 67% for the TF-TAVR group respectively (log-rank p < 0.001). The type of procedure (TAVR, HR 2.59 [1.50; 4.46], p < 0.001), embolic events (HR 2.38 [1.16; 4.88], p = 0.018), acute kidney injury (HR 2.06 [1.04; 4.10], p = 0.039), EuroScore II (HR 1.16 [1.05, 1.28], p = 0.004) were identified as independent predictors for mortality in the multivariate cox regression model.

Conclusion: Minimally invasive AVR with RD-valves still represents an excellent treatment modality for AS and was associated with a lower mortality, lower rates of permanent pacemaker implantation and paravalvular leakage compared to TF-TAVR in an older, low-risk patient cohort.

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1-3

Long-term results after 1000 consecutive aortic valve replacements with rapid-deployment valves: a single center analysis

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Introduction: Rapid-deployment (RD) prostheses facilitate minimally invasive surgical aortic valve replacement (SAVR) by reducing procedural times and showed improved valve hemodynamics due to the incorporated stent frame. Our department participated in the market-release trial and post-market multicentric European trials, to demonstrate the safety and efficacy of the Edwards Intuity Valve System, which was standardized at our institution, with a high volume of implantations. This study aimed to analyze long-term durability, survival and valve related adverse events after 1000 consecutive RD-SAVRs and more than 10-years follow-up in a single-center study cohort.

Methods: Between May 2010 and May 2023, 1000 consecutive patients (mean age was 73 ± 7 years, 45% female, median STS Score 1.9% [IQR: 1.3–3.1]) with severe aortic stenosis or combined aortic valve disease implanted with a rapid-deployment valve at our institution were included in a prospective and ongoing database with longitudinal end-point assessment. Median follow-up was 55 months [IQR: 26–80] and the total accumulated follow-up was 4694 patient years. Preoperative characteristics, operative parameters, survival, valve related adverse events and valve hemodynamics were assessed. Adverse events were classified after the EACTS/STS/AATS guidelines for reporting morbidity and mortality after valve interventions*.

Results: Concomitant procedures were performed in 500 (50%) patients. In case of isolated SAVR, a minimally invasive surgical approach was conducted in 415 patients (83%), of which 44.2% (n = 221) through a right anterior thoracotomy. Mean gradients at discharge, one year, three and five years were 12 ± 5, 11 ± 4, 11 ± 5 and 13 ± 8 mmHg. New early pacemaker implantation was required in 9.1%. Perioperative Stroke (< 72 h) was observed in 1.6% (n = 16) and overall cumulative incidence of thromboembolic and major bleeding events at 10-years was observed in 8.1% (95% CI:6.2–10.4%). The 5 and 10-year cumulative incidence of severe structural valve degeneration were 0.8% (95% CI:0.3–2.1%) and 9.2% (95% CI:4.5–15.9%). Overall reintervention or reoperation with valve explantation for structural degeneration, non-structural dysfunction or endocarditis occurred in 38 cases, with a cumulative incidence at 10-years FU-up of 7.7.% (95% CI:5.0–11.2%). Overall 30-Day Mortality was 0.6% (n = 3) and 0.2% (n = 1) in isolated RD-SAVR and survival at 1, 5 and 10-years FU-up was 95%, 81% and 58%, respectively. Preoperative age, diabetes, chronical pulmonary obstruction disease and creatinine, concomitant procedures and acute operative indication were independent predictive factors for mortality in a multivariate regression model at the time of index AVR; moreover valve explantation and a composite endpoint of thromboembolic and major bleeding events after the index AVR were also predictive factors of overall mortality.

Conclusion: Rapid-deployment valves showed excellent long-term haemodynamics with stable transvalvular gradients and consequently one of the lowest long-term structural valve degeneration rates for stented bioprostheses reported in the literature. Modern SAVR with RD prostheses can be performed with excellent results and near zero perioperative mortality in a real-world collective.

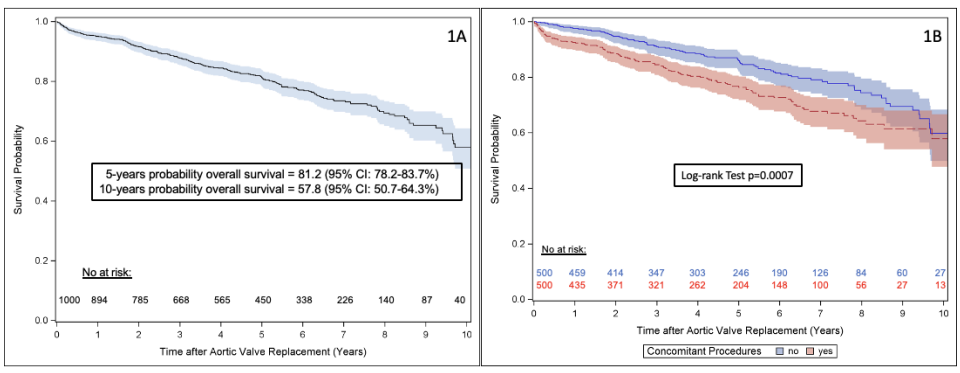

Fig. 1 A: Kaplan-Meier survival-analysis; 1B: log-rank test. Blue = isolated RD-AVR, Red = concomitant procedures. The survival in patients with isolated RD-AVR is significantly higher than in patients with a concomitant procedures – log-rank p<.001

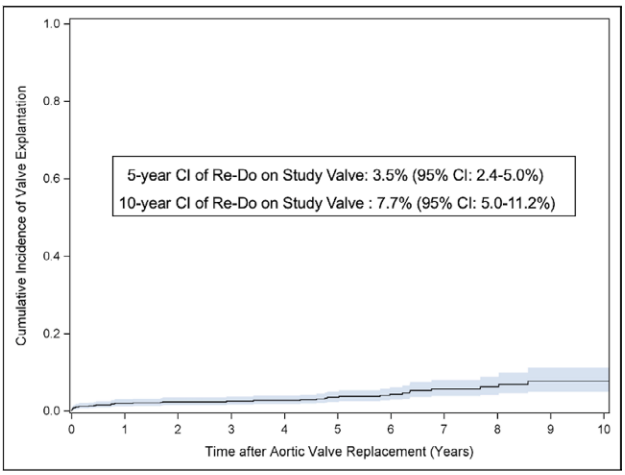

Fig. 2 Cumulative incidence of re-operation with valve explantation. *Competing risk analysis was performed to estimate the cumulative incidence of Re-Do after RD-AVR considering death as competing event

References

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1-4

Prediction Model for Leaflet Thrombosis in Patients Undergoing Transcatheter Aortic Valve Implantation: The EFFORT Study

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Introduction: Leaflet thrombosis (LT) represents a multifaceted and underexplored condition that can manifest following transcatheter aortic valve implantation (TAVI). The objective of this study was to formulate a prediction model based on laboratory assessments and clinical parameters, providing additional guidance and insight into this relatively unexplored aspect of post TAVI complications.

Methods: The present study was an observational prospective study, including 101 patients who underwent TAVI and a screening for LT (the primary endpoint) by multidetector computed tomography (MDCT). All images were acquired on a third-generation dual-source CT system. Levels of von Willebrand factor (vWF) activity, hemoglobin (Hb) and lactate dehydrogenase (LDH) were measured among other parameters. A predictive score, utilizing univariate binary logistic regression, Kaplan-Meier time-to-event analysis and Receiver Operating Characteristics (ROC) analysis, was established.

Results: LT (11 subclinical and 2 clinical) was detected in 13 of 101 patients (13%) after a median time to screening by MDCT of 105 days (IQR: 98–129 days). Elevated levels of vWF activity (>188%) pre TAVI, decreased Hb values (<11.9 g/dL), as well as increased levels of LDH (>312 U/L) post TAVI and absence

Tab. 1 Statistical Estimates for Leaflet Thrombosis Prediction Based on the EFFORT Score

	Leaflet Thrombosis n = 7 (10%)								
	Test								
EFFORT Score <2 vs ≥2 Points	c-Index (95%CI)	*p*-Value	Cut-Off Value	Sensitivity, %	Specificity, %	PPV, %	NPV, %	LR+	LR-
	0.89 (0.74–1.00)	0.001	2	86	92	55	98	10.8	0.2

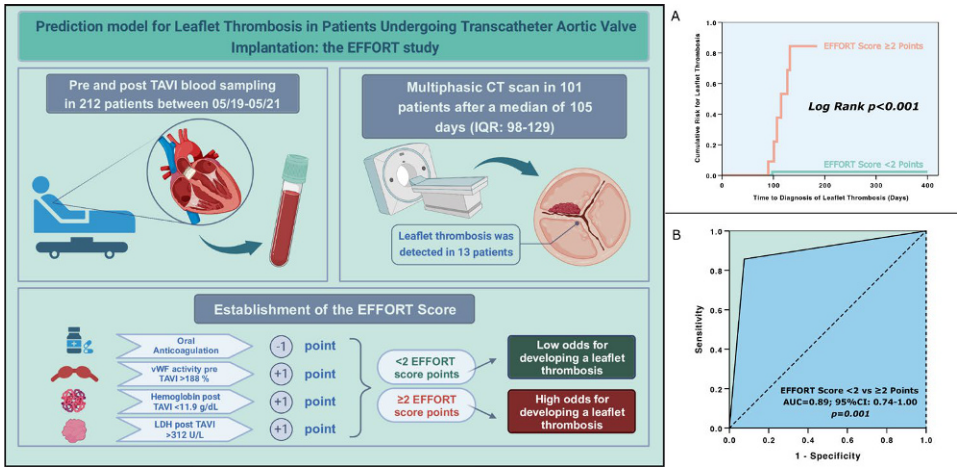

Fig. 1 Central Illustration and A) Kaplan-Meier Analysis: Time-to-Event Assessment of Leaflet Thrombosis Incidence in EFFORT Score Groups (<2 vs ≥2 Points) and B) Receiver Operating Curve (ROC) Analysis for the EFFORT Score to Predict Leaflet Thrombosis after Transcatheter Aortic Valve Implantation (TAVI)

of oral anticoagulation (OAC) were found in patients with subsequent LT formation as compared to patients without LT. The established EFFORT score ranged from −1 to 3 points, with an increased probability for LT development having ≥2 points (85.7% of LT cases) vs <2 points (14.3% of LT cases; p<0.001). Achieving an EFFORT score of ≥2 points was found to be significantly associated with a 10.8 times higher likelihood of developing an LT (p=0.001). The EFFORT score has an excellent c-statistic (area under the curve [AUC]=0.89; 95%CI: 0.74–1.00; p=0.001) and an outstanding negative predictive value (98%) for prediction of LT.

Conclusion: An EFFORT score of >2 points is associated with an increased likelihood of LT development and might be potentially used in risk assessment of LT formation after TAVI. This information could guide the stratification of individuals for the planning of subsequent MDCT screenings.

1-5

Multiorgan dysfunction and its association with congestion and outcome in aortic stenosis treated with transcatheter aortic valve implantation

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Introduction: Degenerative severe aortic stenosis (AS) is treated by valve replacement to improve outcome. Despite diagnostic advancements, many AS patients are still diagnosed late with advanced heart failure, fluid overload (FO), and multiorgan dysfunction with associated poor post-interventional outcome. We aimed to assess multiorgan dysfunction in severe AS using blood biomarkers and their association with quantitative fluid levels and clinical outcomes after transcatheter aortic valve implantation (TAVI).

Methods: Consecutive patients with severe AS scheduled for TAVI underwent prospective risk assessment with comprehensive serum biomarker profiles and quantitative systemic FO using bioelectrical impedance spectroscopy. FO by bioelectrical impedance was defined according to the previously established cut-off of ≥1.0 L. Time to first heart failure hospitalization (HHF) or death served as composite primary endpoint.

Results: Among 880 patients (81±7y/o, 47% female) undergoing TAVI, 357 (41%) had FO with median fluid levels of 2.1 L (IQR 1.4–3.0). By multivariate linear regression adjusted for important clinical confounders, ascending fluid levels were associated with lower haemoglobin and haematocrit, higher creatinine, lower albumin and cholinesterase, higher bilirubin, alkaline phosphatase and gamma-glutamyltransferase, higher C-reactive protein, and higher NT-proBNP levels. After 2.4±1.0 years of follow-up, 236 patients (27%) had reached the primary endpoint (29 HHF, 194 deaths, 13 both). By multivariate Cox regression (adjusted for age, sex, EuroSCORE-II, and fluid levels), biomarkers across domains of kidney, hepatic, cardiac function, inflammation, and anaemia showed significant associations with event-free survival (Fig. 1). After stratification of biomarkers according to highest/lowest tertile, the addition of FO demonstrated a significant incremental effect in predicting increased risk of poorer post-interventional outcomes (Fig. 2).

Conclusion: Serum biomarkers reflecting multiorgan dysfunction in severe AS are associated with congestion and predict poor post-TAVI outcomes. The potential role of decongestive treatment in improving biomarker risk profiles and prognosis in AS warrants further research.

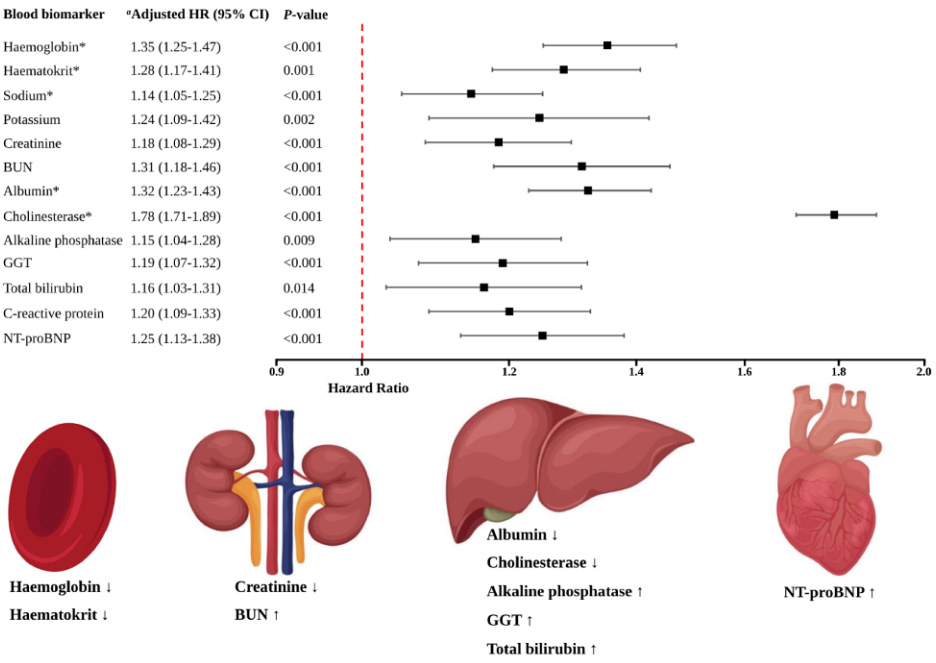

Fig. 1 Association of blood biomarkers with outcomes in patients with severe aortic stenosis

[a] Adjusted for age, sex, EuroSCORE II, and fluid levels. Blood biomarkers were analysed as Z-values.
* indicates reciprocal value with lower values yielding higher hazard ratios.

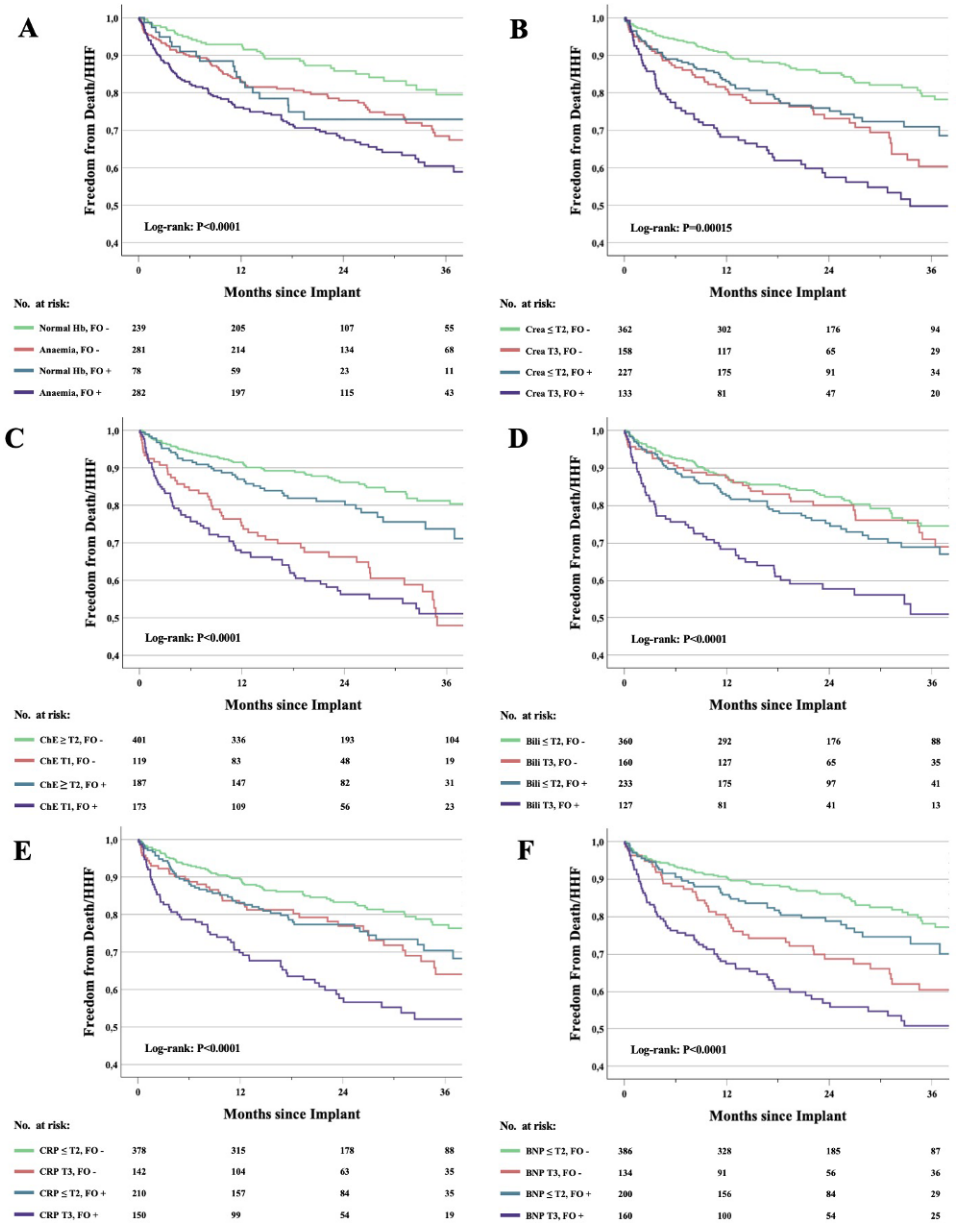

Fig. 2 Kaplan Meier curves stratified by tertiles (T) of laboratory parameters and fluid overload (FO)

1-6

Performance of currently recommended sex-specific aortic valve calcification thresholds in relation to aortic valve size

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Introduction: Current guidelines recommend sex specific aortic valve calcification (AVC) thresholds as an additional tool to diagnose severe aortic stenosis (AS). Recently, we described an independent association of aortic valve (AV) size with the degree of AVC. However, it has not been shown whether there is an effect of AV size on the performance of existing sex specific AVC cutoffs.

Methods: Consecutive patients with severe AS who underwent cardiac computed tomography (CT) between 01/2020 and 04/2023 were included. AV annulus area and the degree of AVC using the Agatston score were measured on CT. AV annulus areas quartiles were calculated for both sexes and the percentages of patients with Agatston scores below the sex specific AVC thresholds (women: 1200 Agatston Units (AU), men: 2000 AU) were compared.

Results: In total, 734 patients (mean age 80 ± 6 years, 43% female) were included. Median Agatston scores were lowest in the smallest AV annulus area quartiles in both sexes (women: 1515 AU [1208–1978]; men: 2694 AU [2057–3484]) and highest among patients of the largest AV annulus area quartile (women:

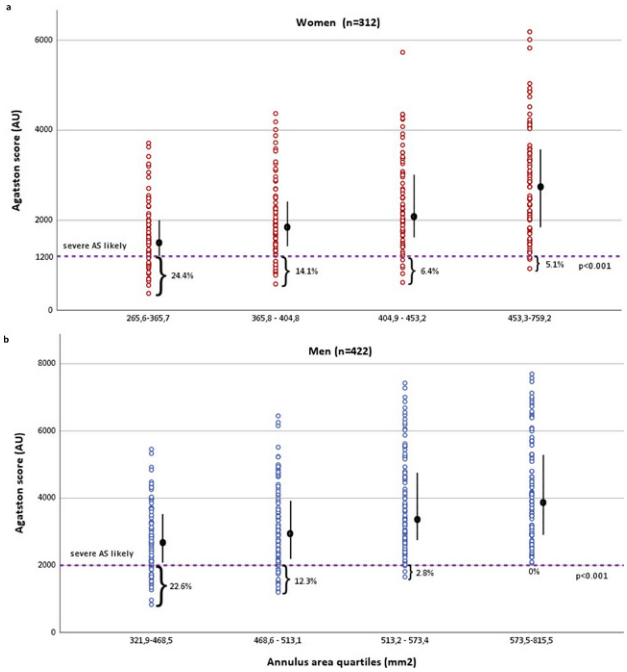

Fig. 1 Proportion of patients with Agatston scores below the recommended sex-specific AVC thresholds across aortic valve annulus area quartiles

2743 AU [1811–3570]; men: 3890 AU [2912–5302]). Importantly, the proportion of patients with Agatston scores below the recommended AVC thresholds was significantly higher in the smallest AV annulus area quartile than in the largest quartile of both females (24.4% (n = 19) vs. 5.1% (n = 4), p < 0.001) and males (22.6% (n = 24) vs. 0% (n = 0); p < 0.001). In the second quartile respective percentages were 14.1% (n = 11) for women and 12.3% (n = 13) for men which decreased to 6.4% (n = 5) in females and 2.8% (n = 3) in males of the third AV annulus area quartile (Fig. 1).

Conclusion: Severe AS patients with small AVs are significantly more likely to present with Agatston scores below the recommended sex specific AVC thresholds than patients with larger AV annulus on CT. Based on the present results, an indexation of sex specific AVC thresholds to AV annulus size should be implemented.

1-7

Long-term outcomes in patients with dual pathology aortic stenosis and cardiac amyloidosis referred for valve intervention

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Introduction: The coexistence of aortic stenosis (AS) and cardiac amyloidosis (CA) is common. If treated with transcatheter aortic valve implantation (TAVI), patients with the combined phenotype (AS-CA) have a comparable short term survival to those with lone AS, whereas data on longer term outcomes is currently lacking. This study aimed to evaluate the clinical outcomes of AS-CA compared to lone AS over a 5-year follow-up.

Methods: Using a prospective, multicentre, observational, case-control design, we screened consecutive patients with severe AS referred for TAVI for co-existing CA. CA screening included blinded 99mTc-DPD bone scintigraphy (Perugini Grade-0 negative, 1–3 increasingly positive) with additional SPECT/CT and light chain assessment prior to intervention. Transthyretin CA (ATTR) was diagnosed by bone scintigraphy and unremarkable light chain assessment, light-chain CA (AL) by endomyocardial biopsy. Mortality (all-cause and cardiovascular [CV]) and hospitalisation for heart failure (HHF) were captured as clinical endpoints.

Results: 376 patients (83 ± 7 years, 52% female, EuroSCORE-II 4.9 ± 2.9) were recruited, of which 43 (11.4%) had AS-CA (42 ATTR, 1 AL). Compared to lone AS, patients with AS-CA were older with higher cardiac biomarkers (NT-proBNP, high-sensitive Troponin-T) and a higher prevalence of atrial fibrillation. Heart team decision yielded valve replacement in 320 (85%) and conservative management in 56 (15%) patients, without differences between AS-CA and lone AS. Over a median follow-up of 5.4 (Q1: 4.9; Q3: 5.7) years, 230 (61.1%) patients died and 67 (17.8%) experienced HHF (with a total HHF number of 91). AS-CA was associated with higher all-cause mortality (crude HR 1.64, 95%CI 1.15–2.35; log-rank, p = 0.006), which remained significant after multivariate adjustment for clinical confounders (EuroSCORE-II, valve replacement; adjusted HR 1.63, 95%CI 1.15–2.32; p = 0.006). AS-CA was not associated with CV mortality (log-rank, p = 0.18) or time to first HHF (log-rank, p = 0.43), but the rate of HHF was significantly higher in AS-CA compared to lone AS (5.7 versus 3.5 per 1,000 patient years, p = 0.022).

Conclusion: Among elderly patients referred for TAVI, long-term outcomes of AS-CA are characterized by higher mortality and a higher rate of heart failure hospitalisations compared to patients with lone AS. Studies evaluating the role of CA-specific treatments are warranted in this population.

1-8

Procedure-related radiation and contrast use during TAVI procedures with balloon-expandable versus self-expanding devices

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Introduction: Transcatheter aortic valve implantation (TAVI) procedures show some fundamental differences, depending on the use of balloon-expandable- (BEV) or self-expanding (SEV) devices. We aimed to assess, how it translates into contrast use and radiation exposure.

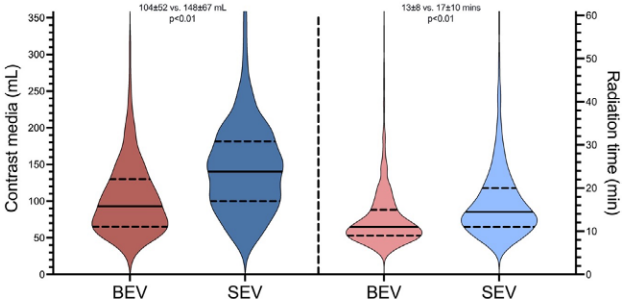

Fig. 1

Methods: From five high volume European centers consecutive patients were included, who underwent transfemoral TAVI procedure. Patient- and procedural characteristics were recorded and compared in relation to the used TAVI device.

Results: In total 3131 patients were included. 53% were male and the mean age was 80 ± 9 years. 1273 (41%) patients were treated with BEV, while 1858 (59%) with a SEV system. Patients, receiving SEV were older (81 ± 9 vs 79 ± 9 years, respectively; p < 0.01) and were more often females (57% vs 33%, respectively; p < 0.01). There was also a trend for less peripheral artery disease (14% vs 17%, respectively; p = 0.06). Overall total radiation time was 15 ± 9 mins, that was markedly shorter for BEV than for SEV (13 ± 8 vs. 17 ± 10 mins, respectively; p < 0.01). On average 130 ± 65 mL contrast media was used, that was less for BEV than for SEV (104 ± 52 vs. 148 ± 67 mL, respectively; p < 0.01) In terms of contrast use, retrievable- and non-retrievable SEVs were comparable (148 ± 71 vs. 146 ± 63 mL, respectively; p = 0.41), but both markedly higher, than for BEVs (p < 0.01 for both). Non-retrievable SEVs required less radiation (14 ± 7 vs. 18 ± 10 mins, respectively; p < 0.01), but still markedly more than BEVs (p < 0.01).

Conclusion: TAVI procedures with BEV require shorter radiation exposure for the team and markedly less contrast, than with SEV. This might be reasonable to consider during patient-tailored procedure planning.

BESTE POSTER 2

2-1

Impact of aortic arch repair technique on patient outcome in Frozen Elephant Trunk procedure: multicenter analysis of outcomes and risk factors

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Introduction: Although, the Frozen Elephant Trunk (FET) technique is a standardized procedure for aortic arch pathologies, the according impact of various applied arch repair techniques in this regard is currently unknown. This study analyzed outcomes and risk factors of arch repair techniques in FET procedure on overall patient outcome.

Methods: Between 05/2005 and 01/2024, overall 269 patients underwent FET procedure (male: 159 [59.1%]; age: 63 [IQR 55.5–70]) for aortic arch pathologies (acute: n = 85 [85%]; aneurysm: n = 236 [87.7%]), by either aortic arch island (n = 155, [57.6%]) or peninsula style (n = 84; [31.2%]) repair, as well as branched graft repair (n = 26; [9.7%]) and proximal aortic arch sparing (n = 4; [1.5%]), alternatively. Surgery was facilitated primarily in zone 3 (n = 157; [58.4%]), with overall left subclavian artery bypass grafting in 135 patients (50.2%), of which 46 (17.1%) were anastomosed to the left carotid artery prior FET procedure. The population's median extracorporeal circulation and aortic cross clamp time was 195 (IQR 170–223.5) and 99 (IQR 76.5–129.5) minutes, including 9 patients (3.3%) with marfan syndrome and 29 (10.8%) with bovine aortic arch anomaly.

Results: Over a median follow-up time of 23 (IQR 3–63.5) months, forty-eight (17.8%) and 11 patients (4.1%) experienced stroke and spinal cord ischemia respectively, documented collectively in 41 patients (15.2%) thirty days after surgery, with multivariate logistic regression revealing preoperative dissected left carotid artery (OR: 2.646; 95% CI: 1.017–7.044; p = 0.046) as a risk and aortic aneurysm (OR: 0.372; 95% CI: 0.139 – 0.994; p = 0.049) as a protective factor, accordingly. Laryngeal nerve paresis was documented in 24 (8.9%) and overall island complications in 17 patients (6.3%), including type Ia endoleak (n = 8; [3.0%]), vascular patch pseudo aneurysm (n = 10; [3.7%]) and aortic arch rupture (n = 1; [0.4%]), with aortic arch island (OR: 1.054; 95% CI: 0.389–2859; p = 0.917) or peninsula style (OR: 1.173; 95% CI: 0.419–3.283; p = 0.762) repair techniques being no risk factors in this regard. Left subclavian artery reinterventions (n = 11; [4.1%]) included stentgraft application in 10 (3.7%) and aortic reinterventions in 98 patients (36.4%), including 4 (1.5%) redo-FET and 81 (30.1%) endovascular aortic repair procedures. Thirty-day (n = 22; [8.2%]; log-rank: p = 0.263) and overall mortality (n = 54; [20.1%]; log-rank: p = 0.381), did not differ between aortic arch repair techniques. Aortic related mortality (n = 3; [1.1%]) included, one (0.4%) during initial surgery for ruptured penetrating aortic ulcer, one (0.4%) during surgical endoleak repair, one (0.4%) bleeding.

Conclusion: Application of various techniques of aortic arch repair is safe, feasible and reproduceable in FET procedure, without impact on overall neurological complications, vascular patch dehiscence and target graft patency.

2-2

Omission of Antiplatelet Therapy in Patients with HeartMate 3 Left Ventricular Assist Devices: A Systematic Review und Meta-Analysis

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Introduction: The HeartMate 3 (HM3) left ventricular assist device has decreased thromboembolic events and minimized the risk of pump thrombosis. However, bleeding complications due to combined antithrombotic therapy with a vitamin K antagonist (VKA) and aspirin remain high. Only limited data on the safety of VKA monotherapy in HM3 patients are available, so far. We therefore aimed to systematically review trials investigating the omission of aspirin in HM3 patients.

Methods: A systematic search on the main databases Medline, Web of Science, and Embase until 11th November 2023 was performed. Observational data and randomized trials were eligible for this analysis. As primary endpoint we analysed hemocompatibility-related adverse events (HRAE), defined as a composite of bleeding and thromboembolic events. As secondary endpoints, we investigated the individual components of the primary endpoint. The analysis was carried out using the odds ratio (OR) as outcome measure. Due to the expected heterogeneity across studies, a random-effects model was fitted to the data.

Results: Out of 512 manuscripts, 5 manuscripts fulfilled the inclusion criteria. These trials included 785 patients (381 on VKA monotherapy, 404 on VKA and aspirin). VKA monotherapy significantly reduced HRAE (OR 0.11 [95%CI 0.02-0.59], p = 0.01, I2 = 87%; Fig. 1). The reduction was driven by a decrease of bleeding complications (OR 0.12 [95%CI 0.02-0.62], p = 0.01, I2 = 86%) without increasing the rates of thromboembolic events (OR 0.69 [95%CI 0.26–1.81], p = 0.45, I = 0%; Fig. 2).

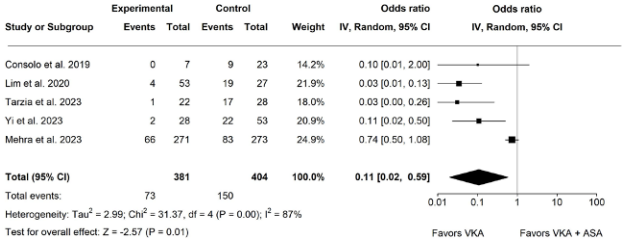

Fig. 1 Forest plot for hemocompatibility-related adverse events during HeartMate 3 left ventricular assist device support

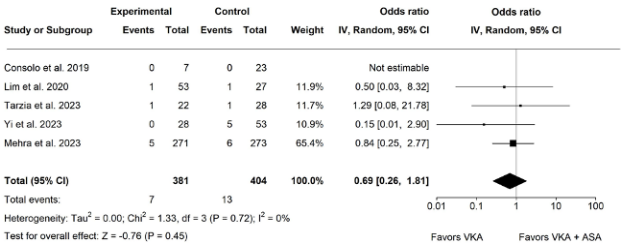

Fig. 2 Forest plot for thromboembolic events during HeartMate 3 left ventricular assist device support

Conclusion: VKA monotherapy is associated with a significant reduction of bleeding events without increasing the risk of thromboembolic complications in HM3 patients.

2-3

Long-term Follow-Up after Simultaneous Arterial Switch Operation and Aortic Arch Repair

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Introduction: Taussig Bing anomaly (TBA) and transposition of the great arteries (TGA) with hypoplastic or interrupted aortic arch (AA) are rare anomalies. Various operative techniques and a high incidence of reinterventions are described. The aim of this retrospective single center study was to evaluate operative data, mortality and reintervention rate with special regard to the AA.

Methods: At the single center, 50 patients with the abovementioned diagnosis have been corrected by a simultaneous repair between 2001–2022. 37 children had TBA, 13 TGA, 5 of them an interrupted AA. Median age at operation was 7 (IQR 5–9) days, weight 3.38 (IQR 2.9–3.8) kg, follow-up 9.3 (IQR 3.1–14.5) years. The AA reconstruction was performed without patch material in 49 cases.

Results: There was one in hospital mortality in a TBA patient and one late mortality (7 years later, neuroblastoma). 14/49 patients needed at least one reoperation (28.6%, all TBA), 3 further patients had catheter reintervention or radiofrequency ablation only (6.1%, 2 TBA). 75% of these procedures affected the right heart/pulmonary arteries, there was one re-coarctation repair.

Conclusion: The simultaneous correction of TBA and TGA with AA obstruction or interruption is a safe operation with very low mortality. The AA reconstruction with minimized use of patch material resulted in a low restenosis rate.

2-4

Impact of preoperative quantitative flow ratio on long term coronary artery bypass grafts patency

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Introduction: Preoperative fractional flow reserve in the native coronary arteries is a known predictor of long-term graft patency after coronary artery bypass graft (CABG) surgery. Quantitative flow ratio (QFR) offers a wireless alternative to assess functional severity of coronary stenoses. However, its predictive value of graft patency is still unknown. The aim of our study was to investigate the impact of preoperative QFR value on the long-term graft patency after CABG.

Methods: In our retrospective multicentric study, we included consecutive patients treated with CABG between 2011 and 2022, with available coronary angiogram before and at any timepoint after the CABG. Three-vessel QFR analysis has been performed based on the baseline coronary angiography. Follow-up coronary angiography was checked for assessing graft patency. Only vessels entered the vessel-level analysis, for which the quality of baseline angiography was appropriate for QFR analysis and on which a bypass has been placed. Each bypass was classified either as patent or as occluded.

Results: Overall, 400 patients were included. Mean age was 67 ± 8 years. Patients received on average 2.0 ± 0.9 bypasses. In total 788 coronaries and related conduits were included in the analysis. Among them, 455 were arterial and 333 were veins. 37% of the bypasses were placed on LAD, 26% on RCA and 26% on the LCx. Stenosis severity at baseline was 73 ± 22% with a QFR value of 0.68 ± 0.30. Follow-up coronary angiographies were performed at 34 ± 29 months. Overall graft patency was 83%, with markedly higher occlusion rate for venous rather than arterial conduits (27% vs 9%, respectively; HR 3.9 [2.60 to 5.88]). Occlusion rate was lower for grafts implanted on QFR significant native vessels versus those, placed on non-significant native vessels (13% vs 30%, respectively; HR 2.86 [1.93 to 4.26]). This benefit was maintained for both, arterial grafts (5% vs 22%, respectively; HR 5.23 [2.78 to 10.38]), as well as for venous conduits (24% vs 39%; HR 2.09 [1.21 to 3.50]).

Conclusion: QFR significantly predicts graft patency rate irrespective of whether the graft is arterial or venous. However, patency of venous grafts is poor, even if implanted on functionally significantly native stenotic coronaries.

2-5

Effect of a hypertensive response during exercise on growth rates of aortic diameters

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Introduction: Aortic diameters are related to age, sex, and body size. There are a scarcity of data on the long-term sequelae of a hypertensive response to exercise (HRE) on aortic diameters. In this retrospective cohort study, we aimed to evaluate the relationship between the growth rates of the aorta in individuals with a HRE.

Methods: Our analysis included follow-up data of 649 patients recruited between January 2009 and December 2014 with a HRE. Participants with known connective tissue disease or a history of acute aortic syndrome were excluded. Sinus of Valsalva (SoV) and ascending aorta (AscAo) diameters were measured by transthoracic echocardiography using leading edge to leading edge convention at end-diastole.

Results: At baseline, median age, maximum systolic blood pressure (BP), body mass index (BMI), diameter of the SoV, and AscAo were 62 years, 208 mmHg, 26.9 kg/m2, 35 mm, and 35 mm respectively. 32% of patients were female and 67% had hypertension. After a median follow-up of 7.1 years, mean yearly growth rates (±SD) of the SoV and AscAo were 0.09 (0.41) mm and 0.13 (0.56) mm respectively. No significant associations were observed between growth rates of aortic diameters and maximum systolic and diastolic BP or when considering only individuals with a baseline diameter > 40 mm.

Conclusion: In this large cohort study, maximum systolic and diastolic BP during exercise showed no association with growth rates of aortic diameters. Furthermore, the mean growth rates of aortic diameters in this population were in line with growth rates in a normal population.

2-6

Long-term Outcomes After Surgical Correction of Tetralogy of Fallot – 25 Years Single Center Experience

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Introduction: Tetralogy of Fallot (TOF) is the most common cyanotic congenital heart defect and is characterized by a ventricular septal defect, an obstruction in the right ventricular outflow tract (RVOT), a right ventricular hypertrophy and an aorta overriding the ventricular septal defect. The obstruction can differ significantly among patients, resulting in a variety of presentations from less symptomatic forms to forms with severe cyanosis. Surgical correction is performed using different patch-techniques depending on the level of the RVOT obstruction and the development of the pulmonary valve annulus. The aim of the study was to assess survival and freedom from reintervention in the second decade after correction. The study compared patients with transannular patch (TAP), patients with RVOT patch and patients with correction without patch.

Methods: A retrospective analysis of all patients, who underwent surgical correction of TOF from January 1995 until April 2021 was conducted. Follow-up data was included until December 2021. Mortality was cross checked with the national health insurance and was available for (77%, 124/161), as patients were also transferred from foreign centers for surgery and could not be cross checked. Kaplan-Meier estimator was used to asses time-related outcome events and univariable Cox-proportional hazard analysis was used to determine risk factors.

Results: From January 1995 until April 2021 161 patients (50.3% male, 81/161) underwent correction of TOF. Median age at surgery was 6 months (IQR 3–18 months). 65.2% (105/161) were aged < 1 year at time of correction. Median cardiopulmonary bypass time was 131.5 minutes (IQR 107–159 minutes) and median aortic cross clamp time was 81 minutes (IQR 64–103 minutes). Among the 161 patients, 52,8% (85/161) received a TAP (patch implantation in the RVOT, extending through the pulmonary valve annulus into the pulmonary artery), 40,4% (65/161) an RVOT patch (patch implantation below the pulmonary valve annulus in the right ventricle), and 6,8% (11/161) no patch. 3.7% (6/161) of all patients required implantation of a permanent pacemaker within 30 days after corrective surgery due to a complete AV block (AV block III°). All of these patients had previously been corrected using TAP. Early mortality was 2.5% (4/161) and two late deaths occurred. The Kaplan-Meier estimated survival was 96.6% ± 1.5% after 10 years, 94.6% ± 2.5% after 15 years and after 25 years. The Kaplan-Meier estimated survival did not differ (p = 0.298) between the three groups (TAP 90.3% ± 5% at 25 years; RVOT patch 98.5% ± 1.5% at 25 years; correction without patch 100% at 25 years). Surgical pulmonary valve replacement was necessary in 20.5% (33/161; 17 bioprosthetic valves, 16 homografts) of the patients during the follow-up period and in 4 patients (12.1%, 4/33) required a repeated valve replacement. The most common indicat

Conclusion: Survival rates after TOF correction are excellent in the second postoperative decade. There was no difference in survival between patients with TAP, RVOT patch and correction without patch. However, the TAP correction was associated with an increased risk of reintervention.

2-7

Mid-regional pro-adrenomedullin is an independent predictor of cardiovascular outcomes in cardiac surgery – a prospective cohort study in 500 patients

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Introduction: MR-proADM (mid-regional pro-adrenomedullin) is a stable pro-peptide of Adrenomedullin, which is expressed in various cell types such as heart, lung, and renal tissue. It is a prognostic parameter for heart failure (HF) and sepsis as well as all-cause and cardiovascular (CV) mortality. Considering the characteristics of MR-proADM as a reliable biomarker for adverse events, we aimed to investigate the prognostic impact of MR-proADM in patients undergoing elective cardiac surgery.

Methods: We prospectively enrolled patients undergoing elective cardiac bypass and/or valve surgery at the department of cardiac surgery between May 2013 and August 2018. Blood samples were taken one day prior to surgery. MR-proADM was measured using an automated immunofluorescence assay. Patients were followed prospectively until endpoints were reached. The primary combined endpoint was the composite of hospitalization for heart failure (HHF) or CV mortality, the secondary endpoint was postoperative atrial fibrillation (POAF). The multivariate regression model was adjusted for age, sex, NT-proBNP, type of surgery, and CRP-level at baseline.

Results: A total of 500 patients (146 female [29.2%]; median age 69.8 years [IQR 60.6–75.5years]) were followed over a median of 4.6 years (IQR 3.0–5.8). Valve surgery was performed in 214 (42.8%) patients, 160 (32%) underwent a bypass operation and 126 (25.2%) a combined valve and bypass surgery. The median MR-proADM value of the entire study population was 0.58 nmol/L (IQR: 0.44-0.79 nmol/L). Patients were stratified in risk categories based on their MR-proADM values (Low Risk ≤ 0.63 nmol/L, Intermediate Risk 0.63-0.83 nmol/L, High Risk > 0.84 nmol/L). Patients in the highest category presented with higher rates of diabetes mellitus (p < 0.001), COPD (p < 0.001), HF (p = 0.009) and either bypass surgery (p = 0.039) or the combination of bypass and valve surgery (p = 0.008), compared to patients in the lowest tertile. We observed a significant increase in 5-year's event rates for HHF/CV Mortality in patients in higher risk groups (Low Risk 8.6% vs High Risk 37.7%, p < 0.001, Fig. 1). The adjusted Cox regression model found that MR-pro ADM was independently associated with a risk increase for HHF/CV Mortality (adjusted HR of 4.45, 95% CI 2.55–8.09; p < 0.001, Fig. 2) comparing the High Risk to the Low Risk Group. A comparable risk increase could be observed in POAF, with an adjusted HR of 2.61 (High Risk Group vs Low Risk Group, 95% CI 1.46–4.67, p < 0.001).

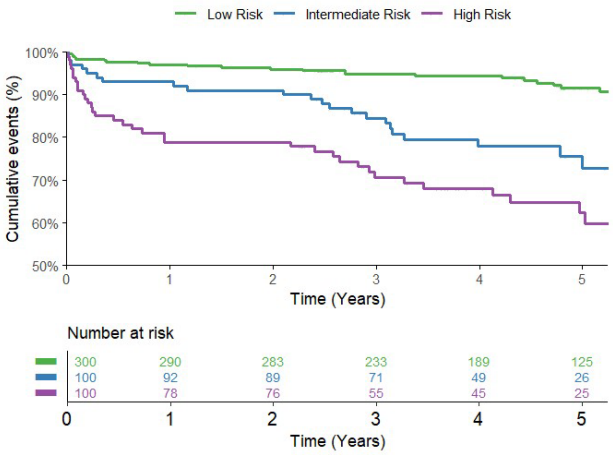

Fig. 1 Illustration of HHF/CV mortality using Kaplan-Meier curve, classified in MR-proADM Risk Groups (Low Risk ≤0.63 nmol/L, Intermediate Risk 0.63-0.83 nmol/L, High Risk >0.84 nmol/L p<0.001)

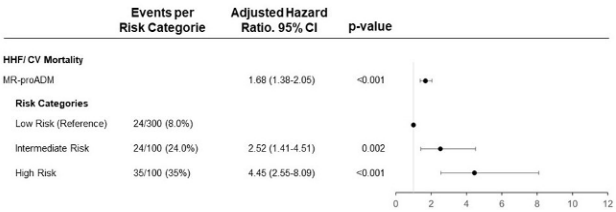

Fig. 2 Adjusted Hazard Ratios for the composite of HHF/CV Mortality; the Cox Regression Model has been adjusted for age, sex, type of surgery, NT-pro BNP, and C-reactive protein; Risk Groups: Low Risk ≤0.63 nmol/L, Intermediate Risk 0.63-0.83 nmol/L, High Risk >0.84 nmol/L

Conclusion: Within the present prospective investigation, MR-pro ADM was found to be a strong an independent predictor for HHF and CV mortality in patients undergoing cardiac bypass and/or valve surgery. Furthermore, there was a consistent predictive potential for POAF. In the era of personalized medicine, preoperative MR-pro ADM levels could help to identify patients at risk for serious adverse events, in order to apply intensified secondary prevention and reduce mortality and morbidity.

2-8

Aortic Dissection Type A in the Young: Progression of untouched aortic segments after surgical repair in long-term follow-up

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Introduction: The aim of our study was to evaluate the development of untouched aortic segments in young patients suffering from acute aortic dissection type A (AADA) and the risk of retained proximal aortic tissue and patent false lumina for aortic reoperation or death.

Methods: We retrospectively reviewed our hospital database for patients aged 50 or younger who suffered from AADA (n=105; median age 43 years [IQR 39y; 47y]). CT and/or MR imaging was measured at timepoint of dissection, at discharge and at last follow-up scan/last CT-scan before reoperation. If available, pre-dissection CT images were analyzed (n=13). Patients who died within the first year after surgery, who were lost to follow-up (CT follow up time <1 year) or with missing image data were excluded.

Results: Since 2000 105 patients under the age of 50 underwent surgery for AADA. Sixty-two patients met the inclusion criteria for imaging work-up. Fourteen patients (13%) had an underlying genetic aortopathy, 13 patients (12%) a bicuspid aortic valve, 22 patients (21%) an arch anomaly. Thirteen patients had CT imaging within one year before AADA. Mean diameters before aortic dissection were 4.2 cm (ascending aorta) and 4.4 cm (aortic root). Mean aortic length was 9.8 cm and aortic angle was 73°. Mean aortic height index (AHI) was 2.4, mean aortic size index (ASI) 2.1 and mean length height index (LHI) was 5.4 retrospectively. Estimated mean pre- dissection diameter of the ascending aorta was 3.9–4 cm, estimated pre-dissection aortic length 10 cm. Median follow-up time was 8.6 years [IQR 5y; 13y]. Mean aortic growth rates over the whole follow-up period in the untouched segments were 4.1 mm for the aortic root (mean growth rate 0.5 mm/year); 6.7 mm for the arch (1 mm/y); 5.4 mm in the descending and 4.6 mm (0.8 mm/y) and 4.5 mm (0.2 mm/y) in the abdominal aorta. Reoperation was necessary in 19% (n=12) of patients. Seven (11%) patients died during follow-up, 4 (7%) of them due to aortic events. There was no significant difference in survival and reoperation rates as well as growth rates of untouched aortic root, arch or descending aorta between patients with genetic aortopathy or without known genetic aortopathy.

Conclusion: In young patients growth rate of the untouched aortic segments is slow with fastest growth rates in the untouched aortic arch. Predissection CT imaging once again confirmed that aortic dissection in the young is happening in small diameters.

POSTERSITZUNG 1 – BILDGEBUNG 1

1-1

CMR-derived pulmonary artery to aorta ratio as a predictor of adverse outcome in patients with cardiac transthyretin amyloidosis

Kronberger C., Mascherbauer K., Willixhofer R., Ermolaev N., Poledniczek M., Duca F., Rettl R., Binder-Rodriguez C., Donà C., Koschutnik M., Nitsche C., Badr Eslam R., Bergler-Klein J., Kastner J., Kammerlander A.

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Introduction: Cardiac transthyretin amyloidosis (ATTR) represents a heart failure phenotype often accompanied by pulmonary hypertension. The pulmonary artery to aorta ratio (PA/Ao), as assessed on cardiac computed tomography or cardiac magnetic resonance (CMR), has demonstrated to indicate risk for adverse events in a variety of cardiovascular diseases, par-

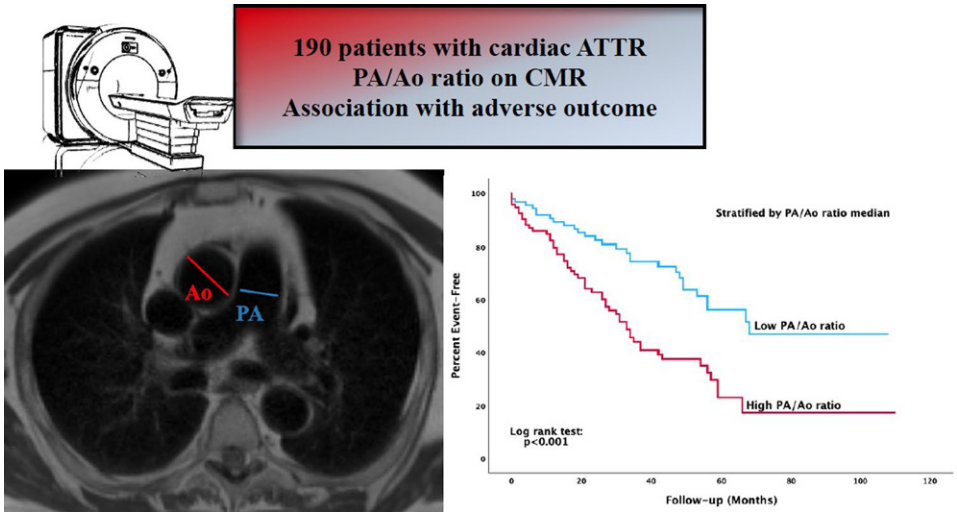

Fig. 1 A – The PA/Ao ratio was obtained by measuring the widest transverse diameter of the PA (blue) and the corresponding transverse diameter of the aorta (red). Abbreviations. ATTR = transthyretin amyloidosis; PA = pulmonaiy artery; Ao = aorta: CMR = cardiac magnetic resonance B – Kaplan-Meier curve illustrating the time to adverse outcome, defined as heart failure hospitalization and/or all-cause death, with stratification by the median PA/Ao ratio

ticularly in heart failure and pulmonary hypertension. However, its prognostic value in cardiac ATTR remains unknown. We aimed to investigate the prognostic value of the PA/Ao ratio in patients with cardiac ATTR.

Methods: Data of consecutive patients diagnosed with cardiac ATTR undergoing CMR were prospectively collected. PA/Ao ratios were measured from CMRs using axial images (Fig. 1A). Adverse outcome, defined as heart failure related hospitalizations and/or mortality, was recorded during follow-up.

Results: Among the 190 confirmed cardiac ATTR patients (mean age 76 ± 11 years, 79% males), encompassing hereditary transthyretin (vATTR, n = 22) and senile (wtATTR, n = 168) types, the median pulmonary artery diameter was 28 mm (IQR 25–31) and the median ascending aorta diameter was 35 mm (IQR 33–39). Over the median follow-up period of 28 months (IQR 11–50 months), 84 (44%) patients experienced an adverse event. Kaplan Meier curves demonstrated an increased risk for adverse outcome in patients with PA/Ao ratios above the median of ≥ 0.8 ($p < 0.001$ by log rank test, see Fig. 1B). In univariate analysis, a high PA/Ao ratio was associated with adverse outcome (HR = 10.3, 95% CI = 2.59–41.1, $p < 0.001$). When adjusted for age, sex, body mass index and right ventricular function, the PA/Ao ratio remained significantly related to adverse outcome (adj. HR = 10.8, 95% CI = 1.76–65.8, $p = 0.010$).

Conclusion: A PA/Ao ratio ≥ 0.8 on CMR is associated with heart failure hospitalization and death in patients with cardiac ATTR. This threshold, notably lower than the commonly reported ≥ 1.0 in other patient populations, holds promise for future risk stratification.

1-2

Comparative assessment of extracellular volume metrics in predicting adverse outcome in patients with transthyretin amyloid cardiomyopathy

Kronberger C., Mascherbauer K., Willixhofer R., Ermolaev N., Poledniczek M., Duca F., Rettl R., Binder-Rodriguez C., Donà C., Koschutnik M., Nitsche C., Badr Eslam R., Bergler-Klein J., Kastner J., Kammerlander A.

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Introduction: The indexed total extracellular volume of the myocardium (iECV) has recently been proposed to be superior in predicting adverse outcome in severe aortic stenosis as compared to conventional extracellular volume (ECV). So far, no study has assessed the comparative predictive performance of both measures in transthyretin amyloid cardiomyopathy (ATTR-CM). We aimed to assess and compare the predictive performance of conventional ECV against iECV in determining adverse outcomes in patients with ATTR-CM.

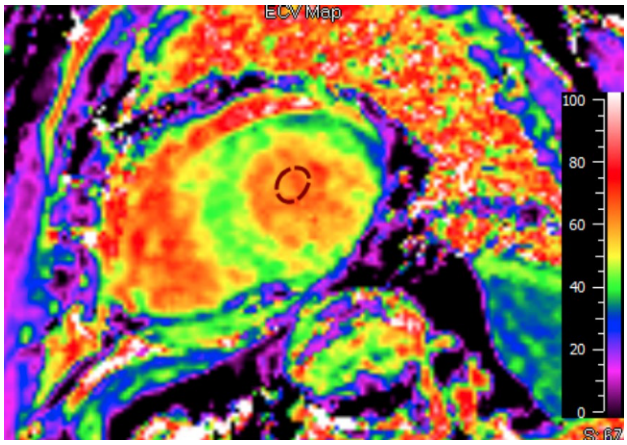

Fig. 1 Example of an extracellular volume (ECV) map of the left ventricle to quantify diffuse myocardial fibrosis

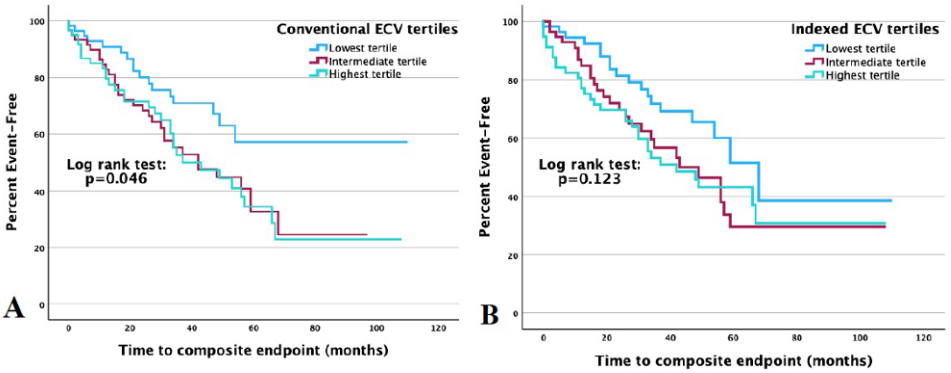

Fig. 2 Kaplan-Meier curves illustrating the time to the composite endpoint, stratified by tertiles of (A) conventional ECV (B) indexed ECV; ECV = extracellular volume

Methods: From 2012 to 2023, patients with ATTR-CM undergoing contrast cardiac magnetic resonance (CMR) imaging prior to any specific treatment were enrolled. Both, conventional ECV (Fig. 1) and iECV were quantified on CMR alongside left ventricular volumetrics and late gadolinium enhancement. Adverse outcome was defined as a composite endpoint of hospitalization for heart failure and/or death.

Results: Analysis of 178 patients with ATTR-CM (82% males, mean age 77 ± 8 years) revealed a mean conventional ECV of 47 ± 13% and a mean iECV of 46 ± 21 mL/m2, with a median follow-up of 2.5 years (IQR: 1.00–4.08 years). Conventional ECV was significantly associated with the composite endpoint (HR = 1.03, 95%CI = 1.01–1.05, p = 0.006), outperforming iECV (HR = 1.01, 95%CI = 1.00–1.02, p = 0.010). On multivariate analysis, adjusted for age, sex and left ventricular function, conventional ECV remained associated with the composite endpoint (p = 0.002), while iECV demonstrated a slightly less significant association (p = 0.003). Kaplan-Meier analysis, stratified by conventional ECV tertiles, revealed that patients in the highest tertile (ECV ≥ 53%) demonstrated the highest event rate (p = 0.043 by log rank test, see Fig. 2A), in contrast to iECV (p = NS, Fig. 2B).

Conclusion: High conventional ECV, among CMR fibrosis markers, is linked to heart failure hospitalizations and death in ATTR-CM, demonstrating superior prognostic value compared to iECV. Conventional ECV measurements may offer enhanced risk stratification for patients with ATTR-CM.

1-3

Age-related Outcomes in CMR versus CT-Guided TAVR: A Secondary Analysis of the TAVR-CMR Trial

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Introduction: The TAVR-CMR (Cardiac Magnetic Resonance Imaging Versus Computed Tomography to Guide Transcatheter Aortic Valve Replacement) trial demonstrated that cardiac magnetic resonance (CMR)-guided transcatheter aortic valve replacement (TAVR) was non-inferior to computed tomography (CT)-guided TAVR. This analysis aims to evaluate the impact of age on outcomes in patients undergoing TAVR for severe aortic valve stenosis.

Methods: This was a secondary analysis of the TAVR-CMR trial, a randomized clinical trial comparing TAVR planning by CT or CMR. Outcomes (based on the Valve Academic Research Consortium (VARC)-2 definition) with each imaging strategy were compared according to median age into those ≤ 82 and > 82 years.

Results: In TAVR-CMR, of 380 randomized patients, 267 underwent TAVR based on the heart team decision. There was no significant age-related difference in TAVR selection between patients ≤ 82 and > 82 years (66% vs. 76%, p = 0.124). Implantation success was not significantly different between imaging strategies for patients ≤ 82 years (92% (CT group) vs. 95% (CMR group), p = 0.524) and patients > 82 years (89.4% (CT group) vs. 91.9% (CMR group), p = 0.622). All-cause mortality at 6 months was not significantly different between imaging strategies for patients ≤ 82 years (4.8% (CT group) vs. 5.3% (CMR group), p = 0.839) and > 82 years (9.1% (CT group) vs. 12.9% (CMR group), p = 0.490).

Conclusion: CMR-guided TAVR was associated with similar TAVR outcomes compared with CT-guided TAVR irrespective of age.

1-4

Clinical Characteristics and Outcomes of Different Microvascular Injury Patterns in Patients with ST-Segment Elevation Myocardial Infarction – A Multicenter Observational Cardiac MRI Study

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Introduction: In patients with STEMI, the differences in patient characteristics and outcomes of various patterns of microvascular injury (MVI) by cardiac magnetic resonance (CMR) imaging are not well known. This study aims to investigate the characteristics and prognostic implications of different MVI patterns in patients with STEMI.

Methods: This study analyzed 1,109 STEMI patients who were enrolled in three prospective studies conducted in Austria, Germany, and Scotland. CMR was performed three days (IQR 2–5) after primary PCI and included late gadolinium enhancement imaging for microvascular obstruction (MVO) assessment and T2* mapping for intramyocardial hemorrhage (IMH) assessment. Patients were categorized into three groups according to the CMR phenotype: those without MVI (MVO-/IMH-), those with MVO but no IMH (MVO+/IMH-), and those with IMH (IMH+). The patient characteristics and clinical outcomes, defined as the composite of all-cause death or new congestive heart failure, were compared between groups.

Results: MVI was found in 633 (57%) patients of whom 274 (25%) had an MVO+/IMH- pattern and 359 (32%) had an IMH+ pattern. Patients with IMH+ were more likely to have LAD or LCX as culprit lesion, less likely female, presented with higher Killip classes on admission and presented more commonly with pre-interventional TIMI flow 0 compared to patients with MVO+/IMH-. Infarct size was larger and ejection fraction lower in IMH+ than in MVO+/IMH- and MVO-/IMH- (infarct size: 27% vs. 19% vs. 18% $p < 0.001$; ejection fraction: 45% vs. 50% vs. 54%, $p < 0.001$). During a median follow-up of 12 (IQR 12–35) months, a clinical outcome event occurred more frequently in IMH+ than in MVO+/IMH- and MVO-/IMH- subgroups (19.5% vs. 3.6% vs. 4.4%, $p < 0.001$). In multivariable Cox regression, IMH+ was the sole independent MVI parameter predicting MACE (HR: 3.65 [95% CI: 1.82–7.35], $p < 0.001$).

Conclusion: MVI is independently associated with future adverse outcomes only in patients with a hemorrhagic phenotype (IMH+). Patients with only MVO (MVO+/IMH-) had a similar prognosis compared to patients without MVI (MVO-/IMH-). This highlights the crucial importance of IMH in assessing risk and advising the direction of future therapeutic strategies for patients with STEMI.

1-5

Kidney T1-times as a risk predictor for major cardiovascular events in all-comers referred for cardiovascular magnetic resonance tomography

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Introduction: Renal disease is a frequent finding in cardiovascular patients and is associated with impaired outcome. Serum creatinine, estimated glomerular filtration rate (eGFR) and urine albumin-creatinine ratio (uACR) are the most common parameters used for assessing kidney dysfunction. Little is

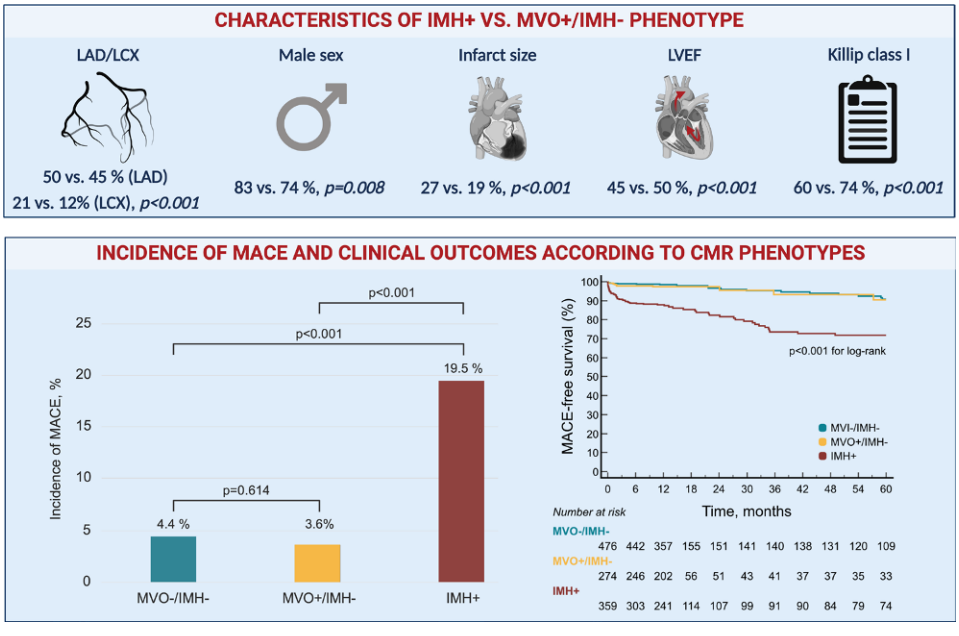

Fig. 1 Characteristics and outcomes of different MVI patterns in STEMI

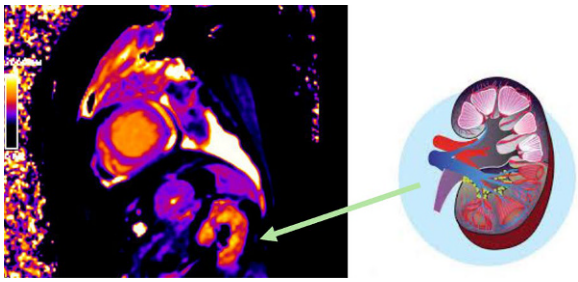

Fig. 1 example of a short axis view displaying the kidney in T1-mapping

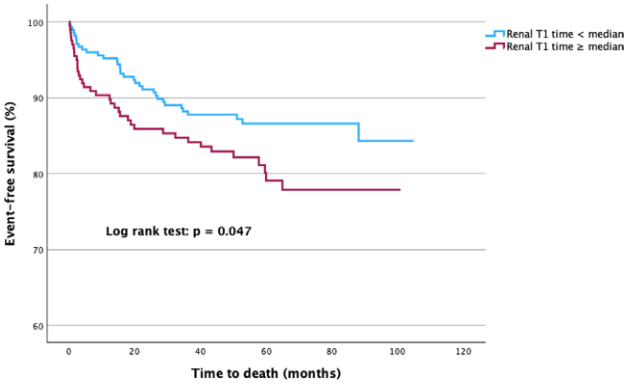

Fig. 2 Kaplan-Meier curve over the time

known whether elevated T1-times measured on cardiac magnetic resonance tomography (CMR), allowing for non-invasive tissue characterization, may reflect kidney dysfunction related to higher risk for cardiovascular adverse events.

Methods: We measured native T1-times in short-axis-view (Fig. 1) in an all-comer cardiac magnetic-resonance-cohort. At the time of CMR renal function parameters (serum creatinine and eGFR) were measured. Adverse outcome was defined as all cause death and/or heart failure hospitalization.

Results: A total of 1132 patients (mean age: 64 ± 18 years, 55% male) were included. Mean kidney T1-times were 1236 ± 125 ms, mean eGFR was 75 ± 31 mL/m2 and mean creatinine was 1.2 ± 0.5 mg/dL. Kidney T1-times were significantly correlated with eGFR (r = −0.129, p = 0.008) and creatinine (r = −0.089, p = 0.047). Kaplan Meier curves demonstrated increased risk for all cause death for patients with kidney T1-times above the median (p = 0.047 by log rank test, Fig. 2). In univariate analysis high kidney T1-times were associated with adverse outcome (per 10-ms increase, HR = 1.02, 95% CI = 1.00–1.05, p = 0.038).

Conclusion: Renal T1-times are associated with eGFR and adverse outcome in this preliminary analysis. Thus, renal T1-times may be considered for cardiovascular risk-stratification in future.

1-6

Refining Risk Stratification in Hypertrophic Cardiomyopathy: The Role of Late Gadolinium Enhancement and Syncope in Predicting Adverse Outcomes

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Introduction: The presence of late gadolinium enhancement (LGE) on cardiac magnetic resonance imaging (MRI) has emerged as a significant marker of myocardial fibrosis and a predictor of adverse outcomes in hypertrophic cardiomyopathy (HCM). Nevertheless, the exact amount of disadvantageous LGE remains a matter of debate. Therefore, this study sought to assess LGE combined with a history of syncopal events and its association with clinical prognosis.

Methods: Between May 2018 and June 2023, a total of 230 HCM patients was prospectively enrolled at the Medical University of Vienna, Austria, a tertiary referral center. The primary endpoint was a composite of new-onset ventricular tachycardia (VT), appropriate ICD therapy, and all-cause mortality.

Results: Median age of enrolled patients was 56 (IQR 44–64) years and 40% (n = 94) were female. Median interventricular septal thickness (IVS) was 21 (IQR 18–25) mm and 43% (n = 84) had significant left ventricular outflow tract obstruction (LVOTO). Over a median follow-up of 3.2 years, 13% (n = 30) met the composite endpoint. These patients had significantly more LGE compared to the non-event group (1.1% vs. % 9.0, P = 0.012). An LGE threshold of 5.25% was identified as an optimal predictor of the composite endpoint, with an area under the curve of 0.72, which increased to 0.77 when including at least one syncopal event in

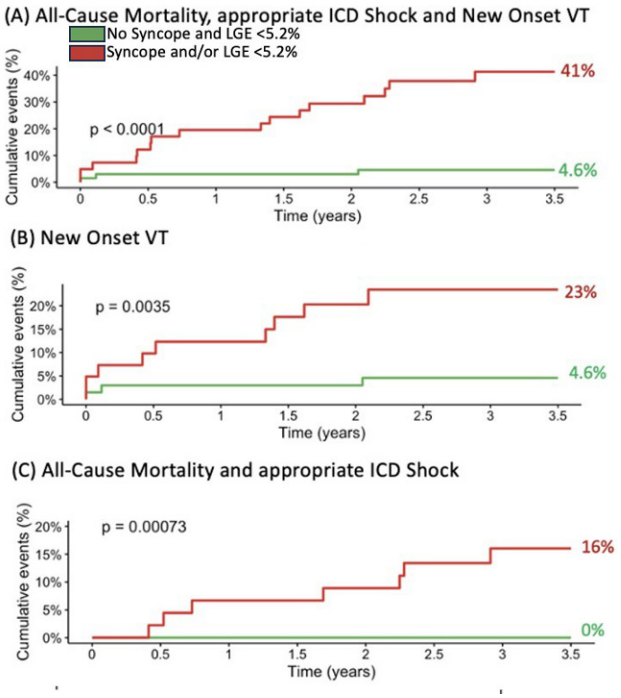

Fig. 1

medical history. By multivariable regression analysis, LGE > 5.25% and/or syncope were independently associated with adverse outcomes (HR 7.26 [95%CI 2.54–20.72]). Furthermore, by logistic regression analysis serum levels N-terminal pro brain natriuretic peptide and high-sensitive troponin T were associated with the presence of at least one these two clinical risk markers (OR for a 1-unit increase in standardized log-transformed: 3.35 [95%CI 1.42–10.85] and 3.48 [95%CI 1.48–10.24], respectively). Interestingly, commonly used variables for risk stratification, such as age, IVS or LVOTO did not show any significant association.

Conclusion: An extent of LGE > 5.25% and the history of at least one syncope may predict unfavorable clinical outcome in HCM patients. These findings necessitate proper MRI appraisal and suggest the need for a more practical approach on an individualized patient level in order to adequately define those at high risk. Further research is warranted to validate these findings in larger, prospective studies.

1-7

Impact of Dynamic Volume Shifts on Echocardiographic Assessment of Cardiac Abnormalities in Patients with Kidney Failure Undergoing Hemodialysis

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Introduction: Cardiovascular disease is the leading cause of morbidity and mortality in patients with kidney failure (KF) undergoing hemodialysis. Although echocardiography is essential for detecting cardiac abnormalities, its reliability and accuracy may be compromised by dynamic volume shifts in these patients. The optimal timing for echocardiography in this patient population has not been yet determined.

Methods: Objective: To determine the impact of dynamic volume shifts on echocardiographic measures in patients with KF undergoing hemodialysis, and to explore their correlations with NTproBNP levels. Methods: Echocardiography was performed in patients undergoing maintenance hemodialysis treatment both before and after hemodialysis to quantify chamber sizes, systolic and diastolic function, global longitudinal strain rate (GLS), and the left ventricular mass index (LVMI). All assessments were made by an evaluator blinded to the patients' clinical information. In addition, NTproBNP concentrations were measured immediately before dialysis.

Results: Results: In total, 20 patients with KF undergoing hemodialysis (mean age 56 yrs, 35% female, 45% diabetes, median NTproBNP 4984 pg/ml) were included in the study. There were no significant differences in pre- versus post-dialysis measurements of LVEDD (53 vs. 47 mm, P = 0.15), LVEF (54% vs 55%, P = 0.84), GLS (−16% vs −14%, P = 0.37), E/E' ratio (11 vs 11, P = 0.34), and LVMI (162 g/m2 vs 158 g/m2, P = 0.69). NTproBNP concentrations significantly correlated with pre- and post-dialysis measurements of LVEF (r = −0.55 and −0.65, both P < 0.05) and E/E' ratio (r = 0.76 and 0.71, both P < 0.001).

Conclusion: Conclusion: The timing of echocardiography relative to hemodialysis sessions (pre- or post-treatment) has minimal impact on evaluation of cardiac function and structure. NT-proBNP levels, despite chronic elevation in KF patients, show consistent correlations with key echocardiographic parameters of systolic and diastolic function.

1-8

Reliabilität der automatisierten Analyse des rechten Ventrikels mittels 3D-Echokardiographie bei jungen SportlerInnen

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Einleitung: Die präzise echokardiographische Bestimmung der rechtventrikulären Parameter stellt aufgrund seiner speziellen Geometrie eine Herausforderung dar. Insbesondere bei AthletInnen findet sich nach wie vor eine geringe Datenlage zur rechtsventrikulären Normwertbildung. Dabei ist die Unterscheidung von physiologischen und pathologischen Anpassungen von grundlegender Bedeutung. Die Verwendung von automatisierten RV 3D Analysen finden noch wenig Anwendung. Dies könnte jedoch eine valide Methode darstellen, um Struktur und Funktion adäquat zu beurteilen und in weiterer Folge eine Basis zur Normwerterstellung bei AthletInnen zu bilden.

Methoden: Retrospektive Analyse von 99 Echokardiographie-Datensätzen (n = 99) im Zeitraum vom 01.01.2020 und 31.12.2022 von AthletInnen (m = 77, w = 22) verschiedener Sportarten. Die Echokardiographien wurden im Rahmen einer sportmedizinischen Untersuchung am ÖSIM in Wien durchgeführt. Die Echokardiographien wurden mittels Philips Epiq CVx und X5-1 Matrix Array Probe (1 to 5 MHz, Philips, Andover, MA) durchgeführt. Die Auswertung der Basisdaten erfolgte über die Workstation IntelliSpace Portal 9.0 Advanced visual analysis. Die RV 3D Analysen wurden durchgeführt durch eine voll automatische, Artificial Intelligence basierte, 4D Software (3D Auto RV, TomTec, Philips) mittels QLab (Version 15.0, Philips) und in diesem erfolgte die Überprüfung der Intra-Observer Variabilität mittels manueller Auswertung des RV 3D Modells zu zwei Messzeitpunkten.

Resultate: Die automatisch generierten Werte aus dem RV 3D Model zeigten eine hohe Korrelation mit manuell adaptierten Werten unter Ausscheidung der Parameter schlechter Bildqualität (EDV: r = 0.88-0.90 ,p < 0.001; EDVi: 0.81-0.84, p < 0.001; ESV r = 0.75-0.774, p < 0.001, ESVi: r = 0.67-0.72, p < 0.001; SV: r = 0.75-0.77, p < 0.001; EF: r = 0.45-0.52, p < 0.001); Datensätze mit schlechter Bildqualität ergaben 17.3 %. LV 2D Basisdaten mit MW ± SD: EDV 139.4 ± 28.4, ESV 45.64 ± 14.1, EF 67.2 ± 7.9, IVS 9.6 ± 1.6, LVPWd 9.0 ± 1.5, EDD 53.4 ± 5.8, ESD 33.2 ± 4.2, E/A 1.9 ± 0.5, E'/A'med 1.9 ± 0.5, E'/A'lat 2.5 ± 0.7

Schlussfolgerungen: Die automatische 3D-Auswertung des rechtens Ventrikels mittels Software der Firma Philips unter Verwendung des QLabs ist eine gute Methodik zur Gewinnung von funktionellen und strukturellen Parametern sowie der Möglichkeit der Normwertgenerierung bei AthletInnen.

POSTERSITZUNG 2 – CHIRURGIE 1

2-1

Long-term patency rate of venous bypass grafts targeting the RCA: A single-center analysis

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Introduction: An increasing level of evidence supports the choice of arterial conduits for coronary artery bypass graft (CABG) surgery in the left coronary system whereas the optimal strategy for revascularization of the right coronary system remains controversial. The aim of our study was to investigate long-term patency of venous bypass grafts targeting the right coronary artery (RCA) based on postoperative coronary angiograms and to identify predictors of graft occlusion.

Methods: All patients who underwent coronary angiography between June 2005 and May 2021 and at least 30 days after undergoing isolated CABG with revascularization of the RCA using a venous graft in our center were evaluated retrospectively. The primary endpoint was graft occlusion and median angiographic follow-up time was 9.1 (IQR 4.5–14.3) years.

Results: Among a total of 1106 patients (17.0% women, 64 (IQR 57–71) years median age) 289 (26.1%) received a sequential vein graft, 798 (72.2%) a single vein graft and 19 (1.7%) a venous Y-/T-graft. Postoperative angiography showed graft occlusion in 368 patients (overall graft patency 66.7%) of whom 101 had a sequential graft (overall graft patency 65.1%) and 260 a single graft (overall graft patency 67.4%). Predictive factors for graft occlusion were age (HR 1.019, CI 95% 1.007–1.032; $p = 0.002$), the urgency of CABG (HR 1.355, CI 95% 1.108–1.656; $p = 0.003$) and severely impaired left ventricular function (HR 1.883, CI 95% 1.290–2.748; $p = 0.001$), but not gender and chronic total occlusion (CTO). Moreover, multivariate cox regression also revealed single grafting as a predictive factor for long-term graft patency (HR 0.575, CI 95% 0.449-0.737, $p < 0.001$). In Kaplan-Meier analysis the 5-year (10-year) freedom from graft occlusion was 76.9% ± 2.8% (57.8% ± 4.0%) for sequential grafts and 90.4% ± 1.1% (77.8% ± 1.7%) for single grafts (log rank $p < 0.001$).

Conclusion: In patients with medical indication for postoperative angiography, venous bypass grafting of the RCA showed acceptable graft patency rates. Single bypass grafting of the RCA was beneficial for long-term outcome compared to sequential grafting, which needs to be the subject of further investigation.

2-2

Temporäre mechanische Kreislaufunterstützung bei drogeninduzierter Kardiomyopathie: Fallbeispiel der Impella 5.5-Erstimplantation in Österreich

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Einleitung: Ein 26-jähriger männlicher Patient im Substitolprogramm wurde in August 2022 kaltschweißig mit Hyperventilation und Tachykardie über die Notfallambulanz aufgenommen. Nach rapider respiratorischer Verschlechterung war kurz nach der Intubation, bei höhergradig reduzierter Linksventrikelfunktion, ein erhöhter Pressorbedarf zu verzeichnen. Bei einer spontan aufgetretenen Asystolie musste der Patient mechanisch reanimiert werden. Am Folgetag zeigte sich eine bilaterale Pneumonie und bei steigenden Troponin-, CK-, BNP- und Laktatwerten erfolgte in der Nacht die notfallmäßige Implantation einer v-a ECMO, femoro-femoral.

Methoden: Bei unzureichender Oxygenierung und weiterhin hohem Laktat wurde 18 Stunden später eine Impella 5.5 über die A.subclavia dext. implantiert.

Resultate: Nach rascher Stabilisierung konnte die v-a ECMO am 7. Tag auf v-v ECMO geswitcht werden. Die Impella wurde am 14. Tag entfernt. Explantation der v-v ECMO erfolgte nach 4 Wochen, die respiratorische Entwöhnung (bei Tracheostoma) war nach insgesamt 7 Wochen erfolgreich. Nach 11 Wochen Aufenthalt konnte der Patient vollmobilisiert nach Hause entlassen werden.

Schlussfolgerungen: Die Impella 5.5 ermöglichte ein rasches Bridging zu Erholung. Die Implantation via A.subclavia dext., das Weaning und die Explantation gestalteten sich weitestgehend komplikationslos.

2-3

Developments and outcomes in surgical treatment of the aortic valve over the last decade: The influence of gender on type of surgery and outcome

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Introduction: The aim of this study is to monitor the results of aortic valve replacement over the last ten years at our clinic.

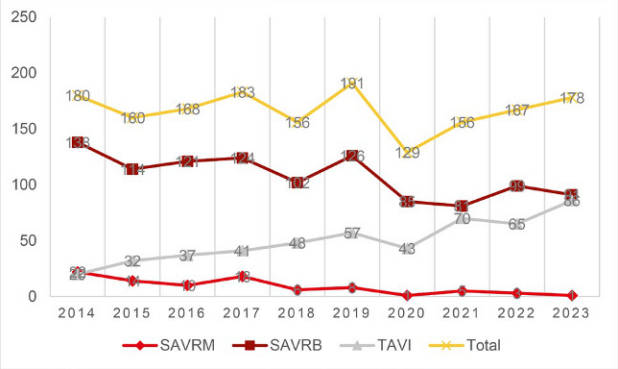

Fig. 1 Number and type of surgeries

Special attention was paid to the complication rate and mortality in women [1].

Methods: Between January 2014 and December 2023, 1634 patients underwent aortic valve surgery 37.4% (n = 611) of whom were women. Acquired aortic stenosis was the main indication for surgery. Patients with infective endocarditis of the aortic valve were also included. Patients undergoing aortic root replacement of any kind were excluded. Preoperative risk, type of surgery, age and surgical outcomes including 30 day and late mortality were analysed. Changes over time regarding patient selection, surgical approach and outcomes were also taken into account.

Results: The mean age was 70 (+/− 11) years. Women were 73 (+/− 10) years old and men 69 years, +/− 11 ($p < 0.001$). Most frequently biological prostheses were used. 1064 pericardial tissue valves and 502 transcatheter valves (TAVI) of which 75% (n = 377) were implanted via a transapical access. As expected, the TAVI patients were significantly older at 80 years(+/−9). In the TAVI patients, the proportion of women was higher compared to the overall collective and amounted to 44%.Mechanical valves were rarely implanted. The overall 30 day mortality rate was 4.2%, for women was 5.9% and for men 3.1%, with a trend towards adverse outcome for women ($p = 0.08$). The mortality rate for TAVI patients was 5.9% (male = 5.0%; female = 7.1%, ns). The reexploration rate due to bleeding was 5.2%.The total number of AVRs has remained stable over the years, with a dip during the coronavirus pandemic. There was a reduction in surgical AVRs. In 2023, almost as many TAVIs were performed as SAVRs (see Fig. 1).

Conclusion: Our data show that women have a higher mortality rate in AVR [2]. In our collective, they were older at the time of surgery. Unlike in other studies, the mortality rate did not differ between TAVI and SAVR. It was even slightly, but not significantly, higher in the TAVI group [3]. In summary, it can be stated that aortic valve replacement, whether SAVR or TAVI, can be performed safely and that a decision on which procedure to choose should be made according to risk profile and individual preference, preferably in a heart team

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2-4

Influence of gender on left ventricular hypertrophy after replacement of the aortic valve with a RESILIA tissue valve

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Introduction: There is evidence that after aortic valve replacement (AVR), LV hypertrophy regresses faster in men than in women [1, 2]. We have controlled this observation for patients who underwent AVR with a RESILA tissue valve.

Methods: Three years follow up data for our institution were taken from the prospective multicentre IMPACT registry [3]. Patients were included if they were scheduled to undergo SAVR with or without concomitant CABG, supracoronary tube graft and/or root replacement, and excluded if they had active endocarditis/myocarditis within 3 months prior to SAVR or underwent double valve procedure (replacement and repair).

Results: A total of fifty-nine patients from our clinic were included in the registry, of which thirty-two patients have three-year follow-up data, fourteen women and eighteen men. The patient groups were comparable in terms of age [67 y, IQR 12] and preoperative risk scores (STS [1,4, IQR 1,5], EuroScore II [1,43, IQR 1,77]). The mean gradient in women before surgery was 48 mmHg [IQR 24] and for men 53 mmHg [IQR 13,5]. The thickness of the septum (15 mm) and the ventricular posterior wall (12 mm) were exactly the same in men and women before the procedure. After three years, the mean gradient for women was 10,5 mmHg [IQR 5 mmHg] and for men 10 mmHg [6 mmHg]. Only one patient (3%) showed minor structural valve deterioration, all others had completely normal biological valve prostheses. The wall thickness of the ventricular posterior wall decreased by 2 mm [IQR 1.5 mm] in women and by 1 mm [IQR 2.5 mm] in men over the three years ($p = 0{,}446$). The thickness of the intraventricular septum decreased over the three years by 2.5 mm [IQR 3.75 mm] in women and 1.5 mm [IQR 3.25 mm] in men ($p = 0{,}310$).

Conclusion: In our highly comparable patient population, there was no gender difference in the extent of regression of left ventricular hypertrophy over the course of three years. All patients had a good outcome after AVR. It is planned to perform this evaluation as soon as all patients have reached the 3-year follow-up for the entire cohort of the IMPACT register and thus obtain even more valid results.

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2-5

MODIFIED LAMPOON-PROCEDURE FOR TRANSAPICAL MITRAL VALVE REPLACEMENT USING THE TENDYNE© DEVICE – A NOVEL TREATMENT MODALITY IN PATIENTS NOT ELIGIBLE FOR OPEN-HEART SURGERY

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Introduction: Transcatheter, transapical mitral valve replacement (TMVR) using the Tendyne© device (Abbott Laboratories, Abbott Park, Illinois, USA) is a novel technique to treat severe mitral regurgitation (MR) without the use of cardiopulmonary bypass or sternotomy, which can be advantageous for older patients with multiple comorbidities. However, a potential complication of TMVR includes the dynamic obstruction of the left ventricular outflow tract (LVOT) by the native anterior mitral valve leaflet (AMVL), which may result in systolic anterior motion (SAM). Anatomical characteristics that are associated with a dynamic obstruction are identified during the (pre) screening process. These patients are not eligible for TMVR. Up to 31.7% (Ludwig et al.) of (pre)screening failures are due to the fear of LVOT occlusion.

Methods: The LAMPOON procedure (Laceration of the Anterior Mitral leaflet to Prevent Outflow ObstructioN) is a transcatheter electrosurgical technique to split the anterior mitral valve leaflet prior to TMVR. This procedure enables the treatment with TMVR in patients who were previously regarded ineligible based on the risk assessment for LVOT obstruction. However, the LAMPOON procedure, which is executed via a transseptal approach, is time consuming and technically challenging.

Results: Hereby, we present the case of an 81-year-old male patient who successfully underwent a modified LAMPOON procedure via an apical access prior Tendyne© implantation.

Conclusion: This novel approach appears to be time saving and technically feasible.

2-6

Two-year outcomes after surgical aortic valve replacement for bicuspid or tricuspid valve morphology: a merged analysis from two international registries

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Introduction: Data on valve performance and outcomes of young patients undergoing surgical aortic valve replacement (SAVR) is limited [1]. We report 2-year safety of a novel aortic bioprosthesis and post-SAVR clinical outcomes in young patients (≤ 60 years) with reference to valve morphology[3].

Methods: Data were merged from two prospective multicenter European registries INDURE and IMPACT [2] of patients undergoing aortic valve replacement (AVR) using a bioprosthesis. Patients were included if they were scheduled to undergo SAVR with or without concomitant CABG, supracoronary tube graft and/or root replacement, and excluded if they had active endocarditis/myocarditis within 3 months prior to SAVR or underwent double valve procedure (replacement and repair).

Results: In a total of 641 patients ≤ 60 years old, 455 (71.0%) patients had bicuspid aortic valve (BAV) and 186 (29.0%) tricuspid aortic valve (TAV) morphology. Compared to patients with TAV, patients with BAV were slightly younger (53.2 vs. 55.6 years, $p < 0.001$), less often in NYHA class III or IV (24.4% vs. 40.9%, $p < 0.001$), CCS class III or IV (3.3% vs. 9.1%, $p = 0.004$), and had lower prevalence of comorbidities, including diabetes mellitus (9.5% vs. 13.6%, $p < 0.001$), hypertension (47.5% vs. 67.2%, $p < 0.001$), and dialysis (0.4% vs. 3.2%, $p = 0.013$). Patients with BAV had a significantly larger left ventricular outflow tract (23.5 vs. 22.3 mm, $p < 0.001$) while the left ventricular ejection fraction was comparable (58.3 vs. 59.1%, $p = 0.361$). Further, patients with BAV less often underwent isolated AVR (55.8% vs. 66.1%, $p = 0.027$), CABG (9.9% vs. 17.2%, $p = 0.008$), had more often supracoronary tube graft replacement (22.0% vs. 8.6%, $p < 0.001$) and received a larger valve size (median 25.0 vs 23.0 mm, $p = 0.001$). At 2 years, freedom from valve-related bleeding was significantly higher in patients with BAV than in those with TAV (91.6% vs. 83.9%, $p = 0.004$), while freedom from other events was comparable.

Conclusion: Except for valve-related bleeding, 2-year outcomes were similar in patients with BAV and TAV, indicating the safety of SAVR with a novel bioprosthesis in young patients regardless of valve morphology. Further investigation of the current patient cohort will determine long-term clinical outcomes and durability of the valve in this patient population.

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2-7

FIRST EXPERIENCE WITH THE NOVEL MITRIS RESILIA MITRAL VALVE BIOPROSTHESIS IN AUSTRIA Die erste Implantation der neuen Mitris Resilia Mitralklappenprothese (Edwards Lifescience, Irvine, CA) in Österreich erfolgte November 2023. Diese neue Bioprothese unterscheidet sich von der bisherigen Magna Mitral Ease durch die Verwendung von RESILIA-Gewebe für die Klappentaschen

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Einleitung: Die erste Implantation der neuen Mitris Resilia Mitralklappenprothese (Edwards Lifescience, Irvine, CA) in Österreich erfolgte November 2023. Diese neue Bioprothese unterscheidet sich von der bisherigen Magna Mitral Ease durch die Verwendung von RESILIA-Gewebe für die Klappentaschen.

Methoden: Wie in der COMMENCE-Studie berichtet(1), zeigten Patienten über einen Zeitraum von fünf Jahren nachhaltige Verbesserungen der transvalvulären Gradienten und der effektiven Öffnungsfläche sowie eine 0 % Inzidenz von struktureller Klappendegenration. Von großer Bedeutung ist, dass die Stenthöhe auf 7 mm gesenkt wurde, um das Risiko einer Obstruktion des linksventrikulären Ausflusstrakts weiter zu minimieren. Zusätzlich wird eine neuartige Verarbeitungs- und Trockenlagerungstechnologie eingesetzt die der Oxidation und Verkalkung der Perikardsegel widersteht(2).

Resultate: Wir möchten hiermit die erste Fallserie Österreichs vorstellen bei der vier PatientInnen mit einem Durchschnittsalter von 68 Jahren in den letzten drei Monaten die Mitris Resilia Mitralklappenprothese erhielten. Alle Operationen verliefen komplikationslos mit einem funktionell guten postoperativen Echokardiographieergebnis bei guter Klappenfunktion ohne relevanter Insuffizienz und ohne paravalvuläres Leak. Alle vier PatientInnen konnten innerhalb von zwei Wochen wieder aus der stationären Pflege entlassen werden.

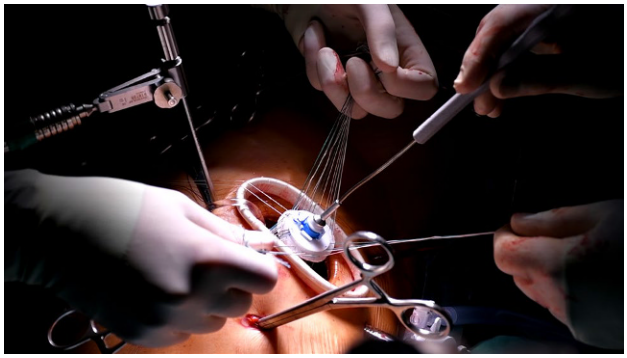

Abb. 1 minimal invasiver Zugang mit der Mitris Bioprothese

Schlussfolgerungen: Diese neue biologische Prothese bietet ein einzigartiges Profil und eine innovative Option für den Mitralklappenersatz bei jüngeren PatientInnen oder bei PatientInnen bei denen ein erhöhtes Risiko einer Obstruktion des linksventrikulären Ausflusstrakts besteht.

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2-8

Elevated levels of lipoprotein(a) predict impaired long-term outcomes following cardiac surgery

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Introduction: 1.4 billion people worldwide are affected by elevated lipoprotein(a) [Lp(a)] concentrations, and it has emerged as a critical player in the realm of cardiovascular health. Lp(a) is an independent risk factor for cardiovascular diseases and as recently published a new risk factor for aortic valve stenosis. This study aims to investigate the impact of elevated Lp(a) on the long-term outcomes following cardiac surgery.

Methods: Patients who underwent cardiac surgery with cardiopulmonary bypass between 2010 and 2020, with Lp(a) levels measured at least once in their lifetime at the University Hospital of Innsbruck, were retrospectively analyzed. Patients undergoing heart transplantation, lung transplantation, and left ventricular assist device implantation were excluded. Using a cut-off of 70 nmol/l for Lp(a), the cohort was separated into low- and high-risk groups. Kaplan-Meier estimators were used to analyze long-term survival.

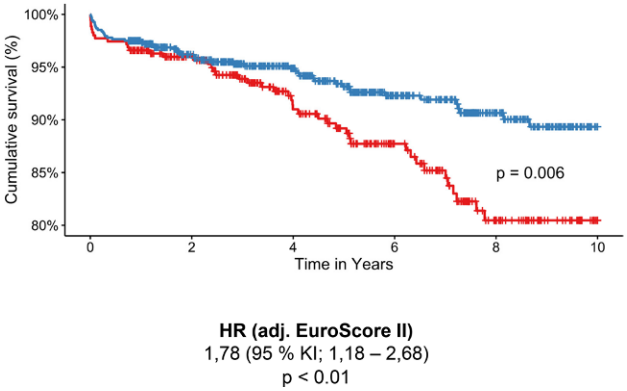

Fig. 1 Lipoprotein(a) predicts impaired long-term outcomes following cardiac surgery

Results: In total, 1,054 patients were included, of whom 28% were female. The median age was 67.2 years [IQR 57.3; 73.9], the median EuroSCORE II was 1.96 [IQR 1.10; 4.10], and the median serum Lp(a) levels were 29.9 nmol/l [IQR 14.1; 119]. 356 (34%) patients had Lp(a) serum levels above 70 nmol/l. The high-risk group showed a median serum Lp(a) level of 177 nmol/l [IQR 116; 239], while the low-risk group had 14.1 nmol/l [IQR 14.1; 29.0] ($p < 0.001$). The groups did not differ in terms of sex, age, EuroSCORE II, the number of smokers, and diabetics. The survival rates at 1, 5, and 10 years following cardiac surgery in the high-risk group were 96,6% (95% CI; 94,7–98,5), 89.2% (95% CI: 85.6–93.0), and 80,5% (95% CI; 75,0–86,4), respectively. The survival rates in the low-risk group were 97.4% (95% CI: 96.2–98.6), 93,2% (95% CI; 91,1–95,3), and 89,4% (95% CI; 86,1–92,7). The hazard ratio adjusted for EuroSCORE II was 1,78 (95% CI; 1,18–2,68) ($p = 0.006$).

Conclusion: Serum Lp(a) levels above 70 nmol/l in patients undergoing cardiac surgery are predictors of reduced long-term survival. These findings underline the importance of measuring the Lp(a) levels of every patient undergoing cardiac surgery. Although elevated Lp(a) levels cannot be directly targeted pharmacologically at present, the literature shows that by lowering LDL-cholesterol levels to a minimum and reducing cardiovascular risk factors, the risk of major cardiovascular events can be reduced. Furthermore, it is of utmost importance to identify patients at risk, as promising therapeutics are currently in phase III trials.

POSTERSITZUNG 3 – CHIRURGIE 2

3-1

PROSTHETIC AORTIC VALVE ENDOCARDITIS IN A PATIENT WITH AN ADDITIONAL DISLOCATED TAVI IN THE DESCENDING AORTA

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Introduction: Herein we report the course of an 80-year old male patient with infectious endocarditis after transfemoral aortic valve implantation. The TAVI procedure was complicated by a dislocation of the initial prosthesis. However, it was possible to move and fixate this prosthesis in the descending aorta. A second prosthesis was then successfully implanted without any complications. 1 Year after this procedure, the patient presented with an endocarditis of the correctly positioned TAVI with vegetations, fever and thromboembolic events.

Methods: The preoperative endocarditis workup included a PET-CT scan, which showed, as expected, an increased metabolic activity of the correctly positioned TAVI. However, the dislocated TAVI also showed, albeit to a lesser extent, metabolic activity. Aiming to remove both valves, we prepared the patient for a procedure in circulatory arrest enabling us to inspect the dislocated TAVI in the proximal descending aorta. After opening the aortic arch, the TAVI prosthesis was inspected by aortoscopy with a bronchoscope (Ambu aScope 4 Broncho). There were no morphological signs of an endocarditis and the TAVI was fully endothelialized. We attempted to remove the prosthesis under endoscopic vision. However, this attempt was unsuccessful as it would have resulted in a severe injury to the descending aorta in an 80-year old patient. Therefore, the prosthesis was left in place. The original TAVI prosthesis in aortic valve position was explanted and replaced with a 25 mm Magna Ease bioprosthesis.

Results: Postoperative recovery was uneventful. The patient was extubated on the day of surgery and transferred to the regular ward on the following day. Antibiotics were continued as per current endocarditis guidelines.

Conclusion: This is the first documented case of a double prosthetic aortic aortic valve endocarditis in a patient with an additional dislocated TAVI in the descending aorta. The surgical approach was adapted to this case. Leaving the dislocated prosthesis in situ to avoid potentially life threating complications was reasonable, as direct visual assessment using the flexible bronchoscope revealed no signs of infection and the prosthesis could not be removed in a safe manner.

3-2

UPSIDE-DOWN INSPIRIS RESILIA BIOPROSTHESIS FOR TRICUSPID VALVE ENDOCARDITIS: A CASE SERIES

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Introduction: Surgical replacement of the tricuspid valve is a rare procedure but the choice of the optimal valve prosthesis in these cases is complex. Despite their young age several patients undergoing this procedure may not be suitable for mechanical valve replacement due to patient choice or non-adherence, especially if they present with a history of drug use. Bioprosthetic valves in tricuspid position are associated with early prosthesis dysfunction and may require early reintervention. The Inspiris Resilia aortic valve bioprosthesis provides promising results regarding increased durability due to a novel anticalcification treatment.

Methods: Five patients aged 21–48 years with symptomatic, severe tricuspid valve disease due to infectious endocarditis were accepted for surgery at our unit. Three patients had previously undergone cardiac surgery, four patients had a history of drug use, the average Euroscore II was 4,2%. All patients received an Inspiris Resilia bioprosthesis, implanted in tricuspid valve position in an upside-down fashion. Intraoperative

transoesophageal echocardiography showed a well-functioning bioprosthesis without paravalvular leaks in all cases.

Results: Routine postoperative echocardiography assessments confirmed regular prosthesis function in all patients prior to discharge. Average intensive care length of stay was 8 days and average length of hospital stay was 43 days. 30-day mortality was 0%, follow-up time is up to 445 days without any cases of valve dysfunction.

Conclusion: We propose the use of the Inspiris Resilia prosthesis in an upside-down position for tricuspid valve replacement in this selected cohort of young high-risk patients with a contraindication for surgical repair and/or mechanical valve replacement.

3-3

SURVIVAL OF A LARGE TRAUMATIC VENTRICULAR SEPTAL DEFECT CAUSED BY A FIREWORK EXPLOSION: FIRST CASE REPORT IN LITERATURE

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Introduction: Large ventricular septal defects (VSD) caused by chest traumas are a rare and potentially life-threatening injury. We report the first case in literature of a traumatic VSD caused by the explosion of an illegal firework in a 16-year old male patient. The patient presented with bilateral open chest injuries and arrhythmias requiring multiple rounds of cardiopulmonary resuscitation (CPR), and had also sustained extensive non-cardiac injuries including a penetrating eye injury and upper limb amputation. Due to severe haemodynamic instability, after CT scan, transoesophageal echocardiography (TOE) was performed, showing a ruptured myocardial ventricular septum with large shunt volumes. Percutaneous closure was not possible due to size and location of the VSD. The patient was immediately transferred to the operating room (OR) for emergency surgery.

Methods: Peripheral cardiopulmonary bypass (CPB) was established under CPR. Following median sternotomy, the right ventricle remained massively dilated and the anterior wall of the heart had a severe myocardial haematoma. Therefore, the both venae cavae were cannulated. After total bypass was established, the right ventricle was incised on the diaphragmatic surface avoiding coronary vasculature, providing direct vision onto the large VSD, approximately 4,5 cm in diameter, surrounded by completely destroyed muscular tissue. The VSD was closed using a bovine pericardial patch 6 cm in diameter, anchored using pledgeted 3/0 Prolene sutures supported by left and right ventricular Teflon felt strips. The RV was closed using two Teflon felt strips and 2/0 Prolene sutures. After de-airing the heart, the aortic cross-clamp was removed and stable sinus rhythm achieved. Intraoperative TOE assessment demonstrated no further shunts over the ventricular septum. Due to high vasopressor doses, a central veno-arterial extracorporeal membrane oxygenation (ECMO) system was established and the patient was transferred to the intensive care unit (ICU) with an open chest.

Results: On ICU, gradual improvement of haemodynamics was observed, allowing for ECMO explantation and chest closure on the 8th postoperative day (POD). The patient was weaned from the respirator and extubated on the 18th POD, showing no neurological abnormalities. He was transferred to the regular ward on the 30th POD and discharged home on the 44th POD.

Conclusion: Life-threatening blunt cardiac injuries caused by blast traumas present a rare occurrence in non-combat settings. Emergency cardiac surgical treatment including extracorporeal life support may be required in case of haemodynamic compromise. This is, to our knowledge, the first reported case of a patient not only surviving a VSD caused by an explosion, but achieving excellent post-injury quality of life with the patient fully reintegrated into his private and working life.

3-4

Surgical approach for the treatment of a giant interatrial paraganglioma

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Introduction: Paragangliomas are rare neuroendocrine tumors arising from extra-adrenal chromaffin cells of the sympathetic and parasympathetic nervous system. Cardiac paragangliomas, though exceedingly rare, represent an intriguing subset of these neoplasms. Less than 2% of chromaffin cell tumors are located in the mediastinum. Possible metabolic activity and catecholamine production are features of this infrequent tumor entity. Given the high vascularity and proximity to vital structures, surgical management necessitates meticulous planning.

Methods: We present a case of a cardiac paraganglioma in a 62-year-old male patient, highlighting clinical presentation, diagnostic workup, surgical intervention and postoperative outcomes. His leading symptoms were exertional dyspnea and chronic cough. Comprehensive echocardiographic assessment indicated an interatrial mass, measuring approximately 7 cm. Further diagnostics included cardiac CT-scan, MRI-scan, FDG-PET CT and DOPA-PET CT. A well-defined 7 cm, enhanced, centrally necrotic tumor was revealed in MRI-scan. It was located interatrial and appeared to arise from the pericardium. Both PET-CT scans indicated neoplastic uptake in the right atrium. Additional findings were excessively elevated dopamine and 3-methoxy tyramine levels in 24 h urine collection. The suspected diagnosis of cardiac paraganglioma was confirmed. The interdisciplinary tumor board recommended primary tumor resection. Pretreatment with alpha und beta-blockers was administered. Due to adequate distance between the tumor and relevant anatomical structures (coronary sinus, AV-valves, as depicted in TEE) the patient was classified as candidate for surgery.

Results: Resection of the tumor was performed in January 2024 via median sternotomy, using extracorporeal circulation and cardioplegia. The suspected paraganglioma was located in the area of the interatrial septum, occluding the superior vena cava. For cannula insertion the superior vena cava and the right femoral vein were chosen. Intense blood supply of the tumor from the coronaries and via the pericardium made preparation significantly more complicated. Both atria were opened. The cranial resection margin was the confluens of superior vena cava and azygos vein. Further resection was performed along a narrow rim around the tricuspid valve and the coronary sinus. The anterior wall of the left atrium had to be removed in toto, leaving the posterior wall and the ostia of the pulmonary veins

in place. Due to adequate distance between the AV-valves and the margins of tumor preparation, reconstruction of the AV-valves was not necessary. For reconstruction of both atria and the superior vena cava, bovine pericardium was used. Two step repair was performed. Firstly, the left atrium was reconstructed using a separate patch. Secondly, the right atrium was rebuild by creating a truncated cone, again using bovine pericardium. Respirator weaning and extubation was possible on the third postoperative day. Histological investigations confirmed the diagnosis of paraganglioma. 1 out of 7 lymph nodes was positive for paraganglioma cells.

Conclusion: Postoperative TTE revealed almost regular morphology of both atria. Despite significant surgical resection of significant parts of both atria no conduction disorders or bradycardia were observed.The patient was released on the 21st postoperative day in excellent clinical condition. Interdisciplinary expertise was essential in finding a comprehensive management plan. Further therapeutic strategies, ranging from watchfull-waiting to chemotherapy, depend on the results of another PET-CT planned for April 2024.

3-5

Left Ventricular Outflow Tract Obstruction as Modifiable Risk Factor for Recurrence of Endocardial Fibroelastosis

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Introduction: Congenital heart defects with left ventricular outflow tract obstruction are often accompanied by subendocardial accumulation of collagen and elastic fibers referred to as endocardial fibroelastosis (EFE). Resection of EFE is performed to improve left ventricular functional recovery, but EFE recurrence is often observed, occasionally hampering LV recruitment endeavors. We previously identified longstanding left ventricular outflow tract obstruction (LVOTO) as risk factor for faster EFE recurrence after primary resection. The goal of this study was to determine whether early surgical elimination of LVOTO at the time of primary EFE resection affects the risk of EFE recurrence.

Methods: A retrospective chart review included all patients with congenital aortic valve (AoV) stenosis/LVOTO (n = 93) who underwent primary resection of EFE at two centers between 01/2010 and 12/2021. Patients with LV long axis z-score >−2, mitral valve area z-score >−2, less than severe mitral stenosis and at least moderate LV function were included (58/93). Children with surgical treatment of LVOTO by a Ross (+/−Konno) procedure (22/58) were compared to patients with resembling anatomy who underwent other kinds of LVOT surgeries, mostly aortic valvuloplasty (36/58). EFE recurrence was defined as increased thickness or progressive appearance in previously resected or new areas determined by echocardiography and/or MRI during follow up. The primary outcome measure was time to EFE recurrence.

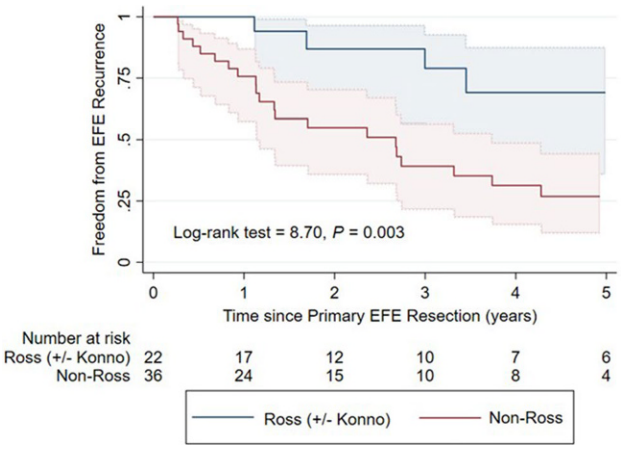

Fig. 1

Results: Freedom from EFE recurrence was significantly higher in Ross (+/− Konno) patients (P = 0.003), with a median time to recurrence in the non-Ross patients of 2.67 years (Fig. 1). Freedom from reintervention on the LVOT/AoV was higher in the Ross (+/−Konno) group, 1/22(4.5%) vs 15/36 (41.7%) (log-rank test = 8.46, P = 0.004). 18/22 (81.5%) of patients after Ross were alive with a biventricular circulation at most recent follow up.

Conclusion: Our data indicate that LVOTO is a modifiable risk factor for EFE recurrence, and early surgical relief by enlargement of the LVOT has the potential to reduce the risk of LV EFE recurrence. This patient cohort also showed a reduced rate of reoperations on the LVOT and AoV. The correct patient selection and timing for surgical LVOTO treatment in the larger context of LV recruitment efforts has yet to be identified through prospective trials.

3-6

Case report of a giant floating right heart embolus through a patent foramen ovale into the left ventricle

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Introduction: A floating thrombus in the right heart is a rare but potential life-threatening condition. Especially in combination with a patent foramen ovale. Floating thrombi in the right heart are migrating thromboembolic events based on deep venous thrombosis, associated with a very high mortality rate. We present herein an interesting case of a huge thrombus formation floating into the left ventricle through an open foramen ovale into the left ventricle through the mitral valve.

Methods: A 50-year-old man was admitted to a peripheral hospital due to a pulmonary embolism. Echocardiography showed a floating thrombus from the right atrium through a patent foramen ovale into the left atrium, extending over the

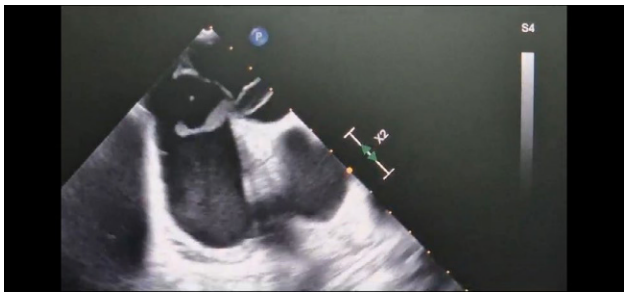

Fig. 1 Echocardiogram image showing the floating right heart thrombus through a patent foramen ovale extending over the mitral valve

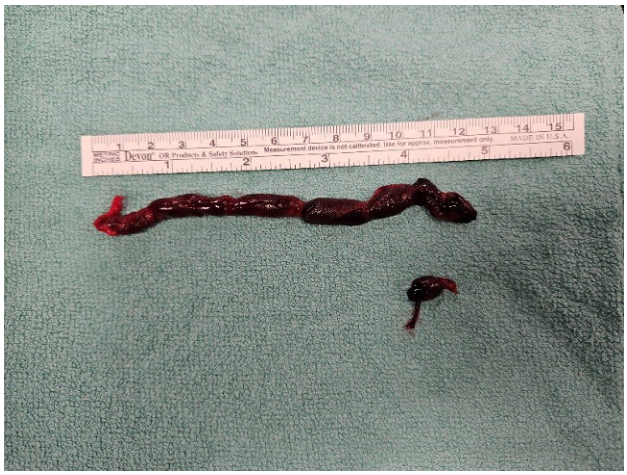

Fig. 2 The large thrombus

mitral valve. The indication for immediate cardiac surgery was made.

Results: We performed an emergency surgery with venous and arterial cannulation through the vasa femoralia. To reduce the risk of an insult, the venous cannula was only pushed up to the level of the diaphragm. Establishing extracorporal bypass, sternotomy was done. The entire thrombus with a size 13 cm was completely removed. Postoperative echocardiography showed no evidence of suspicious thrombus material left in either the atrium or the ventricle. Postoperatively, the patient was neurologically ordinary. He was extubated on the day of surgery, transfer to the normal ward on day 4 and discharge home on day 13.

Conclusion: Our successful case presents the importance of the right strategy and planning before surgery. Furthermore, we show the recommendation of immediate surgery as well as the advantage of immediate inguinal cannulation to relief the heart before sternotomy.

3-7

Redo-Aortic Arch Replacement Employing the Frozen Elephant Trunk Technique: Contemporary Two-Center Experience

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Introduction: In many cases of acute aortic dissection, the dissection extends beyond the left subclavian artery. Initial aortic repair leaves the downstream aorta untouched. The residually dissected aorta carries the risk of aneurysm formation requiring secondary intervention. The aim of this study was to evaluate the outcome of patients undergoing aortic arch replacement employing the frozen elephant trunk (FET) technique after surgery for acute dissection.

Methods: Sixty-six consecutive patients (60% men, mean age: 57 ± 12 years, ES II: 7.29 ± 5.21) underwent open redo aortic arch replacement at two Austrian centers. The reoperation was performed through a repeat sternotomy using selective antegrade cerebral perfusion (bilateral n = 48, 72.7%, unilateral n = 18, 27.3%) under moderate- to- mild hypothermic circulatory arrest (28 °C bladder temperature) in all patients. Intraoperative details, clinical outcomes and follow-up data were evaluated.

Results: Redo FET was performed using either a conventional technique with the distal anastomosis in Ishimaru zone 3 (n = 25, 37.9%) or a simplified technique with an anastomosis in zone 2 (n = 41, 62.1%). Cardiopulmonary bypass time totaled 208 ± 50 min and myocardial ischemic time was 102 ± 33 min. Mean duration of selective antegrade cerebral perfusion (ACP) was 57 ± 19 min. In-hospital mortality was 3% (n = 2). Postoperative neurological complications comprised stroke (n = 6, 9.1%) and spinal cord injury (temporary n = 1, 1.5%; permanent n = 2, 3%). Postoperative renal failure occurred in 10 patients (15%),

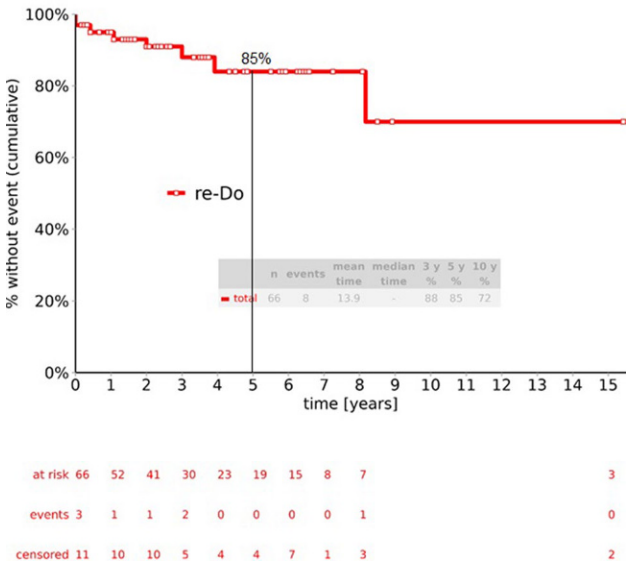

Fig. 1 Survival

necessitating temporary or permanent dialysis in 9 (13.6%) and 1 (1.5%) patients, respectively. Median intensive care unit stay was 3 days. Survival rates after 1, 3 and 5 years were 95%, 88% and 85%, respectively. A multivariate analysis, using a Cox regression model, identified older age, new dialysis and stroke as predictors of mortality (HR = 1.09, 95% CI, 1.05–1.12, HR = 2.37, 95% CI, 1.53 –. 3.65, HR = 1.58, 95% CI, 1.15–2.16, respectively).

Conclusion: Our data suggest that redo FET following previous aortic surgery for acute aortic dissection performed by a dedicated aortic team shows an excellent safety profile. Survival rates are very promising despite the high-risk nature of the surgery. Nonetheless, stroke and renal failure are concerns that can influence late outcome. Our findings justify a less aggressive distal extend during initial surgery for acute type A aortic dissection. Furthermore, successful redo aortic arch surgery employing the FET technique serves as an ideal platform for further downstream aortic interventions.

3-8

A novel 3 step approach with extensive electrocautery septotomy in the treatment of extensive aortic dissection aneurysms

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Introduction: Classical treatment of acute aortic dissection typ A with replacement of the ascending aorta often in combination with an open distal anastomosis, does not eliminate all dissected aortic segments. Due to a persistent false lumen perfusion, patients develop post-dissection aneurysms making subsequent aortic reintervention necessary. Treatment of post-dissection aortic arch and thoracoabdominal aortic pathologies represent significant therapeutic challenges. True lumen collapse or take-off of aortic branches from the false lumen may limit endovascular options. Whereas open thoraco-abdominal replacement remains a highest risk surgery. We present herein our initial clinical results of a 3 step approach to treat thoracoabdominal post-dissection aneurysm with electrocautery septotomy of the dissection membrane.

Methods: Eight patients with a complex multisegmental thoraco-abdominal aortic pathology due to aortic dissection underwent our 3-step approach. Step 1 consisted of total aortic arch replacement via the frozen elephant trunk technique. Step 2 was thoracic endovascular aortic repair for distal extension down to the level of the thoraco-abdominal transition. Step 1 and Step 2 were combined with the EASE procedure. EASE is a method of electrocautery septotomy of the dissection membrande. Finally, step 3 was completion of the endovascular thoraco-abdominal aortic repair with a fenestrated proshtesis. Intraoperative details, clinical outcomes and follow-up data were assessed.

Results: The median age was 55 (22–70) years; 2 patients (25%) presented connective tissue disease. Four patients (50%) had undergone previous aortic surgery for aortic dissection. 3 patients had replacement of the aortic arch employing the frozen elephant trunk technique and EASE procedure in the “Step 1” procedure. The remaining 5 patients had the EASE procedure in “Step 2” with TEVAR of the thoracic aorta. Mean time between step 1 and step 2 was 11 months and mean time between step 2 and step 3 was 3 months, respectively. Overall Mortality rate was 25% (n = 2). This two patients died within two months before FEVAR implantation due to a rupture of the aorta distal of the TEVAR stent ending. Technical success was reported with 100% in the remaining 6 patients. Due to endoloeaks, three patients

Fig. 1 Contrast enhanced computed tomography showing a narrow true lumen and take off of side branches from the false lumen

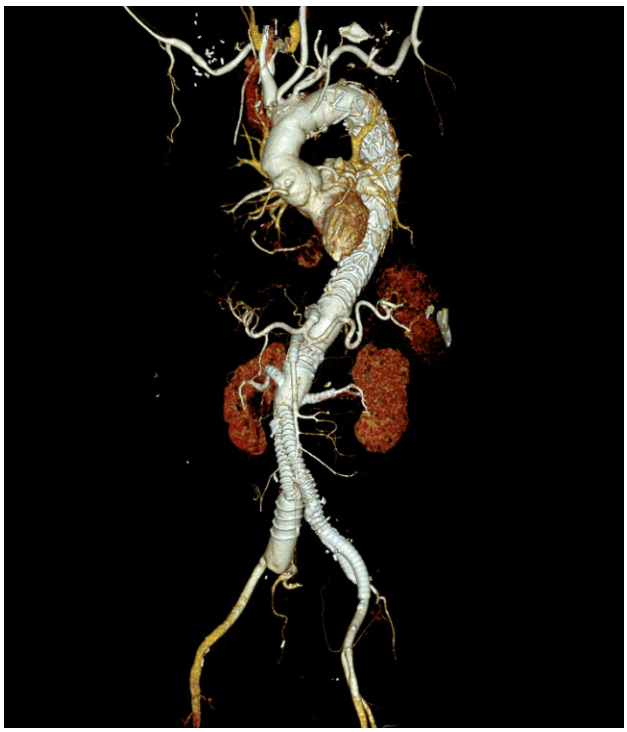

Fig. 2 Final result after complete aortic repair

required further procedures. One suffered symptomatic spinal cord injury. No disabling stroke was documented.

Conclusion: This 3-stage approach offers excellent clinical outcome to a high-risk patient group. While in the past these patients were treated with open thoracoabdominal aortic replacement presenting high mortality rates. In the field of our interest is the behaviour of the aorta after electrosurgical septotomy. Cutting the dissection membrane and creating a large common lumen can increase the risk of rupture on the short run due to changes in the wall stress of the dissected aorta. Especially patients with connective tissue disorder must be under surveillance. Early fenestrated completion of the repair can even progress our results. Even "off the shelf" prosthesis can simplifiy planning of step 3 and shorten the time between the second and the third step.

POSTERSITZUNG 4 – DIGITAL CARDIOLOGY 1

4-1

Using Noninvasive Imaging of Cardiac Electrophysiology to visualize the optimal SyncAV® setting in patients undergoing Cardiac Resynchronization Therapy (CRT)

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Introduction: Cardiac resynchronization therapy (CRT) is a cornerstone treatment for heart failure patients with electrical dyssynchrony, aiming to improve cardiac function, quality of life, and overall survival. The NICE-CRT Trial was designed to investigate the efficacy of the SyncAV® Algorithm in optimizing CRT through non-invasive imaging of cardiac electrophysiology. By utilizing cutting-edge imaging technologies, the study aimed to enhance ventricular activation synchronization in CRT patients, potentially revolutionizing personalized treatment strategies and advancing the field of cardiac electrophysiology [1].

Methods: Fourteen patients with heart failure symptoms, reduced ejection fraction, and preserved atrioventricular conduction were prospectively enrolled in the NICE-CRT study. Following CRT device implantation, patients underwent comprehensive evaluation using the SyncAV® Algorithm, which allowed for dynamic adjustment of atrioventricular intervals based on non-invasive imaging of cardiac electrophysiology [2]. Local activation times within the heart were meticulously measured using sophisticated software incorporating Maxwell's equations and a bidirectional finite element method [3,4,5]. Various programming configurations were systematically analyzed to assess the impact of the algorithm on ventricular synchronization and electrical activation patterns.

Results: The results revealed advancements in optimizing CRT through the utilization of the SyncAV® Algorithm and non-invasive imaging of cardiac electrophysiology. The study enrolled 14 heart failure patients with left bundle branch block and preserved atrioventricular conduction. Various device programming settings were explored to assess the impact on ventricular activation time and QRS duration. The investigation identified that the optimal offset time for automatic dynamic adjustment of the paced atrioventricular interval was found to be 30 and 50 ms, resulting in a significant decrease in mean native QRS duration from 181.6 ± 23.9 ms to 130.7 ± 10.0 and 130.1 ± 10.5 milliseconds, respectively ($p = 0.01$). Additionally, an offset of 40 milliseconds was associated with a decrease in QRS duration to 130.1 ± 12.2 ms ($p = 0.08$). These findings underscore the importance of individualized offset programming in CRT optimization for patients with left bundle branch block and preserved atrioventricular conduction. Furthermore, the study supported the recommendation to program an offset of 50 milliseconds as the default setting in such patients post-implantation of a CRT device capable of SyncAV® optimization. Alternatively, an offset programming of 30 ms may also be considered as a default programming option. The trial revealed that dynamic AV delay programming improves CRT outcomes by targeting fusion with intrinsic conduction, surpassing simultaneous biventricular pacing.

Conclusion: The findings of the NICE-CRT Trial highlight the importance of individualized CRT programming using advanced algorithms like SyncAV® to enhance cardiac synchronization and improve clinical outcomes in heart failure patients. Non-invasive imaging modalities offer a promising approach to visualize and optimize CRT outcomes, emphasizing the need for tailored treatment strategies in heart failure management. Future research endeavors should focus on integrating these innovative technologies into routine clinical practice to further enhance the efficacy of CRT and advance patient care in heart failure populations. The study provides valuable insights into the potential of personalized CRT optimization strategies in improving outcomes and quality of life for patients with heart failure.

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4-2

Machine learning prediction models for individualized technical success of chronic total occlusion revascularization using anatomical input

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Introduction: Chronic total occlusion revascularization (CTO PCI) remains a highly challenging procedure in the realm of percutaneous coronary interventions. Recent advancements in interventional devices and procedural techniques have enabled successful procedures even in difficult lesions and complex coronary anatomy. Especially, the retrograde procedure has improved success rates thus increasing procedural time. Efforts such as implementing the hybrid algorithm for CTO crossing have been made for systematically approaching complex lesions. Nevertheless, CTO PCI remains in general a long procedure requiring preparation and planning to reduce failure rates. Interventional techniques are evolving, and complexity scores such as the J-CTO score might get outdated. For this

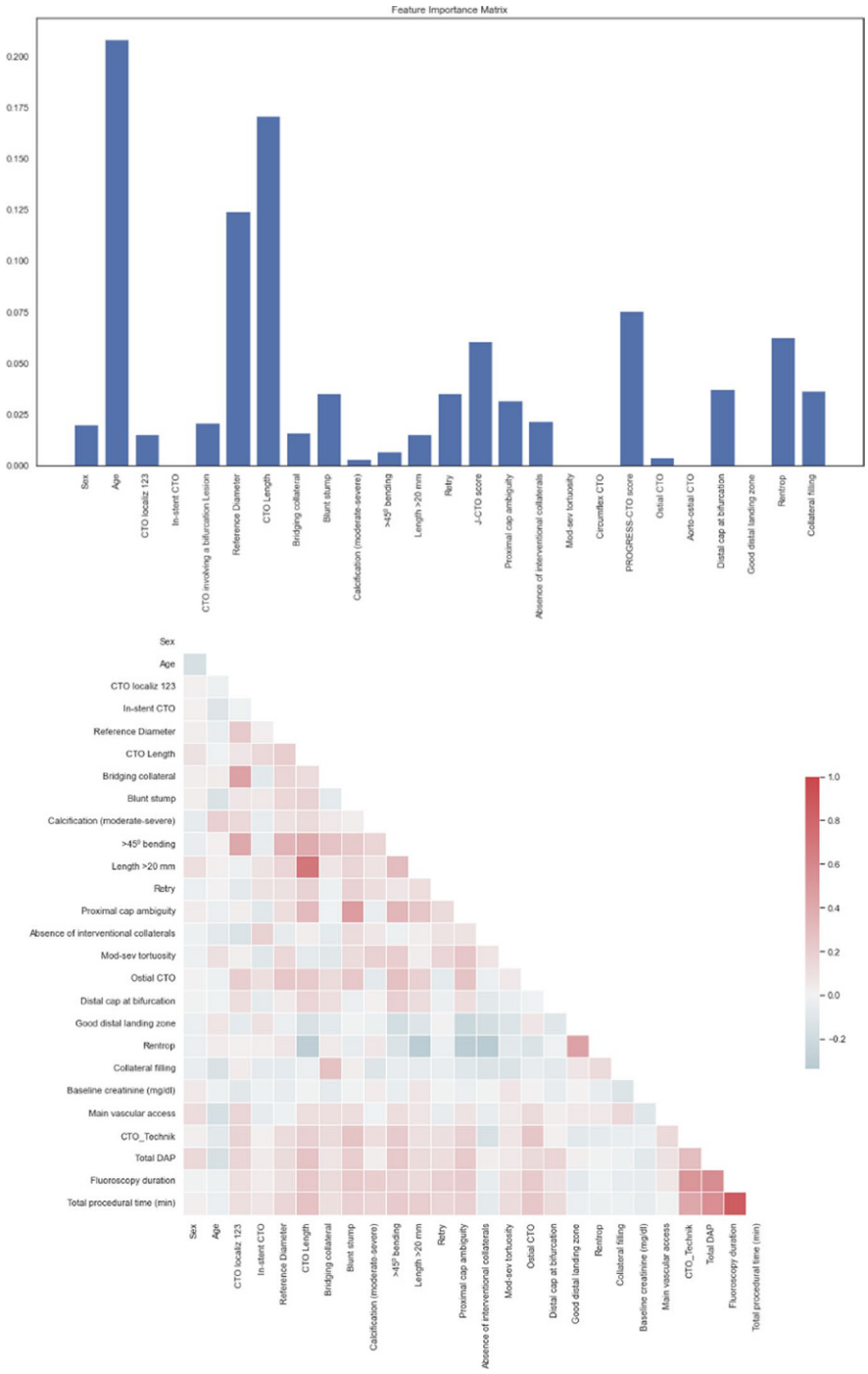
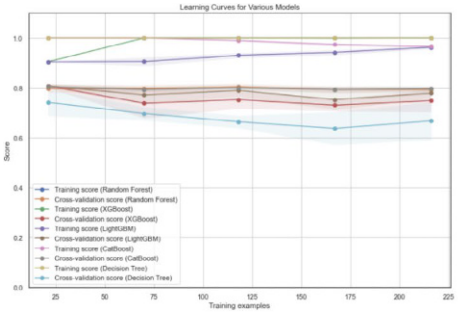
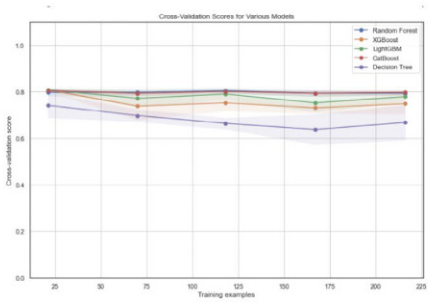


Fig. 1 Feature importance matrix and cross-correlation of anatomical parameters





	Accuracy	Precision	Recall	F1-Score	AUC-ROC
Random Forest	0.77	0.82	0.92	0.87	0.25
XGBoost	0.58	0.78	0.70	0.74	0.22
LightGBM	0.65	0.79	0.78	0.78	0.21
CatBoost	0.81	0.83	0.98	0.90	0.21
Decision Tree	0.48	0.76	0.55	0.64	0.34

	Lightgbm	Random Forest	XGBoost	CatBoost	Decision Tree
Accuracy	0.782290	0.800741	0.763771	0.797037	0.649428
Precision	0.507791	0.403375	0.477377	0.403012	0.470689
Recall	0.518985	0.495455	0.508425	0.493182	0.473245
F1 Score	0.500152	0.444664	0.488370	0.443504	0.467216

Fig. 2 Performance of the machine learning models

reason, machine learning models can be used to overcome this limitation by constantly providing new data and improving the models by continuous data feeding. In this study, we aimed to introduce machine learning models to predict individualized technical success of CTO PCI using broad anatomical coronary information and baseline patient data.

Methods: Consecutive patients undergoing percutaneous coronary intervention of chronic total occlusions were enrolled in this retrospective study. Angiographic data and lesion specific characteristics from coronary angiography were extracted. Outcomes such as technical success, total time of procedure, procedural success were extracted from records immediately after the procedure. Machine learning models were applied to predict technical success rate. A total of 271 patients were used to validate and train the models and 50 separate patients for testing purposes. Data was preprocessed by removing missing values, assessing correlations, and removing multicollinearity. Data was normalized and fed to several classifying machine learning models including decision trees (DT), random forest (RF), extreme gradient boosting (XGB), CatBoost (CB) classifiers, and light gradient boosting (LGB). Finally, accuracy, precision, recall and F1-score of the selected hyperparameters and cross-validation was performed.

Results: Best final optimized results contained normal run models for predicting the technical success. CB was the best performing model with an accuracy of 0.81, precision of 0.83 and recall of 0.98. The F1 score was 0.90. RF was the second-best performing model with accuracy of 0.77, precision of 0.82, recall of 0.92 and F1 score 0.87. LGB an accuracy of 0.65, precision of 0.79 and recall of 0.78. The F1 was 0.78. The tuned models performed modestly with RF having the highest accuracy of 0.80 but a low F1 score of 0.44, due to small sample size. In the tuned models, RF had the highest accuracy of 0.801 but a low precision of 0.403. LGB had a higher F1 score and a relatively high accuracy (0.782) and precision (0.508). The feature importance matrix found age, CTO length, reference diameter to have the highest value among the lesion complexity parameters. Among complexity scores, the PROGRESS CTO Score performed better than J-CTO score in the prediction models. Rentrop and collateral filling had values of more than 0.025 in the feature importance matrix.

Conclusion: Overall, the normal-run CB was the best model for predicting the technical success after a CTO PCI with a high accuracy of 81%, meaning in 81% of the cases it could correctly predict success or no success. The fine-tuned and cross-validated models performed modestly because of the relatively small, unbalanced dataset and overfitting. However, data showed promising first results in implementing machine learning into predicting interventional outcomes. With larger datasets of carefully extracted anatomical information, we could better predict patient-centered outcomes. Further studies like data augmentation and providing a weighted dataset would increase the model performance and provide a very precise statement whether a patient would have increased chances to have a successful PCI based on baseline anatomic information. Adding more parameters related to interventional techniques may help provide a contemporary value of the outcome prediction. This is one of the first studies aiming to predict technical success of CTO PCI using angiographic baseline parameters and machine learning models. Our findings suggest that the tuned CB model is the most suitable for predicting the techincal success of CTO PCI based on previously assessable angiographic data and evaluation metrics. Future studies with larger patient cohorts are needed to involve deploying the selected model in larger patient cohorts including external validation and assessing its performance with new, unseen data.

4-3

Computational fluid dynamics of a segmentated CT compared with 4D-flow MRI: Blood flow analysis of a type B dissection.

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Introduction: TEVAR intervention is the recommended therapy to treat pathologies of the descending aorta. A remain-

ing challenge is the progression of the aortic disease post-TEVAR due to endoleaks, mainly influenced by the degree of oversizing and the landing zones. While the prediction of the aortic geometry by the surgeon is based on conventional CT-scan, an additional imaging of the intraluminal flows based on these data might be helpful. The aim of the study is to prove, if computational 3D fluid dynamics (CFD) based on a segmentated CT can be compared with the imaging known from 4D MRI flow.

Methods: The geometry of an aorta with type B dissection has been remodeled based on the CT-scan of a patient. The generated 3D-model has been used to study the flow using open source CFD-software (OpenFOAM) and the 3D-print of this model has been perfused inside the MRI of the TU Graz with an ECMO device to receive experimental flow data for comparison. The ECMO-tubes have been 8 m long, as the ECMO-device itself had to stay in the control room of the MRI. To validate the boundary conditions independently of the tube resistance, pressure measuring points at the aortic inlet and outlet have been established.

Results: The results of both imaging procedure match qualitatively and quantitatively. Significant differences can be explained by constraints of the experiment (turbulence due to steps, model deviations, tube resistance, ...). By comparing the results from CFD and 4D-Flow MRI in a 3D-printed flow phantom, we conclude, that an accurate aortic flow based on a conventional CT can be simulated with a free software and is "comparable" to standard 3D-flow MRI imaging.

Conclusion: Hemodynamics in vascular disease is important in pathological conditions, especially in aortic diseases. The numeric analysis of blood flow has gained attention from technicians to physicians. The clinical application of CFD-imaging of CTs to evaluate diagnosis and therapeutic options especially in the acute setting of aortic diseases might be a great step toward risk reduction in interventional options. The next step is to evaluate the maximum wall shear stress to select the optimal stent simulating the interaction of flow and structure.

4-4

Bridging Gaps in Cardiac Rehabilitation in Austria: What It Takes to Co-Design a Digital Companion for Patient Empowerment

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Introduction: Cardiac rehabilitation (CR) is underutilised worldwide. In Austria, only approx. 30% of eligible patients participate in phase II CR [1]. Central to this issue is the crucial yet underperforming referral process to CR due to various factors, including patients' lack of information regarding CR's health benefits and how to obtain a referral. This work introduces the co-design process of a digital companion app as a patient-centred approach to facilitate CR referrals.

Methods: We conducted a participatory design project using generative co-design activities [2], such as paper prototyping and persona scenarios. The research environment was a fully equipped but currently not actively used hospital ward to situate the co-design in the immediate physical context where the digital companion would be used. Collected data was analysed qualitatively using thematic analysis [3]. We included healthcare professionals (HCPs) and cardiac patients with CR experience. HCPs were recruited via snowball sampling by contacting universities and hospitals in the federal state of Salzburg and Upper Austria. Cardiac patients were recruited via a cardiac patient network. Each participant was rewarded with 360 € for participating in two workshops.

Results: Three sequential co-design workshops were held, including 17 participants: ten cardiac patients, most of whom had completed a CR programme, six HCPs who worked within the CR pathway, and one who was an HCP with a cardiac condition who had completed a CR programme. During the workshops, 130 minutes of audiotape from the group presentations and discussions were recorded. The dataset was complemented by participants' paper prototypes, flipcharts with sticky notes, and researchers' field notes. Each participant was engaged in approximately 10 hours of active participation and additional travel expenses. Some participants travelled more than 300 kilometres one-way and took time off work to attend the workshops, indicating considerable interest and high relevance of possible outcome solutions. The participants reflected on their

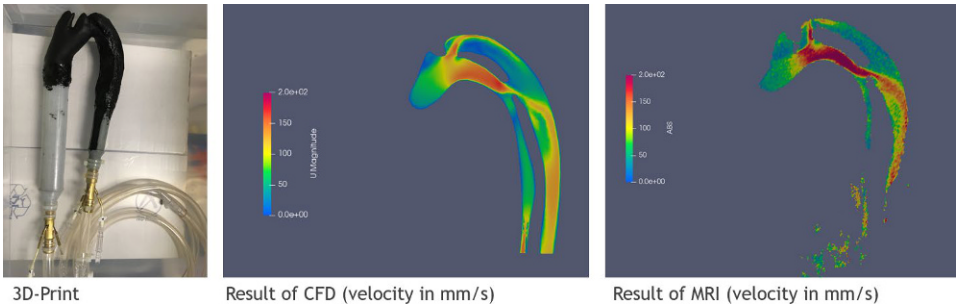

Fig. 1 3D-Print, CFD-Result, MRI-Result

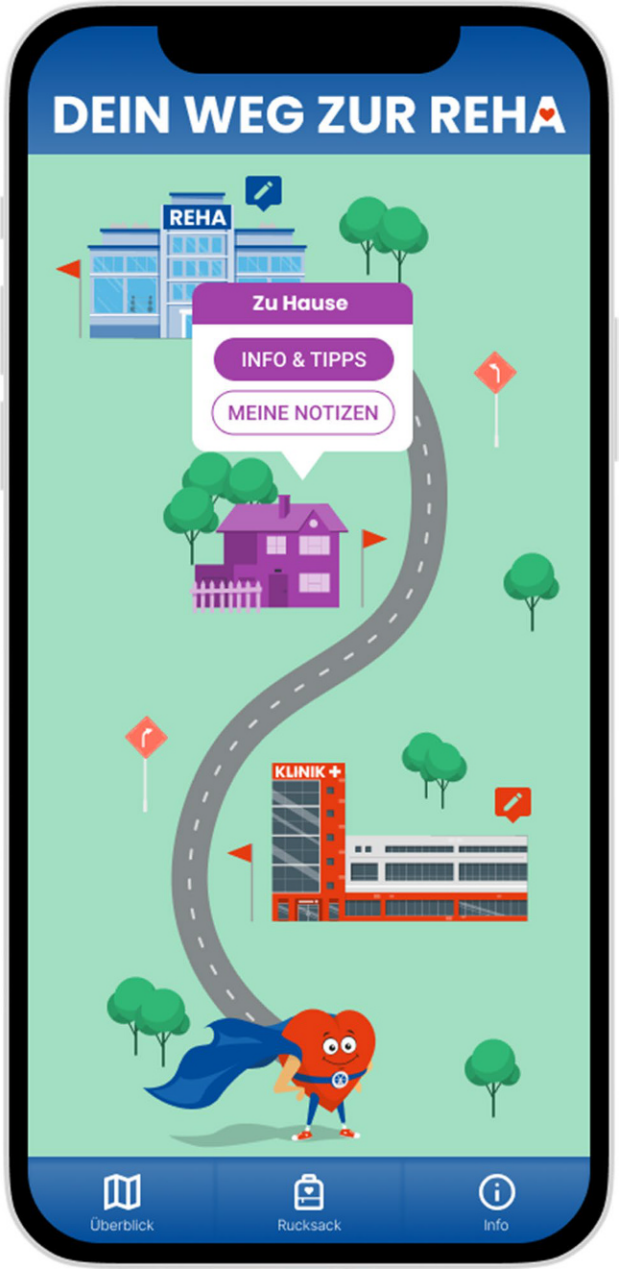

Fig. 1 The app displays the patient journey from hospital to cardiac rehabilitation

Fig. 2 A mascot presents useful tips and information about cardiac rehabilitation

CR referral experiences and hospitalisation. Patients reported their experience with a fragmented care pathway, often missing clear communication about the referral process and information about CR itself. The co-design process yielded the concept of a digital companion app that offers tailored information, motivational support and navigational guidance through the healthcare system (s. figures).

Conclusion: Our co-design approach promotes a patient-centred perspective in cardiac care and enhances stakeholder engagement in CR. The companion app exemplifies how co-design can address the challenges of CR utilisation in Austria by providing patients with the tools needed to participate actively in their recovery.

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4-5

Systematic searching for mobile health applications in cardiovascular care – a practical guide.

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Introduction: In step with the gradual digital transformation of the healthcare domain, more and more mobile health applications (apps) are being developed and researched to enhance, augment and extend cardiovascular care [1]. Examples are apps designed to support the primary and secondary prevention of cardiovascular disease, long-term management of hypertension or heart failure, medication adherence, cardiac rehabilitation, exercise therapy in intermittent claudication, or physical activity in people with cardiovascular disease. The investment required to develop a new working prototype for an app is relatively low. There is, therefore, a risk of unnecessary proliferation and duplication of apps, as new app prototypes are continuously being developed in formally funded projects, by students in educational projects, or by innovative individuals who have the relevant coding skills and who perceive the need for a new app. Healthcare professionals and clinical researchers may find it appealing to develop a new app, tailored to their local use case. But we argue that it is paramount to first conduct a thorough and systematic search for apps that are already available, to minimise the risk of unnecessary waste of resources (creative energy, digital infrastructure, time, personnel, and financial resources) in creating yet another app. In this practical guide, we recommend search strategies to identify existing mobile health applications for cardiovascular clinical practice or research.

Methods: We build on our extensive experience as digital health researchers at a specialist digital health research institute, to provide practical recommendations for healthcare professionals and clinical researchers who may be looking to incorporate a mobile health application in their cardiovascular clinical practice or research. Conducting a thorough systematic search for apps that are "out there" and might be suitable for our purpose mirrors the imperative to conduct a thorough search of the scientific literature prior to embarking on a research project, to ensure that the research question has not already been answered by others. Healthcare professionals and researchers are generally familiar with systematically searching electronic databases for health-related scientific publications, for example to conduct a literature review. But information about already available mobile health applications is not necessarily found in scientific electronic databases, and a search for apps might need to include additional relevant criteria pertaining to the form and function of the app. We therefore need to apply an extended search strategy, to give ourselves the best chance of identifying suitable existing apps.

Results: We suggest conducting a search in three steps. First, the desired form and function of the app need to be articulated. We recommend using everyday language by writing down phrases such as "The app should be able to …." From these phrases, specific search terms are then derived. An example is given in figure 1. Second, the search is conducted using an extended set of information sources. A search that includes scientific databases from the technical domain (e. g., computer science and human computer interaction), app stores, a general search of the World Wide Web, national and international registries/repositories for mobile health applications and queries to relevant organisations, will most likely yield the desired results. These different information sources are summarised in table 1. Third, the search is documented. This is important for efficiency, as it is easy to lose oversight of which information sources have already been searched and their respective search results. We recommend use of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist extension for searching (PRISMA-S), which supports comprehensive reporting of literature searches [2]. Checklist items 4 (searching online resources and browsing), 6 (contacting authors, experts, manufacturers or others) and 7 (any additional information or sources used) can be used to document information sources other than electronic databases of scientific literature.

Conclusion: Once potentially suitable apps have been identified, it is important to consider technical aspects, regulatory implications, the evidence base supporting the apps, and their transferability to the intended geographic, cultural, clinical, or healthcare policy context. Technical and regulatory considerations require an assessment against relevant standards and requirements. The scientific evidence requires critical appraisal of research reports. Transferability can be explored during a testing period with healthcare professionals and patients who are representative for the intended user groups. We have provided healthcare professionals and clinical researchers who are looking for a mobile health application with a practical guide on how to conduct a comprehensive and systematic search for existing apps. A thorough search and appraisal of existing mobile health applications is good practice and contributes to reducing waste in research and in evidence-based clinical practice.

SEARCH TERMS & SYNONYMS		
App	Cardiac Rehabilitation	Exercise Training
Mobile Health Application, mHealth, Digital Health, dHealth, Digital Health Intervention, Digital Therapeutics, Electronic Health, eHealth, Telehealth, Telemedicine, Telerehabilitation, Digital Technology	Cardiovascular Disease, Secondary Prevention	Exercise, Training, Physical Activity, Sports

FORM & FUNCTION

- Stores and displays the patient's personal training plan
- Patient can tick off completed training sessions
- Sends reminder messages about upcoming training sessions
- Sends motivating messages
- The training plan is automatically adjusted as the patient improves
- Runs on both Android and Apple operating systems
- Complies with European Union General Data Protection Regulation (GDPR)

Fig. 1 Articulating the desired form and function of the app and deriving relevant search terms and their synonyms

Information source	Comments
Electronic scientific databases	• Databases from the healthcare domain, e.g., PubMed/MEDLINE, AMED, CINAHL, EMBASE, PsycInfo, etc. • Databases from the technical domain (incl. computer science and human computer interaction), e.g., ACM Digital Library, IEEE Xplore • Databases that list entries across domains, e.g., Web of Science, Scopus
App stores	There are currently four app stores listing millions of apps: Google Play Store (approx. 3.5M apps), Apple App Store (approx. 1.8M apps), Microsoft Store – Windows Apps (approx. 800k apps), Amazon App Store (approx. 500k apps). When searching, it is worth bearing in mind whether an app is available for both or only one of the smartphone operating systems that are currently prevalent (i.e., Android and Apple iOS).
Repositories for add-ons and extensions for web browsers	Add-ons and extensions for web browsers have the potential to fulfill the same functions as stand-alone mobile health applications. The advantage of add-ons and extensions over apps is that they often work across different operating systems and conveniently tie in with other aspects of powerful modern web browsers. They also usually do not require elevated rights on a system to be installed. Examples for repositories listing add-ons and extensions for web browsers are: Google Chrome Web Store (>130k extensions), Apple App Store, Firefox Extensions – Firefox Browser Add-ons (>30k extensions), Edge Extensions – Microsoft Edge Add-ons.
World Wide Web	The World Wide Web is searched by using a web browser, e.g., Google Chrome, Moxilla Firefox, Microsoft Edge, etc. Searches conducted in the World Wide Web yield millions of results and are best documented by recording the search terms and the number of consecutive search results or pages that were screened.
Artificial intelligence (AI) chat systems	More recently, AI chat systems offer another pathway to search for information online. Sometimes it is difficult to find just the right words to describe what one is looking for in an app, or the creators might think about their application in particular ways and use a vocabulary that differs considerably from what oneself would use. AI chat systems, particularly those based on large language models (LLMs), can bridge this gap, as they can grasp underlying conceptual implications from various "fuzzy" ways of describing something and then signpost towards related concepts in their training data (typically wide coverage of information available on the World Wide Web). It is important to keep in mind that such systems can produce fictitious outcomes. To prevent this, instructing the AI chat system to return "only applications that really exist" can already make a difference. Additionally, it is recommended to ensure that the web search ("browsing") function of the AI chat system is enabled. Examples for such systems include: Microsoft Copilot, Google Gemini, Open AI Chat GPT 4 (with a browsing plugin enabled).
National and international digital registries and repositories	In some countries, mobile health applications that have been vetted and recommended by a trusted authority – or officially approved by a regulator – are listed in an online registry or repository, e.g., the German DiGA Verzeichnis (digital therapeutics registry), mHealth Belgium and healthdirect Australia. Other types of national and international registries may lead to helpful search results, such as the World Health Organization's Digital Health Atlas.
Organisations and networks	Mobile health applications are often developed by – or in collaboration with – relevant organisations and networks, such as: CVD societies/associations (e.g., the British Heart Foundation, the World Heart Federation) and CVD professional and scientific networks (e.g., the European Society of Cardiology's Association of Cardiovascular Nursing & Allied Professions), CVD patient organisations and patient networks (e.g., the British Heart Foundation's Heart Voices community of CVD patients or the Austrian Herzverband) and health professional associations (e.g., for cardiology, dietetics, exercise physiology, nursing, pharmacy, physiotherapy, sports science, etc.). Enquiries directed at the appropriate points of contact within such organisations and networks will often yield access to valuable internal knowledge.
Higher education and other research institutions	Mobile health applications are often developed as part of student projects or funded projects by higher education institutions in computer science, human computer interaction, design, and healthcare departments. While these projects often serve a primary educational purpose and these mobile health applications may remain at the stage of an early working prototype, such work can provide a helpful basis for further development.
Experts in the field	Enquiries directed at individual experts in the field (researchers, clinicians, app developers) will often yield information that is not easily found or not accessible in the public domain.

Fig. 2 Information sources for searching available mobile health applications

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4-6

Mobile Devices for ECG Recording in Pediatric Patients compared to 12-lead standard ECG

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Introduction: Accurate electrocardiogram (ECG) recording is paramount to diagnose arrhythmias in pediatric patients. The 12-lead ECG is the gold standard. However, mobile ECG devices, such as Smart Watches or hand-held devices, offer potential advantages in terms of portability and accessibility. The latter is especially important when dealing with paroxysmal tachycardias. We aimed to compare the efficancy and diagnostic accuracy of ECG tracings obtained using selected mobile devices to standard 12-lead ECG tracings in healthy children.

Methods: ECG data were acquired from healthy pediatric subjects aged 4 to 17 years using the Apple Watch, Cardia Mobile 6L, and standard 12-lead ECG (n = 30). Single leads were acquired sequentially. The time required for ECG acquisition was recorded for each device. Subsequently, ECG leads were analyzed for voltage, duration, and morphology of P waves, QRS complexes, T waves, PR intervals, and ST segments. Assessment was performed by two blinded pediatric electrophysiologists.

Results: The time it takes to acquire the ECG tracings differed significantly using the Apple Watch, when compared to standard 12-lead ECG or the Cardia Mobile 6L. However, the analysis revealed that ECG leads obtained by the Apple Watch demonstrated comparability to standard 12-lead ECG tracings in terms of key parameters, including R- and S-wave voltage (mV), QRS duration (ms), and morphology of cardiac waveforms. Qualita-

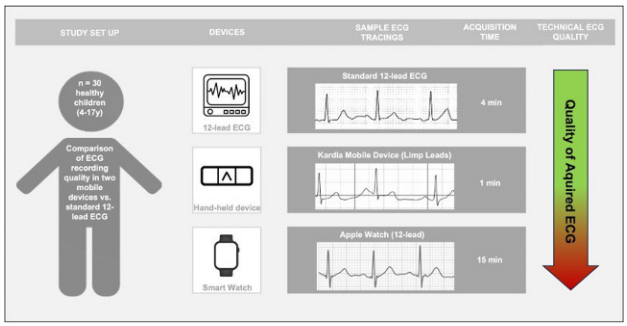

Fig. 1 Graphical Abstract

	12-Lead ECG	Smart Watch	Hand-Held
P wave (mV)	0.1 (0.05;0.2)	0.1 (0.05;0.2)	0.15 (0.03;0.2)
PR interval (ms)	120 (90;160)	130 (100;170)	122 (85;160)
R wave (mV)	0.65 (0.05;2.1)	0.7 (0.05;2.6)	0.65 (0.05;1.5)
S wave (mV)	0.25 (0;2.0)	0.47 (0.05;1.7)	0.25 (0;1.0)
QRS (ms)	80 (70;100)	80 (70;100)	80 (70;90)
T wave (mV)	0.25 (0.05;0.7)	0.26 (0.05;0.9)	0.2 (0.03;0.6)
QTc (ms; Bazett)	380 (300;400)	424 (361;424)	396 (364;437)
PVC origin	RVOT	RVOT	6 lead identical

Fig. 2 Comparison of ECG parameters

tive assessment showed superiority of the 12-lead standard ECG and Kardia Mobile 6L, when compared to the Apple Watch.

Conclusion: Our study suggests that mobile ECG devices offer a diagnostic accuracy comparable to standard 12-lead ECGs in healthy children. While the Apple Watch may be slower in ECG acquisition, it is possible to acquire all 12 ECG leads in pediatric patients. Mobile devices' potential for use in pediatric patients targeting specific clinical scenarios such as diagnosing paroxysmal tachycardia, palpitations or in an emergency setting is promising.

POSTERSITZUNG 5 – HERZINSUFFIZIENZ 1

5-1

Characteristics and outcomes of heart failure with preserved ejection fraction (HFpEF) in patients with a history of breast cancer

Alvieva E., Kronberger C., List L., Poledniczek M., Kokabi V., Spannbauer A., Willixhofer R., Ermolaev N., Duca F., Rettl R., Binder-Rodriguez C., Badr Eslam R., Kastner J., Kammerlander A., Bergler-Klein J.

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Introduction: Breast cancer survivors experience significant short-term and long-term cardiovascular morbidity and mortality, including an elevated risk of heart failure with preserved ejection fraction (HFpEF). Heart failure and breast cancer have shared risk factors and morbidities. This study aims to investigate the characteristics and outcomes of individuals diagnosed with HFpEF with a history of mammary carcinoma.

Methods: Data were extracted from a specialized university center HFpEF registry, focusing on patients with a historical diagnosis of breast cancer. Demographics, clinical data, and comorbidities were assessed, along with echocardiography parameters. Cox-regression models were utilized to analyze the association between mammary carcinoma and all-cause death.

Results: Analysis of 419 female HFpEF patients revealed a subset of women (n = 28 (7%), mean age 74 ± 5 years) with a history of breast cancer. Among them, 70% had left-sided tumors, 25% right-sided tumors and 5% bilateral involvement. Common treatments included radiotherapy (administered in 79% with a mean dose of 45 ± 10 Gray) and chemotherapy. The mean interval since the last radiation therapy was 7 ± 6 years. Of these 28 patients, 29% underwent chemotherapy, predominantly anthracycline therapy, specifically with epirubicin (n = 5), while 3 had received paclitaxel and 2 a combination of cyclophosphamide and 5-fluoruracil, in addition to radiation therapy. At the time of HFpEF diagnosis, 2 patients had metastatic cancer, and 2 experienced tumor recurrence. Demographic, cardiovascular risk factors, and echocardiographic profiles within this subset were comparable to patients without a history of breast cancer (refer to Table 1). After a median follow-up of 5.0 years (IQR 3.0–8.0 years), 13 (46%) HFpEF patients with breast cancer and 159 (41%) non-breast cancer patients died. The risk of all-cause mortality was similar for patients with and without breast cancer history in the HFpEF group (p = 0.799).

Variables	HFpEF with breast cancer history (n = 28)	HFpEF without breast cancer history (n = 391)	p-value
Demographic and clinical data			
Age (years), mean (SD)	74 ± 5	72 ± 10	0.178
Height (cm), mean (SD)	163 ± 6.1	166 ± 9.0	0.216
Weight (kg), mean (SD)	82 ± 21	82 ± 18	0.911
NT-proBNP (pg/mL), median (IQR)	668 [336-1455]	1075 [456-2003]	0.143
NYHA class, n (%)			0.507
Class I	0 (0)	11 (3)	
Class II	11 (39)	139 (36)	
Class III	14 (50)	224 (57)	
Class IV	3 (11)	17 (4)	
Cardiovascular risk factors, n (%)			
Smoking (ex and current)	5 (18)	101 (26)	0.631
Diabetes mellitus	5 (18)	127 (32)	0.250
Coronary heart disease	7 (25)	103 (26)	0.878
Arterial hypertension	26 (93)	363 (93)	0.946
Hyperlipidaemia	13 (46)	212 (54)	0.668
Atrial fibrillation or flutter	17 (61)	225 (58)	0.934
Chronic kidney disease	10 (36)	193 (49)	0.358
Echocardiographic parameters, mean (SD)			
Left ventricular size (mm)	43 ± 4.9	44 ± 5.3	0.354
Right ventricular size (mm)	34 ± 6.4	37± 7.1	0.067
Left atrial size (mm)	60 ± 9.1	62 ± 8.3	0.149
Right atrial size (mm)	59 ± 9.3	62 ± 9.5	0.310
E/e' medial	12 ± 6.1	15 ± 7.2	0.246
Septal thickness at end diastole (mm)	12 ±1.6	12 ± 2.3	0.721
Peak tricuspid velocity (m/s)	3.5 ± 0.6	3.3 ± 0.6	0.370
Peak aortic velocity (m/s)	1.7 ± 0.8	1.7 ± 0.6	0.654

Abbreviations. HFpEF = heart failure with preserved ejection fraction; NT-proBNP = N-terminal prohormone of brain natriuretic peptide; NYHA = New York Heart Association; SD = standard deviation; IQR = interquartile range.

Fig. 1 Patient characteristics

Conclusion: This study provides insights into the distinctive profile of HFpEF patients with a history of breast cancer, emphasizing the importance of educating individuals undergoing breast cancer treatment on evidence-based lifestyle behaviors to optimize overall health outcomes. Contemporary heart failure treatment appears to enable a similar cardiovascular prognosis in patients after breast cancer as in other patients with HFpEF.

5-2

Characteristics and outcomes of patients with a history of cancer enrolled in a prospective HFpEF registry

Alvieva E., Kronberger C., List L., Poledniczek M., Kokabi V., Spannbauer A., Willixhofer R., Ermolaev N., Duca F., Rettl R., Binder-Rodriguez C., Badr Eslam R., Kastner J., Kammerlander A., Bergler-Klein J.

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Introduction: Along with the aging population, the incidence of concomitant heart failure with preserved ejection fraction (HFpEF) and cancer, is increasing. However, little is known about the typical characteristics of patients with both HFpEF and a history of oncologic disease. We aimed to characterize the distinctive characteristics and outcomes of patients with a history of cancer within a prospective HFpEF registry.

Variables	HFpEF with cancer history (n = 101)	HFpEF without cancer history (n = 390)	p-value
Demographics, mean (SD)			
Age (years)	74 ± 7	72 ± 10	0.063
Height (cm)	167 ± 9.3	166 ± 9.0	0.723
Weight (kg)	81 ± 18	82 ± 18	0.660
Comorbidities, n (%)			
Smoking (ex and current)	23 (23)	101 (26)	0.783
Diabetes mellitus	33 (33)	127 (33)	0.878
Coronary heart disease	22 (22)	103 (26)	0.632
Arterial hypertension	92 (92)	362 (93)	0.715
Hyperlipidaemia	44 (44)	211 (54)	0.143
Atrial fibrillation or flutter	65 (65)	225 (58)	0.431
Chronic kidney disease	52 (52)	192 (49)	0.836

Abbreviations. HFpEF, heart failure with preserved ejection fraction; SD, standard deviation.

Fig. 1 Patient characteristics

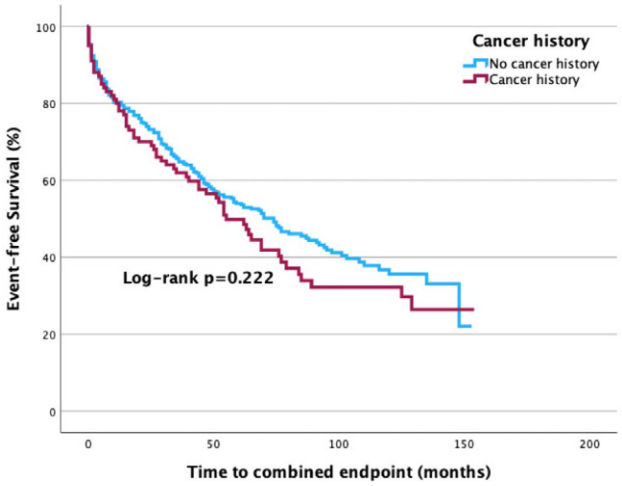

Fig. 2 Time to combined endpoint, stratified by cancer history

Methods: We analyzed data from 491 unselected HFpEF patients from our tertiary university center between 2010 and 2022 and followed the patients until 2023. Laboratory parameters and comorbidities were assessed. Patients were categorized into those with and without a history of cancer, including various malignancies, survivors of childhood cancer, radiation therapy, with or without chemotherapy. Kaplan-Meier estimates were used to explore the association between cancer history, as well as previous radiotherapy, and a combined endpoint of heart failure hospitalization and/or all-cause death.

Results: In this analysis of 491 HFpEF patients, a total of 101 patients (21%) had a history of cancer [mean age 74 ± 7 years; female 72 (71%), male 29 (29%)]. The median time from cancer diagnosis to the initial HFpEF visit was 7.0 years (IQR 13-0.5 years). The most prevalent primary cancer sites included the chest wall (32%) comprising 4 adenocarcinomas of the lung and 28 cases of breast cancer, followed by the gastric (28%), urogenital system (18%), hematologic and lymphatic system (16%), cancers located at the head and neck (5%) and endocrine malignancies (1%). Radiotherapy (39%) and chemotherapy (26%) were common. Notably, no significant differences were observed, between patients with or without a history of cancer, in terms of median NT-proBNP levels [1037 (IQR 416–2075) vs. 1060 pg/ml (IQR 462–2013)] and the frequency of key cardiovascular comorbidities (all $p > 0.05$, see Table 1). Over the study period [median follow-up 50 months (IQR 18–76)], 64 (64%) of cancer patients met the combined endpoint, with no statistically significant difference in outcomes between HFpEF patients with and without a cancer history (log-rank $p = 0.222$, see Fig. 1). Furthermore, there was no significant difference in the combined endpoint between patients who had undergone radiotherapy and those without (log-rank $p = 0.162$).

Conclusion: Our findings highlight a high coexistence of cancer and HFpEF, which can frequently occur after oncologic therapies. The data suggest that the presence of a history of cancer or previous radiotherapy did not significantly impact overall outcomes in HFpEF patients compared to those without cancer during the study period. Further research is needed to characterize patients with both disease entities in detail. Due to modern cardiovascular therapy in a university and cardio-oncology clinical setting, outcomes for cancer patients appear better than expected.

5-3

The Prognostic Interplay of Heart Failure and Chronic Kidney Disease in Atrial Fibrillation – Focus on Cardiorenal Outcomes

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Introduction: Heart failure (HF) and chronic kidney disease (CKD) create a mutually reinforcing cycle, escalating disease development, and increasing morbidity and mortality rates. Both are common comorbidities promoting atrial fibrillation (AF) and contributing to heightened symptom burden and poorer outcomes in AF. Here we aim to investigate the relationship of HF and CKD with cardiorenal outcomes in patients with AF.

Methods: For this analysis we included patients with known AF, treated at a tertiary centre between 01/2005 and 07/2019. The primary endpoint was a composite of cardiovascular (CV) death and hospitalization for HF (HHF). Secondary outcomes were renal death and dialysis. The multivariate model has been adjusted for age, sex, body mass index, HF, diabetes mellitus, CKD, coronary artery disease, previous myocardial infarction, and C-reactive protein.

Results: We included in total 7412 patients (median age 70 years, 39.7% female) with AF and followed them over a median of 4.5 years. A total of 1668 patients (22.5%) were diagnosed with HF, 806 (10.9%) with CKD and 372 (5.0%) were suffering from both conditions. Both CKD (adjusted HR 1.87, 95% CI 1.55–2.25) and HF (adjusted HR 2.57, 95% CI 2.22–2.98) were significantly associated with the composite of CV death/HHF after multivariable adjustment. There was a significant stepwise increase in 5-year's event rates of CV death/HHF (no CKD & no HF: 23%, HF: 61%, CKD: 63%, CKD & HF: 82%; P-logrank < 0.001). These results remained significant in the multivariate analysis, showing the highest increase in risk in patients with both HF and CKD with an adjusted HR of 3.96 (95% CI 3.34–4.68), followed by patients with only HF (adjusted HR 2.53, 95% CI 2.26 to 2.84) and only CKD (adjusted HR 2.22, 95% CI 1.87–2.63, p-value of < 0.001, respectively). Regarding renal death/dialysis we could observe a similar distribution of the 5-year's event rates (no CKD & no HF: 1.5%, HF: 4.0%, CKD: 11.8%, CKD & HF: 17.7%; P-logrank < 0.001). Both conditions, CKD and HF, remained

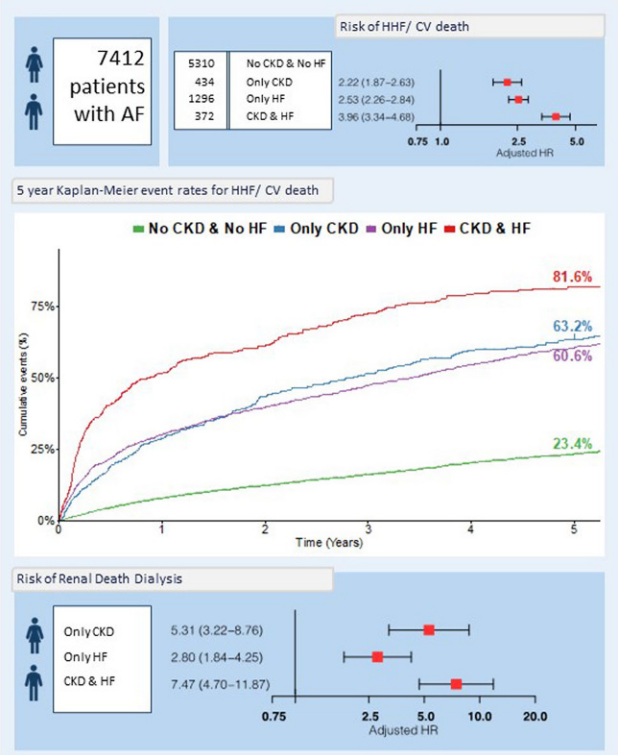

Fig. 1 The prognostic interplay of chronic kidney disease and heart failure in patients with atrial fibrillation

independently associated with the combined endpoint of renal death/dialysis after multivariable adjustment (only HF: adjusted HR of 2.80, 95% CI 1.84 to 4.25; only CKD: adjusted HR of 5.31, 95% CI 3.22 to 8.76; CKD & HF: adjusted HR of 7.47, 95% CI 4.70 to 11.87; Fig. 1).

Conclusion: Both CKD and HF significantly increase the risk of CV death and HHF, as well as renal death and dialysis in patients with AF. Risk assessment should expand beyond stroke and bleeding to cardiorenal complications including HHF, CV and renal death, as well as kidney failure in an unselected AF patient population.

5-4

Potential Hematopoietic Effects of SGLT2 Inhibitors in Patients with Cardiac Amyloidosis

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Introduction: Sodium-glucose cotransporter 2 inhibitors (SGLT2i) have been revealed to have potential hematopoietic effects in patients with heart failure (HF), leading to an improvement in clinical outcome. However, these benefits have not been studied in patients with cardiac amyloidosis (CA), despite CA often causing symptoms of heart failure (HF) and contributing to an iron-deficient state, which further complicates by limiting erythropoiesis and lowering haemoglobin and haemotocrit levels. We aimed to determine the potential of SGLT2i in improving haematological parameters and functional capacity (FC) in amyloidosis patients.

Methods: A prospective analysis was conducted to compare the effects of SGLT2i in a cohort of patients who received the best medical therapy (BMT) alongside SGLT2i (n = 20), as opposed to patients receiving only BMT without SGLT2i (n = 20). All of patients underwent blood testing and cardiopulmonary exercise testing (CPET) at baseline and after 6 months (IQR:5.0–6.0).

Results: The SGLT2i-based therapy resulted in a significant improvement and difference in hematological parameters upon follow-up assessment compared to the control group. In the SGLT2i group, the mean haemoglobin level increased from 13.3 g/dL to 14.5 g/dL, whereas in the control group, it decreased from 12.7 g/dL to 10.9 g/dL ($P < 0.001$). Furthermore, the haematocrit difference showed a significant increase in the SGLT2i group (+3.8%) compared to a decrease in the control group (−4.4%) ($P < 0.001$). Additionally, the iron status improved in the SGLT2i-treated group (+6.7 µg/dL) compared to a decrease in the control group (−14.9 µg/dL), although the difference was significant only with a p-value of 0.034. However, neither group demonstrated significant improvement nor regression in CPET parameters. The peak oxygen consumption (peak VO2, (ml/min)/kg) showed no significant change in either group ($P = 0.286$), as well as VE/VCO2 slope ($P = 0.295$).

Conclusion: Treatment with SGLT2i could be utilized in the treatment of patients with amyloidosis. This potential benefit in improving hematological parameters warrants further investigation and consideration in clinical practice.

Tab. 1

	SGLT2i group, n = 20		Control group, n = 20		
	Baseline	Follow-up	Baseline	Follow-up	p-value
Haemoglobin (g/dL), mean (SD)	13.3 (1.0)	14.5 (1.8)	12.7 (1.1)	10.9 (1.9)	< 0.001
Haemotocrit (%), mean (SD)	39.8 (2.8)	43.7 (5.3)	38.0 (2.9)	33.6 (4.1)	< 0.001
Iron (µg/dL), mean (SD)	78.9 (14.2)	85.6 (25.0)	65.4 (23.5)	50.5 (27.8)	0.034
Peak VO_2 ((ml/min)/kg), mean (SD)	16.3 (4.8)	16.4 (4.4)	12.8 (1.9)	12.8 (5.1)	0.286
VE/VCO_2 Slope, mean (SD)	35.6 (6.8)	38.4 (11.3)	39.9 (9.5)	41.6 (12.7)	0.295

5-5

The Clinic OttakRing – Acute Heart Failure Registry (The COR – AHF Registry): a contemporary single-center real-world analysis from a tertiary hospital

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Introduction: Acute heart failure (AHF) is a major driver of cardiovascular morbidity and mortality, positioning itself among the foremost causes of death. While the dynamics of chronic heart failure have been explored extensively in various global patient cohorts, comprehensive data specific to AHF are comparatively scarce.

Methods: This retrospective, single-center, real-world study comprises hospitalized patients with AHF, admitted to a tertiary care hospital in Vienna, Austria, between January 1st, 2012 and December 31st, 2019. Intensification of diuretic therapy during hospitalization was necessary for inclusion in the study. We gathered and evaluated baseline characteristics, demographics, vital signs, chest X-rays, electrocardiograms, echocardiograms, blood gas analyses, previous medical histories, and laboratory results during hospitalization. Additionally, detailed follow-up data for all patients were collected. In this abstract, we outline our study population offering detailed insights into demographic specifics.

Results: Our single-center study encompassed a total of 3,185 patients admitted for AHF. The median age of the study population was 79 years (IQR, 70–86) with 50.7% of patients being of male gender. A considerable prevalence of cardiovascular comorbidities was observed, including arterial hypertension (79.6%), atrial fibrillation (57.5%), and established coronary artery disease (38.4%). Heart failure with reduced ejection fraction (HFrEF) at 43.9% was the predominant presentation, succeeded by preserved ejection fraction (HFpEF) at 39.2%, and mildly reduced ejection fraction (HFmrEF) at 16.8%. The majority of patients sought care at the emergency department (85.9%), predominantly arriving by ambulance (85.6%) during daylight hours (68.2%). During the index hospitalization 359 patients (11.3%) had to be transferred to the intensive care unit (ICU) due to worsening conditions. Overall, 1-year mortality was high with 870 patients (27.3%) reaching the primary endpoint. Older patients had a significantly higher risk of mortality (log-rank, $P < 0.001$) with those aged 90 years and above exhibiting an event rate of 49.5%.

Characteristics	Study population n = 3185
Baseline characteristics	
Age, years	79 (70 – 86)
Male sex	1615 (50.7%)
Arterial hypertension	2531 (79.6%)
Diabetes mellitus	1202 (37.8%)
Atrial fibrillation	1828 (57.5%)
Stroke	466 (14.7%)
Coronary artery disease	1220 (38.4%)
Vital signs	
Systolic blood pressure, mmHg	140 (120 – 160)
Diastolic blood pressure, mmHg	80 (70 – 92)
Heart Rate, bpm	87 (55.1%)
Heart failure therapy	
Beta-blocker	2462 (77.8%)
RAS-blockers	1636 (51.7%)
MRA	1588 (49.8%)
Loop diuretics	2919 (92.2%)
Laboratory results	
Hemoglobin, g/dL	12.5 (11.0 – 14.0)
Creatinine, mg/dL	1.3 (1.0 – 1.7)

Characteristics	Study population n = 3185
Demographics	
Season at admission	
Spring	768 (24.1%)
Summer	748 (23.5%)
Autumn	756 (23.7%)
Winter	913 (28.7%)
Admission through ED	2737 (85.9%)
Mode of transport to ED	
Self-presentation	378 (14.4%)
Ambulance	2248 (85.6%)
Time of admission at ED	
Day-time	1866 (68.2%)
Night-time	871 (31.8%)
Residential area income (Vienna)	
High-income	740 (24.2%)
Medium-income	766 (25.0%)
Low-income	1557 (50.8%)
Outcomes	
ICU admission	359 (11.4%)
1-year mortality	870 (27.3%)

Fig. 1 Baseline characteristics, demographics

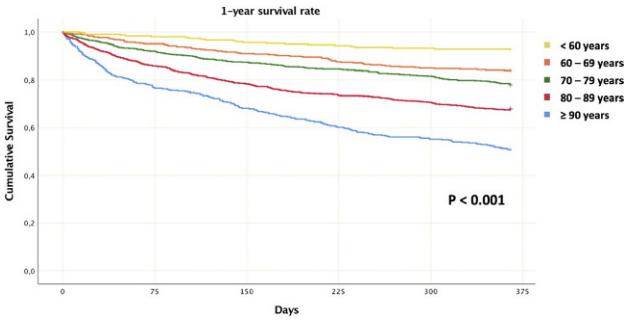

Fig. 1 Mortality across age bins

Conclusion: Our well-characterized, real-world cohort of 3,185 patients with AHF had an advanced age demographic with a high cardiovascular co-morbidity burden. The typical mode of admission for patients was through the emergency department following arrival by ambulance. Short-term mortality was high, especially among the elderly subset of our study population.

5-6

Safety of SGLT2-Inhibitors in cardio-oncology patients with heart failure undergoing cancer treatment

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Introduction: Sodium-glucose cotransporter 2-Inhibitors (SGLT2i) have demonstrated benefits for patients with heart failure (HF), regardless of their diabetes status and left ventricular ejection fraction (LVEF). Cancer therapy-induced cardiac dysfunction (CTRCD) encompasses a broad spectrum of cardiovascular complications resulting from cancer treatments including myocardial ischemia, coronary vasospasm, and arrhythmias.This study aimed to assess the cardiac effectiveness and overall safety of SGLT2 inhibitors in patients undergoing cancer treatment.

Methods: Prospective cancer patients with different malignancies or survivors of childhood cancer, undergoing cancer treatment with radiotherapy and/or additional chemo- or immune therapy, who received a SGLT2i therapy were evaluated at baseline and at 6 months follow-up. Transthoracic echocardiography, speckle tracking strain and laboratory assessments were performed in all patients at baseline and follow-up at our cardio-oncology clinic.

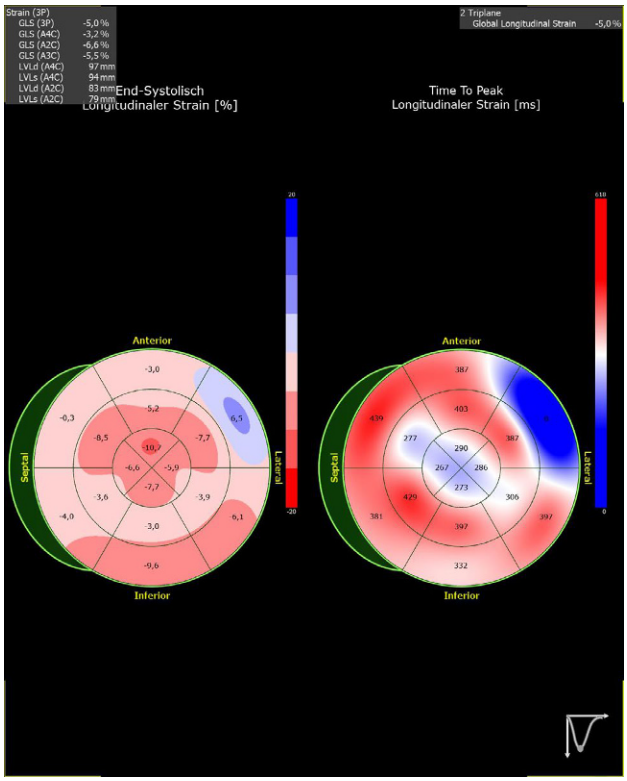

Fig. 1 Strain was highly reduced in most cancer patients

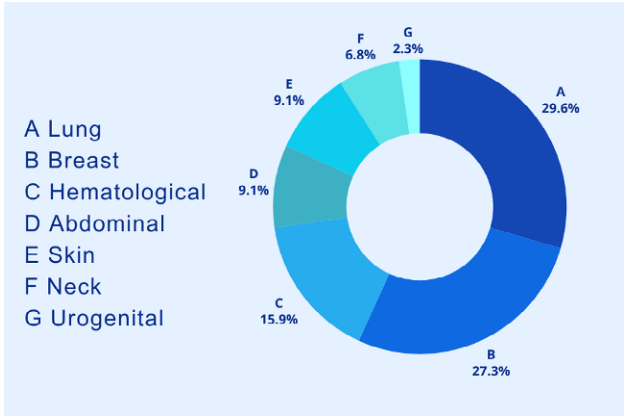

Fig. 2 Type of primary cancer

Results: A total of 44 Patients (52,28% female, 47,72% male) with SGLT2i treatment were analyzed with a mean age of 80 ± 14 years (range 28–85 years). The most common primary cancer sites included cancer of the lungs (13 patients, 29,55%), breast cancer (12 patients, 27,27%) followed by the hematologic system (7 patients,15,91%), the abdominal system (4 patients, 9,09%), the skin (4 patients, 9,09%), cancer in the neck area (3 patients, 6,82%) and the urogenital system (1 patient, 2,27%). The median NT-proBNP level at baseline was 448 pg/mL (IQR 195–1589). During the treatment with SGLT2i the median NT-proBNP decreased to a level of 397 pg/mL (IQR 220–1126). In echocardiography, reduced systolic left ventricular function was present in 33 patients (75%) and reduced right ventricular function was present in 11 patients (25%). During the study period the mean creatinine stayed stable with an average of 1.13 ± 0.55 mg/dL at baseline and 1.13 ± 0.6 mg/dL at follow-up.

Conclusion: The use of SGLT2-Inhibitors is associated with an improvement in NT-proBNP levels in patients with heart failure undergoing cancer treatment. The treatment with SGLT2-Inhibitors is well tolerated in patients undergoing cancer treatment and no clinically relevant side effects were observed.

5-7

Mavacamten as a Gamechanger in Hypertrophic Obstructive Cardiomyopathy – Case Series

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Introduction: Hypertrophic cardiomyopathy (HCM) is a relatively common heart disease, affecting 1 in every 200 to 500 individuals, which can potentially result in obstruction of the left ventricular outflow tract. This variant, known as hypertrophic obstructive cardiomyopathy (HOCM), carries a heightened risk of sudden cardiac death, progressive heart failure as well as atrial and ventricular arrhythmias [1]. Diagnostic methods for hypertrophic obstructive cardiomyopathy (HOCM) include electrocardiography, echocardiography, and cardiac magnetic resonance imaging. In echocardiography, hypertrophic obstructive cardiomyopathy (HOCM) is identified by a maximum provoked peak left ventricular outflow tract obstruction (LVOTO) gradient of ≥ 50 mmHg [2]. Treatment is based on symptom severity, with beta-blockers or non-dihydropyridine calcium channel blockers being the first-line therapeutic options. If symptoms persist, additional therapy with the cardiac myosin ATPase inhibitor mavacamten should be considered, according to recently published ESC guidelines [2, 3]. This novel therapeutic agent reduces myosin-actin cross bridges and has shown promising reductions in LVOTO gradients, potentially offering an alternative to invasive septal reduction therapies.

Methods: Prior to initiating mavacamten therapy, patients need to undergo CYP2C19 metabolizer profiling. Except for patients with poor CYP2C19 metabolism, the recommended starting dose is 5 mg once daily, with dose increments every 4 weeks based on left ventricular ejection fraction (LVEF) and LVOT provocation gradients determined by echocardiography [3]. Patients receiving mavacamten are closely monitored for the emergence of heart failure (HF) stemming from systolic dysfunction. We report a case series of the first three HOCM patients (two male, one female) in whom mavacamten therapy

Patient	Case I	Case II	Case III
Age	40	61	39
Sex	Male	Female	Male
GFR (CKD-EPI) (mL/min/1,7m2)	>90	86.4	>90
Troponin T-hs (ng/L)	13.2	16.5	11.0
NT-proBNP (ng/L)	352	321	43
CYP2C19 metabolizer status	intermediate	normal	rapid
NYHA class	II	II	II
			Echocardiography
Left Ventricular Ejection Fraction (%)	68	77	70
Peak LVOT gradient (Exercise) (mmHg)	89	99	90
V_{max} LVOT (m/s)	4.7	5.0	4.8
IVSd (mm)	21	20	18
Mitral Valve	mild MR	mild MR	no MR

Fig. 1 Baseline characteristics of HOCM patients (n = 3)

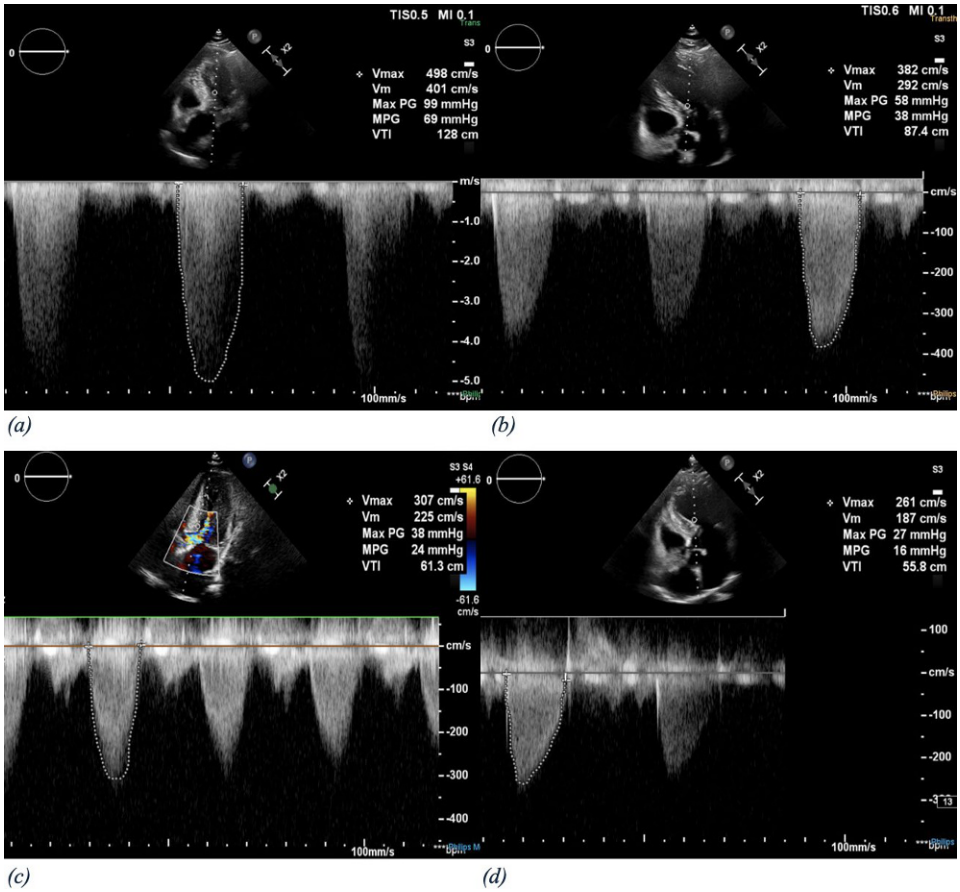

Fig. 2 Echocardiography – Case II changes of maximum provoked peak LVOTO gradient (a) baseline, (b) 4 weeks after mavacamten therapy); (c) 8-week follow-up peak LVOTO gradient (exercise) 38 mmHg; (d) 12-week follow-up peak LVOTO gradient (exercise) 27 mmHg

was initiated due to persistent symptomatic LVOT obstruction under maximum tolerated beta-blocker therapy.

Results: At baseline, two of three patients presented with elevated NT-proBNP levels (mean 238.5 ng/L), all of them were symptomatic (NYHA class II). The mean provoked peak LVOT gradient (exercise) was 92.6 mmHg. Baseline characteristics can be found in Table 1. Four weeks after initiating therapy with the cardiac myosin ATPase inhibitor (at the standard starting dose of 5 mg once daily), all three patients experienced a reduction of at least 40% of the maximum provoked peak LVOTO gradient (mmHg) (Fig. 1 (a,b)). Continuous monitoring of the left ventricular ejection fraction revealed no decline; all patients consistently maintained an LVEF of ≥ 55%. Renal function remained within normal range. In the 4-week follow-up, NT-proBNP values showed a decrease in all patients. Two of the patients transitioned to a near-normal range with a mean value of 148.3 ng/L, while the remaining patient consistently stayed within the normal range. All patients reported improvement in their subjective well-being, corresponding to NYHA class I. After 8 weeks, Case I showed a reduction of 57.3% in maximum provoked peak LVOTO gradient (Fig. 1 (c), 8-week follow-up peak LVOTO gradient (exercise) 38 mmHg). After 12 weeks, Case II showed a reduction of 72.7% in maximum provoked peak LVOTO gradient (Fig. 1 (d) 12-week follow-up peak LVOTO gradient (exercise) 27 mmHg).

Conclusion: After initiation of mavacamten, patients showed improvement of symptoms and NYHA functional class. Significant reduction of LVOTO gradients could be reached after short-term use already. Left ventricular ejection fraction was consistently ≥ 55%. This case series presents initial real-world observations, which further support the promising findings from previous studies. It emphasizes the advantages of utilizing cardiac myosin ATPase inhibitors in treating hypertrophic obstructive cardiomyopathy, offering a significant alternative to invasive septal reduction therapy [4].

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POSTERSITZUNG 6 – INTERVENTIONELLE KARDIOLOGIE

6-1

Time-dependent mortality in patients selected for transcatheter versus surgical aortic valve replacement: results from randomized and observational studies

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Introduction: Recently published data from a randomized trial which compared outcomes between transcatheter aortic valve implantation (TAVI) and surgical aortic valve replacement showed that all-cause mortality curves crossed at approximately 2.5 years of the follow-up and favored surgery thereafter. In this large, population-based cohort study, long-term mortality and morbidity were investigated in patients undergoing aortic valve replacement (AVR) for severe aortic stenosis using a surgically implanted bioprosthesis (sB-AVR) or TAVI.

Methods: Individual data from the Austrian Insurance funds from 2010–2020 were analyzed. The primary outcome was all-cause mortality, assessed in the overall and propensity score-matched populations. Secondary outcomes included reoperation and cardiovascular events. Additionally, time-dependent analyses were performed.

Results: From January 2010 through December 2020, a total of 18 882 patients underwent sB-AVR (n = 11 749; 62.2%) or TAVI (n = 7133; 37.8%); median follow-up was 4.0 (interquartile range 2.1–6.5) years (maximum 12.3 years). The risk of all-cause mortality was higher with TAVI compared with sB-AVR: hazard ratio (HR) 1.552, 95% confidence interval (CI) 1.469–1.640, p < 0.001; propensity score-matched HR 1.510, 1.403–1.625, p < 0.001. Estimated median survival was 8.8 years (95% CI 8.6–9.1) with sB-AVR vs 5 years (4.9–5.2) with TAVI. Estimated 5-year survival probability in the propensity score matched population was 0.690 (0.674–0.707) and 0.560 (0.540–0.582), with sB-AVR vs 0.409 (0.378–0.444) with TAVI respectively. Other predictors of mortality were age, sex, previous heart failure, diabetes, and chronic kidney disease. The time-dependent analyses showed no significant difference between groups in the first year after the index procedure but a significantly lower mortality in patients selected for sB-AVR group with longer follow-up times (Table, Figure).

Conclusion: In patients ≥ 65 years with severe, symptomatic aortic stenosis, early survival was similar in patients selected for TAVI versus sB-AVR. However, beyond 2-year of follow-up, selection for TAVI was significantly associated with higher all-cause mortality compared with sB-AVR.

	Standard Cox model				Time-dependent analyses			
	All patients		Propensity score–matched		All patients		Propensity score–matched	
	HR (95% CI)	P	HR (95% CI)	P-value	HR (95% CI)	P	HR (95% CI)	P
Heart valve (sB-AVR vs. TAVR)	1.552 (1.469–1.640)	<0.001	1.510 (1.403–1.625)	<0.001				
Year 1					1.073 (0.977–1.178)	0.141	1.044 (0.905–1.203)	0.556
Year 2					1.902 (1.662–2.176)	<0.001	2.006 (1.615–2.492)	<0.001
Year 3					1.746 (1.520–2.005)	<0.001	1.971 (1.589–2.445)	<0.001
Year 4					1.796 (1.563–2.064)	<0.001	1.704 (1.393–2.083)	<0.001
Year >5					1.750 (1.611–1.901)	<0.001	1.574 (1.397–1.774)	<0.001

Fig. 1 Hazard ratios (HRs) and corresponding 95% confidence intervals (CIs) from Cox regressions for all-cause mortality in all patients and the propensity score – matched patients for the standard and time-dependent models

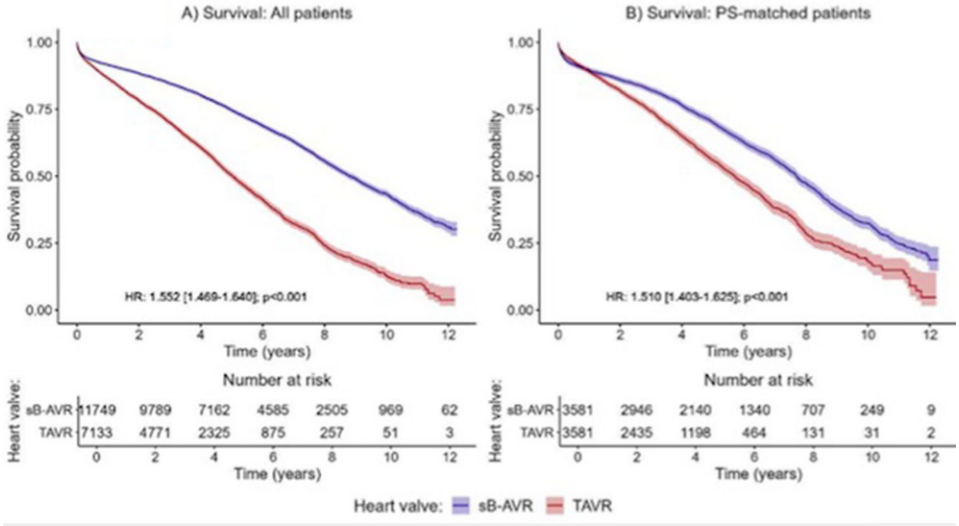

Fig. 2 Kaplan-Meier curves

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6-2

Outcome prediction in tricuspid edge-to-edge repair: echocardiographic and hemodynamic parameters under proof

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Introduction: Background: Tricuspid regurgitation (TR) is associated with high morbidity and mortality. Interventional procedures to reduce TR are increasingly performed. The most frequently performed procedure is transcatheter tricuspid edge-to-edge repair (T-TEER), which has become an established method in recent years. It is known that T-TEER can effectively improve symptoms, but a reduction in mortality has not yet been demonstrated in randomized controlled trials. Therefore, robust parameters that can predict death or heart failure hospitalization after T-TEER are needed. These parameters could help to identify the patients who will benefit most from T-TEER.

Methods: The present study includes all patients who underwent T-TEER at the Medical University of Vienna. The primary endpoint was defined as a composite endpoint of heart failure hospitalization and death. Preinterventional invasive hemodynamic parameters and echocardiographic data were assessed. Uni- and multivariate Cox regression was performed to find an association between preinterventional parameters and the composite endpoint.

Results: 223 patients were included in the study. At a univariate level, right ventricular (RV) end-diastolic basal diameter, RV end-systolic area index, tricuspid annular plane systolic excursion (TAPSE), tissue Doppler imaging s' (TDI s'), effective regurgitant orifice area, TR regurgitant volume, TR grade, inferior vena cava (IVC) size, invasive pulmonary artery pressures (PAPs, PAPd, PAPm), pulmonary vascular resistance (PVR) and total pulmonary resistance (TPR) showed a significant association. The indices TAPSE/PAPs, TAPSE/PVR, TDI s'/PAPs, and TDI s'/PVR as far as the product of RV end-diastolic parameter and PVR could also show significant results. In multivariate analyses, only PVR and IVC size remained significant (Table 1).

Conclusion: In multivariate models, PVR and IVC size predict heart failure hospitalization and death in patients undergoing T-TEER. Indices of RV function parameters and pulmonary artery pressure or PVR remain promising.

Tab. 1 Cox regression analyses with echocardiographic and invasive hemodynamic parameters and the primary composite endpoint (heart failure hospitalization/death) in the overall study population (n = 223). Multivariable analysis was adjusted for parameters with a significant influence at an univariable level

	HR	95% CI	P value	Adj. HR	95% CI	P value
	Univariable analysis			Multivariable analysis		
Echocardiographic parameters – Heart chambers						
RV end-diastolic basal diameter	1.034	1.008–1.061	0.010			
RV end-diastolic basal diameter index	1.071	1.020–1.125	0.006	1.042	0.971–1.118	0.254
RV end-diastolic area	1.021	0.996–1.047	0.100			
… RV end-diastolic area index	1.052	0.998–1.108	0.057			
… RV end-systolic area	1.033	1.000–1.067	0.051			
… RV end-systolic area index	1.081	1.009–1.157	0.027	1.035	0.937–1.142	0.501
RV fractional area change	0.981	0.957–1.007	0.674			
TAPSE	0.950	0.910-0.991	0.017	0.969	0.901–1.041	0.392
TDI s'	0.856	0.771-0.951	0.004	0.907	0.786–1.047	0.184
LV end-diastolic volume	1.002	0.995–1.008	0.571			
LV end-diastolic volume index	1.003	0.991–1.016	0.639			
LV end-systolic volume	1.003	0.995–1.010	0.496			
LV end-systolic volume index	1.004	0.990–1.019	0.576			
LV ejection fraction	0.996	0.979–1.014	0.662			
LA volume index	1.003	0.993–1.013	0.583			
RA area index	0.999	0.968–1.030	0.928			
RA Volume index	1.003	0.996–1.009	0.384			
RA end-systolic area/RV end-diastolic area	0.723	0.444–1.178	0.193			

Tab. 1 Cox regression analyses with echocardiographic and invasive hemodynamic parameters and the primary composite endpoint (heart failure hospitalization/death) in the overall study population (n = 223). Multivariable analysis was adjusted for parameters with a significant influence at an univariable level (Fortsetzung)

RA end-systolic area/RV end-diastolic area >1.18	0.874	0.530–1.439	0.596			
RA end-systolic area/RV end-diastolic area >1.35	0.887	0.555–1.417	0.615			
RA end-systolic area/RV end-diastolic area index	0.544	0.228–1.298	0.170			
RA end-systolic area/RV end-diastolic area index >0.74	0.725	0.452–1.162	0.181			
Echocardiographic parameters – TR quantification						
Vena contracta width	1.032	0.993–1.073	0.113			
EROA	1.571	1.027–2.403	0.037	0.819	0.359–1.867	0.634
TR regurgitant volume	1.009	1.000–1.017	0.041	1.002	0.988–1.017	0.747
TR grade	1.380	1.074–1.772	0.012			0.743
TR VTI	0.995	0.986–1.004	0.313			
TR maximal velocity	0.940	0.621–1.424	0.772			
sPAP echo	1.007	0.989–1.026	0.446			
IVC size	1.041	1.005–1.079	0.024	1.044	1.003–1.087	0.034
Invasive hemodynamic parameters						
PAPs	1.041	1.019–1.063	<0.001	1.016	0.957–1.078	0.606
PAPd	1.053	1.012–1.097	0.011			
PAPm	1.065	1.031–1.100	<0.001	1.063	0.951–1.187	0.281
RAa	1.031	0.977–1.088	0.265	1.277	1.028–1.588	0.027
RAv	1.028	0.992–1.065	0.125			
RAm	1.045	0.999–1.094	0.057			
RVs	1.027	1.010–1.045	0.002			
RVpd	0.985	0.926–1.047	0.629			
RVed	1.026	0.980–1.074	0.272			
LVs	0.984	0.966–1.002	0.080			
LVpd	1.021	0.958–1.088	0.517			
LVed	1.019	0.954–1.089	0.572			
PCWPa	1.001	0.946–1.059	0.969			
PCWPv	1.028	0.999–1.059	0.057			
PCWPm	1.043	0.999–1.089	0.058			
CO Fick	0.892	0.680–1.172	0.414			
CI Fick	0.906	0.508–1.615	0.737			
CO Thermo	1.066	0.811–1.402	0.647			
CI Thermo	1.291	0.729–2.288	0.381			
PVR Fick (PAPm-PCWPm/CO)	1.004	1.002–1.005	<0.001	1.277	1.028–1.588	0.027
PVR Fick index (PAPm-PCWPm/CI)	1.146	1.051–1.250	0.002			
PVR Thermo (PAPm-PCWPm/CO)	1.005	1.002–1.008	<0.001			
PVR Thermo index (PAPm-PCWPm/CI)	1.107	1.010–1.213	0.030			
DPG (PAPd-PCWPm)	1.029	0.974–1.087	0.306			
TPR Fick (PAPm/CO)	1.001	1.000–1.001	0.052			
TPR Fick index (PAPm/CI)	1.047	1.014–1.081	0.005	0.981	0.917–1.049	0.573
TPR Thermo (PAPm/CO)	1.002	1.000–1.003	0.009			
TPR Thermo index (PAPm/CI)	1.076	1.021–1.135	0.006			
CI Fick/PAPm	0.926	0.844–1.015	0.099			
CI Thermo/PAPm	0.897	0.810-0.992	0.035	1.103	0.981–1.240	0.101
Pulsatility index (PAPs-PAPd/RAm)	1.057	0.948–1.178	0.320			
PAPm/RAm	1.069	0.907–1.260	0.425			
Combined indices						
TAPSE/sPAP echo	0.206	0.041–1.034	0.055			
TAPSE/sPAP echo >0.38	0.532	0.332-0.852	0.009			

Tab. 1 Cox regression analyses with echocardiographic and invasive hemodynamic parameters and the primary composite endpoint (heart failure hospitalization/death) in the overall study population (n = 223). Multivariable analysis was adjusted for parameters with a significant influence at an univariable level (Fortsetzung)

TAPSE/PAPs	0.073	0.012-0.440	0.004	0.948	0.882–1.019	0.147
TAPSE/PAPs >0.40	0.439	0.241-0.802	0.007			
TAPSE/RVs	0.050	0.008-0.334	0.002			
TDI s'/sPAP echo	0.943	0.908-0.980	0.003			
TDI s'/PAPs	0.942	0.907-0.979	0.002	0.997	0.891–1.115	0.956
RV end-diastolic basal diameter index*PVR Fick	1.012	1.006–1.018	<0.001			
RV end-diastolic basal diameter index*PVR Thermo	1.018	1.009–1.027	<0.001	1.004	0.990–1.018	0.600
RV end-systolic area index*PVR Fick	1.024	1.009–1.039	0.002			
RV end-systolic area index*PVR Thermo	1.031	1.011–1.051	0.003			
TAPSE/PVR Fick	0.919	0.862-0.979	0.009			
TAPSE/PVR Thermo	0.919	0.865-0.975	0.005	1.040	0.850–1.272	0.707
TDI s'/PVR Fick	0.899	0.808–1000	0.050			
TDI s'/PVR Thermo	0.888	0.798-0.989	0.030	0.912	0.673–1.237	0.555

RV, right ventricle; TAPSE, tricuspid annulus plane systolic excursion; TDI, tissue Doppler imaging; LV, left ventricle; LA, left atrium; RA, right atrium; EROA, effective regurgitant orifice area; TR, tricuspid regurgitation; VTI, velocity time integral; sPAP systolic pulmonary artery pressure; IVC, inferior vena cava; PAPs, systolic pulmonary artery pressure invasive; PAPd, diastolic pulmonary artery pressure; PAPm, mean pulmonary artery pressure; RAa, right atrium a-wave; RAv, right atrium v-wave; RAm, right atrium mean pressure; RVs, right ventricle systolic pressure; RVpd, right ventricle peak diastolic pressure; RVed, right ventricle end-diastolic pressure; LVs, left ventricle systolic pressure; LVpd, left ventricle peak diastolic pressure; LVed, left ventricle end-diastolic pressure; PCWPa, pulmonary capillary Wedge pressure a-wave; PCWPv, pulmonary capillary Wedge pressure v-wave; PCWPm, pulmonary capillary Wedge pressure mean pressure; CO, cardiac output; CI, cardiac index; PVR pulmonary vascular resistance; DPG, diastolic pressure gradient; TPR, total pulmonary resistance;

6-3

Neurologic recurrence after transcatheter PFO closure in patients with cryptogenic stroke

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Introduction: Background: Patent foramen ovale (PFO) is associated with an increased risk of cryptogenic stroke, and interventional closure is recommended for secondary prevention. However, there is limited real-world data on long-term results. Our objective was to evaluate outcomes following successful transcatheter PFO occlusion.

Methods: Methods: Data from patients undergoing PFO closure for cryptogenic stroke between 2010 and 2015 were analysed to determine short- and long-term outcomes and to identify potential predictors of neurological recurrence.

Results: Results: 330 patients underwent successful PFO closure. The mean age of patients was 49 (standard deviation (SD) ± 12) years, and 55.5% were male. Any in-hospital adverse event was observed in eight patients (2.4%). During a median follow-up of 9.85 (SD ± 2.5) years, the combined outcome of transient ischemic attack (TIA), stroke, or death from stroke was observed in 3.6% of patients (0.38 events per 100 person-years). After 5, 10, and 12 years the percentage of patients free of the composite outcome was 97.5%, 96.2%, and 96.2% respectively (Fig. 1). New onset atrial fibrillation was detected in 10 patients (3.0%). A thorough analysis of the neurologic recurrences revealed a total number of six cryptogenic strokes (1.8%). Our results revealed that the Risk of Paradoxical Embolism (RoPE) score (adjHR: 0.70, 95% confidence interval [CI]: 0.52 to 0.95;

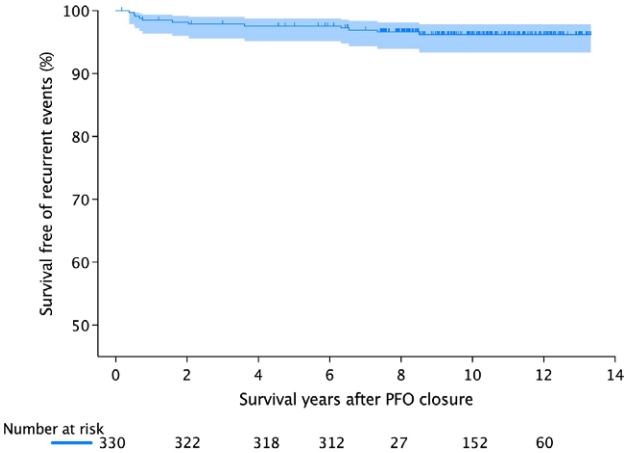

Fig. 1 Kaplan-Meier curve of the combined primary outcome of TIA, stroke, or death from stroke

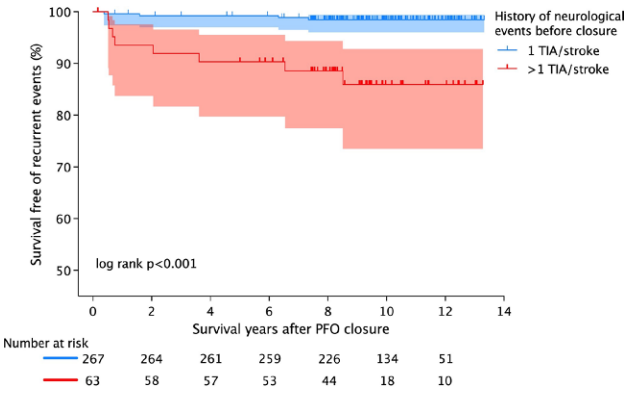

Fig. 2 Kaplan-Meier curves of the combined primary outcome for TIA, stroke, and death from stroke as a function of the rate of previous neurological events; Log-rank p < 0,001, TIA, transient ischemic attack

p = 0.022) and the number of prior neurologic events (adjHR: 9.78, 95% CI: 2.66 to 35.99; p < 0.001) were strong independent predictors of future recurrent neurologic events. Kaplan Meier survival analysis stratified by number of previous neurologic events proved to be statistically significant (p < 0.001; Fig. 2).

Conclusion: Conclusion: In this real-world cohort of patients with cryptogenic stroke we observed excellent safety and good efficacy of percutaneous PFO closure, similar to randomized controlled trials or other long-term cohort studies. The rate of recurrent neurological events was low, especially cryptogenic strokes. The RoPE score confirmed good predictive power; in particular, the number of previous neurological events should be taken more into account when determining the indication for closure.

6-4

Visual assessment of coronary artery stenoses versus fractional flow reserve – unveiling the impact of experience

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Introduction: The assessment of coronary artery stenoses significance has great impact on patient care, guiding therapeutic strategies. Despite the objectivity offered by Fractional Flow Reserve (FFR) in quantifying stenoses severity, routine clinical practice often involves subjective visual assessments, possibly leading to interobserver variability influenced by several factors. This study aimed to analyze if experience impacts visual assessment accuracy of coronary stenoses quantified by FFR and compare the performance between experienced and less experienced cardiologists and medical students.

Methods: Participants with diverse experience levels completed a questionnaire evaluating 20 cases of coronary angiography visually. Stenoses were defined as hemodynamically significant if FFR measurements were ≤ 0.8. Performances of participants with limited or no experience (Group 1) and high expertise (Group 2) were compared.

Results: Among the 68 participants, 27 (40%) were in Group 1 (mean age 28 ± 6 years; 63% females) and 41 (60%) in Group 2 (mean age 46 ± 10 years; 18% females). The highest score of correctly classified coronary lesions (80% correct) was achieved solely by 3 (7%) Group 2 participants, while the lowest score (30% correct) was recorded in 1 (4%) Group 1 participant. Median scores for correctly assessed stenoses severity were 11 [IQR: 10–13] for Group 1 and 13 [IQR: 11.5–14] for Group 2 (p = 0.004). Notably, 13 participants (48%) of Group 1 and 31 (76%) Group 2 participants correctly evaluated the significance of ≥ 60% of coronary artery stenoses presented in the questionnaire (p = 0.02). In linear regression model higher expertise was significantly associated with higher accuracy in correctly assessing coronary artery stenoses severity (β = 1.6, p = 0.001).

Conclusion: Higher levels of experience were associated with higher accuracy in visually assessing the significance of coronary lesions compared to FFR in our study. Nevertheless, we observed limitations in the visual assessment even among most experienced interventional cardiologists.

6-5

Outcomes of CT- or CMR-guided TAVR according to sex: a secondary analysis of the randomized TAVR-CMR trial

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Introduction: Previous studies have reported sex differences in pre-procedural imaging characteristics of patients undergoing transcatheter aortic valve replacement (TAVR) evaluation. Whether these differences affect the outcome of computed tomography (CT)-guided or cardiac magnetic resonance (CMR)-guided TAVR has not been studied. This analysis aimed to evaluate sex-based differences in imaging findings and outcomes in patients undergoing TAVR for severe aortic valve stenosis.

Methods: This was a secondary analysis of the TAVR-CMR trial, a randomized clinical trial comparing TAVR planning by CT or CMR. Outcomes (based on the Valve Academic Research Consortium (VARC)-2 definition) with each imaging strategy were compared according to sex.

Results: Of 380 patient randomized into the TAVR-CMR trial, 194 (51.1%) were female and 186 (48.9%) were male. Of these, 267 patients eventually underwent TAVR (133 women (49.8%) and 134 men (50.2%), p = 0.457). Imaging findings differed between the sexes for both imaging modalities. The compari-

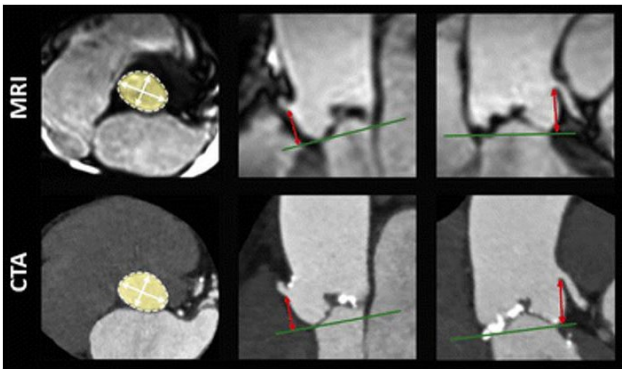

Fig. 1 CMR and CT fir TAVR-planning

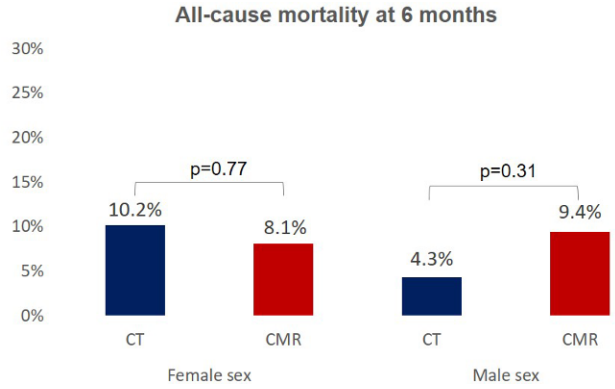

Fig. 2 All cause mortality at 6 months

son between CT and CMR to assess the access route and landing zone showed no difference in both women and men (all $p > 0.05$). Implantation success was not significantly different between imaging strategies for both women (84.7% (CT group) vs. 93.2% (CMR group), $p = 0.16$) and men (95.7% (CT group) vs. 93.8% (CMR group), $p = 0.71$). All-cause mortality at 6 months was not significantly different between imaging strategies for both women (10.2% (CT group) vs. 8.1% (CMR group), $p = 0.77$) and men (4.3% (CT group) vs. 9.4% (CMR group), $p = 0.31$).

Conclusion: This secondary analysis has confirmed sex-related differences in pre-procedural imaging characteristics, with no influence of the imaging modality used. Similar outcomes were observed in both female and male patients when the TAVR was guided by either a CMR or a CT scan.

6-6

Association of metabolic phenotypes with cardiovascular events in primary and secondary prevention

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Introduction: Metabolic disorders are established risk factors for the development of coronary artery disease (CAD) and major adverse cardiovascular events (MACE). Although obesity is strongly related with the metabolic health status, its role as a cardiovascular risk modifier in the absence of metabolic disorders remains controversial. Recent implementation of nutrient-stimulated hormone-based therapies (NUSH) including glucagon-like peptide-1 (GLP-1) receptor agonists in the treatment of obesity even in metabolically healthy individuals requires understanding the function of obesity to ensure optimal patient management. The aim of this study is to investigate the association of metabolic phenotypes with cardiovascular events in primary and secondary prevention of CAD.

Methods: We included patients over 18 years of age electively evaluated for CAD by invasive coronary angiography (ICA) between 2010 and 2021 in our tertiary referral centre in one of Europe's largest university hospitals. Metabolic disorder was considered as the presence of diabetes mellitus, irrespective of additional risk factors, or hypertension and hyperlipidaemia, and obesity as a body mass index (BMI) of ≥ 30 kg/m^2, distinguishing four metabolic phenotypes: metabolically healthy/unhealthy nonobese/obese (MHN, MHO, MUN, MUO). The primary study endpoint MACE was defined as a composite of cardiovascular death, non-fatal myocardial infarction, ischemic stroke, and hospitalization for heart failure. Further endpoints included all-cause mortality and subsequent coronary intervention.

Results: The total study population included 12 760 patients (68 [58–76] years; 57.3% male), of whom 56.5% presented metabolically healthy (43.3% MHN; 13.1% MHO) and 43.5% unhealthy (28.3% MUN; 15.2% MUO). During a median follow up time of 3.91 (1.75–7.09) years, 2 592 (20.3%) MACE and 3 351 (26.3%) all-cause deaths occurred. Cox regression analysis adjusted for age, sex, and chronic kidney disease (CKD) showed different risk patterns for distinct metabolic phenotypes (Table 1). While we observed higher event rates in metabolically unhealthy compared to healthy individuals, obesity alone was not associated with increased events. However, metabolically healthy individuals experienced lower event rates with increasing BMI. Among patients without or with nonobstructive CAD, metabolic disease was strongly associated with increased subsequent coronary revascularization regardless of BMI. These patterns were similar across all endpoints irrespective of presence of obstructive or nonobstructive CAD (Fig. 1).

Conclusion: Whereas metabolic disorders are strongly associated with adverse clinical events, obesity alone does not reflect the cardiovascular risk profile in patients with or without obstructive CAD. Thus, focusing on obesity alone for primary or secondary prevention appears unjustified. Particularly after

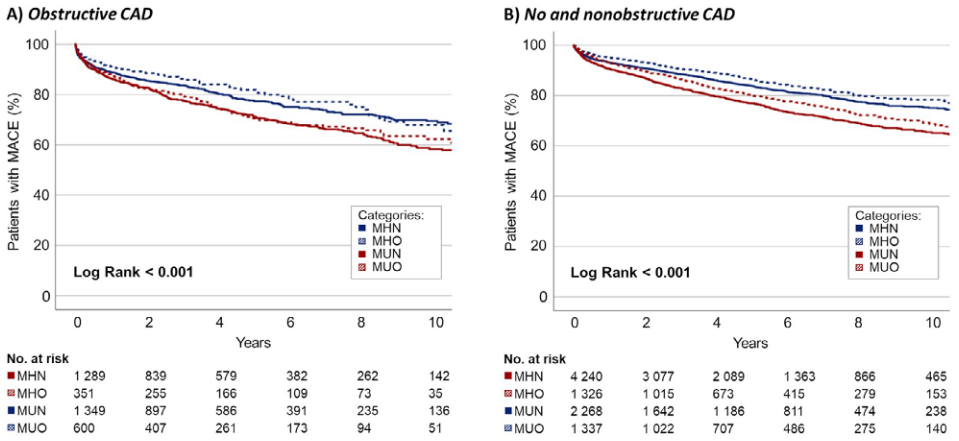

Fig. 1 Cumulative major adverse cardiovascular events (MACE) in A) patients with obstructive coronary artery disease (CAD) and B) patients without or with nonobstructive CAD

	Crude HR (95% CI)	p-value	Adjusted HR (95% CI)	p-value
Obstructive CAD, n = 3 589				
MHN (reference)	1.00 (reference)		1.00 (reference)	
MHO	0.894 (0.688 - 1.162)	0.403	0.964 (0.741 - 1.254)	0.786
MUN	1.363 (1.168 - 1.591)	**< 0.001**	1.216 (1.041 - 1.422)	**0.014**
MUO	1.297 (1.069 - 1.574)	**0.009**	1.228 (1.009 - 1.495)	**0.041**
No or nonobstructive CAD, n = 9 171				
MHN (reference)	1.00 (reference)		1.00 (reference)	
MHO	0.815 (0.692 - 0.961)	**0.015**	0.898 (0.762 - 1.059)	0.201
MUN	1.460 (1.305 - 1.634)	**< 0.001**	1.150 (1.026 - 1.289)	**0.016**
MUO	1.241 (1.080 - 1.425)	**0.002**	1.086 (0.943 - 1.250)	0.250

Multivariate cox proportional hazard model adjusted for age, sex, and chronic kidney disease.

Fig. 2 Cox proportional hazard model for major adverse cardiovascular events (MACE)

the recent implementation of GLP-1 receptor agonists for the treatment of obesity, precise and individual risk stratification is essential to allow for an optimal personalized patient management.

6-7

Dynamics of NT-proBNP in clinical outcomes following left main percutaneous coronary interventions

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Introduction: Indications of percutaneous coronary intervention (PCI) for the treatment of coronary artery disease (CAD) have strongly expanded in recent years due to technical improvements, especially in complex situations including left main coronary artery (LMCA) stenosis. Whether PCI improves event free survival of patients compared to optimal medical therapy (OMT) alone is, however, controversially discussed in current literature. The recently published REVIVED-BCIS2 trial [1] showed no survival benefit of PCI in addition to OMT in a patient cohort with severe ischemic reduced left ventricular function – however, only few LMCA-PCIs were included. Considering the major contribution of the LMCA to left ventricular perfusion and its association with increased mortality, the aim of this study was to investigate whether LMCA-PCI provides clinical benefit using N-terminal prohormone of brain natriuretic peptide (NT-proBNP) as an outcome predictor and marker of heart failure.

Methods: A total of 240 patients over 18 years of age who underwent LMCA-PCI at our university hospital between 2010 and 2021 were included in our study. Baseline NT-proBNP levels at the time of LMCA-PCI and follow-up values after a median of 5.9 months post-intervention were collected for each patient. MACE, a composite of cardiovascular death, non-fatal myocardial infarction, ischemic stroke, and hospitalization for heart failure, was defined as primary study endpoint and all-cause mortality was defined as secondary endpoint.

Results: Our study cohort comprised predominantly male patients (76.3%) with a median age of 70.5 years. Baseline NT-proBNP was significantly associated with long-term MACE (adj. HR per 1 SD 1.35 [1.08–1.70]; p = 0.009) and all-cause mortality (adj. HR per 1 SD 1.81 [1.36–2.41]; p < 0.001), even after adjustment for age, sex, body mass index (BMI) and urgency of intervention (figure 1). Analysis of NT-proBNP dynamics represented by NT-proBNP quotient (defined as follow up NT-proBNP divided by baseline NT-proBNP) revealed a significant decrease of median 33% of NT-proBNP post-intervention in the entire study cohort (paired Wilcoxon test; p < 0.001). Patients with initially highest baseline NT-proBNP values showed particularly strong decrease of 55% (3rd tertile of baseline NT-proBNP; paired Wilcoxon test; p < 0.001; figure 2). Interestingly, NT-proBNP quotient emerged as a robust predictor for MACE (adj. HR per 1 SD 1.39 [1.15–1.69]; p < 0.001) and all-cause mortality (adj. HR per 1 SD 1.99 [1.55–2.56]; p < 0.001), with a stronger decrease indicating less adverse events.

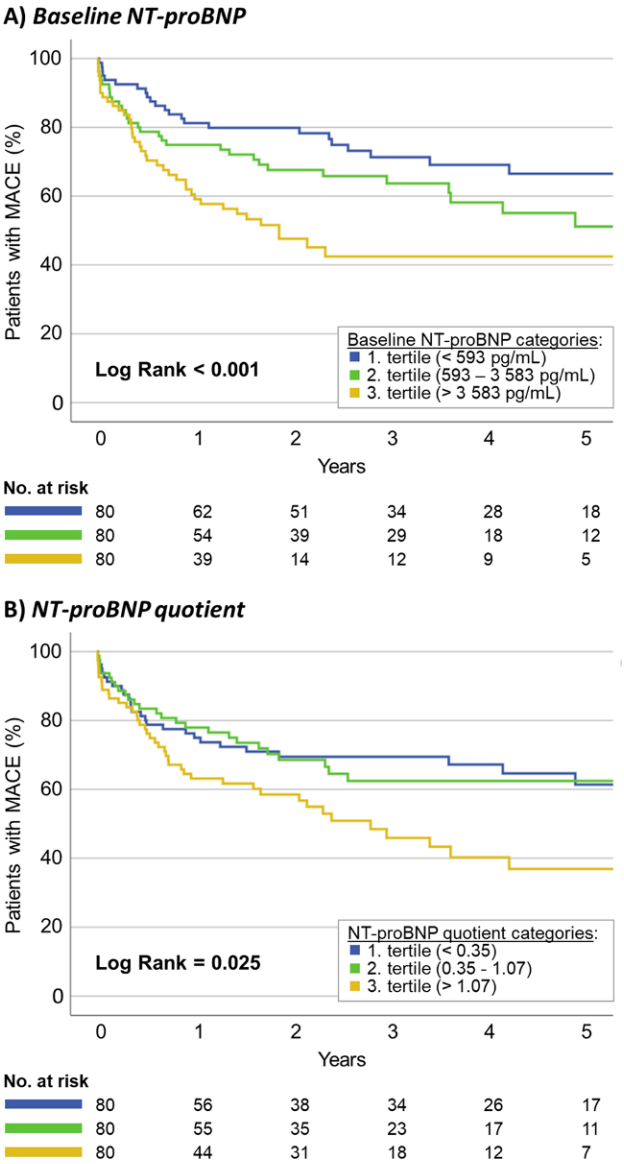
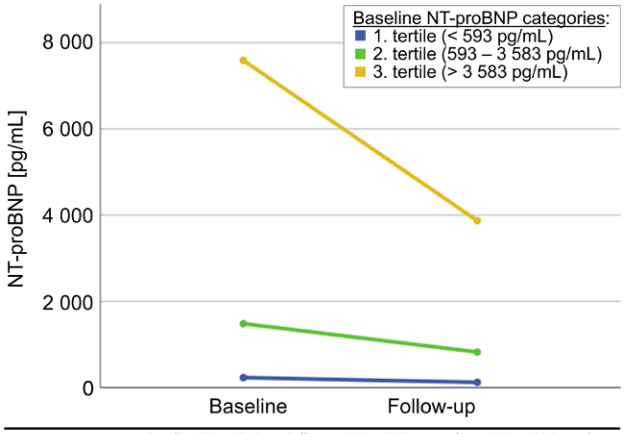


Fig. 1 Cumulative major adverse cardiovascular events (MACE) for A) tertiles of baseline NT-proBNP, and B) tertiles of NT-proBNP quotient

Conclusion: Our findings highlight the prognostic value of NT-proBNP in LMCA-PCI patients for adverse clinical events. Interestingly, the observed decrease in NT-proBNP post-intervention suggests a favourable result of LMCA-PCI. The dynamic change in NT-proBNP emerges as a robust predictor for adverse outcomes, emphasizing its potential utility in risk stratification and patient management following LMCA-PCI.



	Baseline NT-proBNP	Follow up NT-proBNP	p-value	NT-proBNP quotient
Total, n = 240	1 483 (377 – 5 364)	643 (178 – 3 459)	<0.001	0,67 (0,24 – 1,29)
1. tertile, n = 80	232 (89 – 383)	122 (72 – 282)	0.401	0,94 (0,43 – 1,67)
2. tertile, n = 80	1 483 (854 – 2 409)	825 (416 – 3 186)	0.372	0,64 (0,26 – 1,32)
3. tertile, n = 80	7 587 (5 351 – 15 353)	3 871 (1 157 – 11 817)	< 0.001	0,45 (0,15 – 0,95)

Fig. 2

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6-8

Frühe Ergebnisse der Pulmonalvenenisolation mittels Pulsed Field Ablation bei Patientinnen und Patienten mit persistierendem Vorhofflimmern

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Einleitung: Pulsed Field Ablation ist eine neue Energieform zur linksatrialen Katheterablation bei Vorhofflimmern. Der Wirkmechanismus besteht aus der irreversiblen Bildung von Poren in der Zellmembran der Kardiomyozyten, wodurch die Zellen aufgrund der Störung des Wasserhaushaltes in den programmierten Zelltod übergehen. [1] Vielversprechende Ergebnisse wurden in experimentellen und ersten klinischen Untersuchungen erzielt. [2,3] In dieser Studie wurden die Effizienz, die Effektivität und die Sicherheit der gepulsten Feldablation mit einer neuen zirkulären Ablationssonde zur Lungenvenenablation bei Patientinnen und Patienten mit persistierendem Vorhofflimmern evaluiert.

Methoden: Es wurde eine monozentrische, retrospektive Datenanalyse durchgeführt. Dazu wurden die gespeicherten Daten von jenen Patientinnen und Patienten mit persistierendem Vorhofflimmern untersucht, welche im Jahr 2021 eine Pulmonalvenenisolation mittels Pulsed Field Ablation unter Verwendung des PVAC GOLD Katheters (Fa. Medtronic) erhielten. Der Beobachtungszeitraum betrug ein Jahr. Die verfahrensspezifischen Parameter wurden erhoben. Als Hauptzielgröße in Bezug auf die Effektivität der Intervention wurde die Rate an vollständig elektrisch isolierten Pulmonalvenen festgelegt. Der Therapieerfolg nach einem Jahr wurde definiert als die Freiheit von erneutem Vorhofflimmern und atrialer Tachykardien sowie der ausbleibenden Notwendigkeit von weiteren Rhythmus-

Abb. 1 PVAC-GOLD Katheter (Fa. Medtronic)

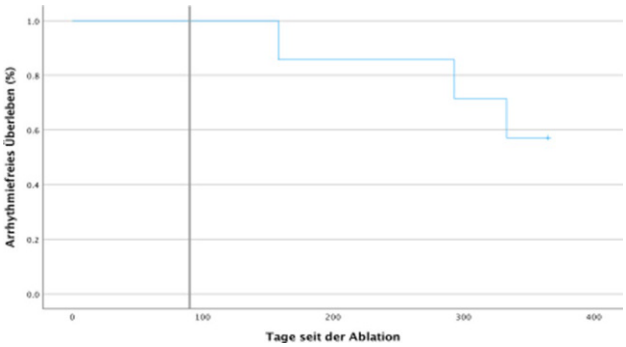

Abb. 2 Kaplan-Meier Kurve des arrhythmiefreien Überlebens über 1 Jahr

erhaltenden Behandlungen. Eine 3 Monate lange Blanking Periode wurde angewendet. Als Hauptzielgröße der Sicherheit wurde evaluiert, wie groß der Anteil an Personen war ohne einer schweren Interventions- oder Gerät-assoziierten Komplikation.

Resultate: 7 Patientinnen und Patienten (68 Jahre (1. Quartile: 65–3. Quartile: 75), 71,4 % männlich) mit symptomatischem, persistierendem Vorhofflimmern wurden mit gepulster Feldablation behandelt. Zur vollständigen Isolierung der Pulmonalvenen waren im Median 56 Applikationen (1. Quartile: 43–3. Quartile: 67) pro Person notwendig. Die mediane Verweildauer des Ablationskatheters im linken Vorhof betrug 74 Minuten (1. Quartile: 46–3. Quartile: 83), die mediane Flouroskopiezeit 28 Minuten (1. Quartile: 18–3. Quartile: 30). Die akute Wirksamkeit im Sinne einer vollständigen elektrischen Isolierung der Pulmonalvenen gegenüber dem linken Vorhof konnte bei 100 % der Patientinnen und Patienten sowie 100 % der Lungenvenen mit dem ringförmigen Pulsed Field Ablationskatheter erreicht werden. Der Therapieerfolg über ein Jahr wurde bei 57,1 % der Studienteilnehmerinnen und -teilnehmer gezeigt. Postinterventionell traten keine schwerwiegenden Interventions- oder Gerätassoziierten Komplikation auf.

Schlussfolgerungen: Die Pulmonalvenenisolation mittels Pulsed Field Ablation bei symptomatischem, persistierendem Vorhofflimmern zeigte sich in unserer Datenanalyse von 7 Patientinnen und Patienten als effizient, effektiv und sicher.

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POSTERSITZUNG 7 – RHYTHMOLOGIE 1

7-1

Vergleich der Single Shot Pulmonalvenenisolation mit Radiofrequenz-, Kryoballon und dem Pulsed Field Ablation System

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Einleitung: Die Pulmonalvenenisolation (PVI) mittels linksatrialer Katheterablation ist eine hoch-wirksame interventionelle Behandlung für Patient*innen mit paroxysmalem und persistierendem Vorhofflimmern (VHF). Die etabliertesten Single Shot Techniken verwenden thermische Energieformen wie Radiofrequenz (RF) und Kryoablation. Neue nicht-thermische Pulsed Field Ablation (PFA) Techniken versprechen hingegen eine schnelle und hohe Effektivität der PVI und eine geringe Komplikationsrate. In dieser retrospektiven Analyse werden die ersten PFA-Prozeduren zur PVI bei VHF an unserer Abteilung analysiert und mit etablierten thermischen Energieformen (RF- und Kryoballon) verglichen.

Methoden: In die Auswertung wurden 84 Patient*innen mit paroxysmalem oder persistierendem VHF eingeschlossen, die einer Ablation mit dem Heliostar® RF-Ballon Ablationssystem (n = 37; Biosense Webster), dem Arctic Front Advance® Kryoballon-Ablationssystem (n = 37; Medtronic) oder dem Farapulse® PFA-Ablationssystem (n = 10; Boston Scientific) unterzogen wurden. Für alle Gruppen wurden demographische und prozedurale Daten erhoben. In der RF- und der Kryoballon-Gruppe wurden außerdem klinische Follow-Up Daten bis zu 12 Monaten analysiert. Die Daten wurden deskriptiv statistisch ausgewertet und miteinander verglichen.

Resultate: In allen Patient*innen aller drei Gruppen (59–62 Jahre) konnten alle Pulmonalvenen erfolgreich isoliert werden. Die Anzahl der Ablationen war bei den thermischen Techniken (Heliostar® 5,8; Arctic Front® 7,4) ähnlich, während in der PFA-Gruppe mehr (Farapulse® 37,0), aber kürzere Ablationen notwendig waren. Die Prozedurdauer war bei der Behandlung mit dem RF-Ballon-Ablations-System etwas länger (107,8 min) als in den beiden anderen Gruppen (Kryoballon 88 min, PFA 77,8 min), die LA-dwell time hingegen war in der PFA-Gruppe mit 66,4 min im Vergleich zu den anderen Gruppen (RF 83,9 min; Kryo78,8 min) niedriger. Die Durchleuchtungszeit zeigte keine wesentlichen Unterschiede zwischen den Gruppen (Kryo 16,7 min; RF 17,8 min; PFA 17,3 min), das Flächen-Dosis-Produkt war bei den RF-Ablationen (2714,3 Gy*cm^2) etwas niedriger als bei den Kryo- (3562,7 Gy*cm^2) und den PFA-Ablationen (4481,0 Gy*cm^2). Insgesamt traten nur wenige und leichte prozedurale Komplikationen auf: 2,7 % in der RF-Ballon- (asymptomatische Luftembolie), 10 % in der PFA- (Leistenkomplikation) und 13,5 % in der Arctic Front®-Gruppe (transiente Phrenicus-Paresen). In den ersten 100 Tagen nach Ablation traten weniger Arrhythmien in der RF-Ballon als in der Kryoballon-Gruppe auf (22 vs. 33 %). Nach einem mittleren Follow-Up von 345 Tagen mussten 5,6 % der Patient*innen der Kryoballon- und 13 % der RF-Ballon-Gruppe kardiovertiert werden, abgesehen davon konnten in keiner Gruppe EKG-bestätigte VHF-Rezidive registriert werden.

Schlussfolgerungen: Die PVI kann mit allen derzeit eingesetzten Ablationssystemen erfolgreich und komplikationsarm durchgeführt werden. Durch das elektroanatomische Mapping vor und nach den Ablationen und die Katheter-Vorbereitung wird die Prozedur-Dauer beim Heliostar® RF-Ballon System etwas verlängert. Allerdings kann so mehr Information über die Anatomie und die Voltage des linken Atriums gewonnen werden. Bei den ersten Farapulse® Prozeduren wurde zwar eine ähnliche Durchleuchtungsdauer erreicht, dafür war die Gesamt-Prozedurdauer aber am kürzesten. Der Vergleich klinischer Follow Up Daten zwischen dem RF- und dem Kryoballon zeigten nach 12 Monaten keine wesentlichen Unterschiede. Unter Berücksichtigung dieser Daten ist der Einsatz des Heliostar® RF-Ballon-Systems als Singleshot PVI System, dem Arctic Front® Kryoballon-System zumindest gleichwertig. Der klinische Effekt der PFA Prozeduren muss noch abgewartet werden und wird derzeit analysiert.

7-2

Do patients with persistent atrial fibrillation have more dispersion of left atrial refractoriness and conduction before development of overt fibrosis?

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Introduction: Background: In patients with persistent atrial fibrillation (PS AF) undergoing pulmonary vein isolation (PVI), left atrial fibrosis, as assessed by voltage mapping prior to ablation, is more common than in patients with paroxysmal (PX) AF. Little is known, however, if subtle changes in left atrial conduction properties, such as conduction time and effective refractory periods (ERP) precede true structural abnormalities and allow to differentiate between PS AF and PX AF. Study aim: To test the hypothesis that patients with PS AF demonstrate a larger local left atrial dispersion of conduction and refractoriness, as compared to patients with PX AF.

Methods: Patients and methods: A total of 49 patients undergoing PVI for symptomatic AF were studied off antiarrhythmic drugs (PX AF, N = 35, PS AF [history of cardioversion], N = 14). Prior to PVI, a voltage map was performed, using the NAVX™ system and the HD Grid™ mapping catheter. Patients with sig-

Tab. 1

	PX AF (35)	PS AF (14)	P value
Age	63 (49–73)	59 (55–67)	0.765
ERP LUPV	280 (250–300)	270 (255–303)	0.546
ERP LLPV	280 (240–305)	280 (238–323)	0.753
ERP RUPV	290 (240–310)	275 (255–305)	0.526
ERP RLPV	290 (270–310)	270 (248–305)	0.201
High septum distance (mm)	22 (15–25)	28 (22–23)	0.010
High septum conduction time (cm/s)	46 (27–67)	41 (35–85)	0.674
High septum ERP (ms)	300 (280–330)	300 (245–320)	0.428
Low septum distance (mm)	23 (18–26)	22 (16–31)	0.634
Low septum conduction time (cm/s)	34 (28–47)	44 (21–66)	0.898
Low septum ERP (ms)	290 (270–300)	285 (245–313)	0.560
Data presented as median (IQR); abbreviations: see methods			

nificant structural heart disease and detectable left atrial fibrosis (voltage < 0.5 mV) were excluded. Local ERP during programmed stimulation was assessed, using the HD Grid™ catheter: On the back of the left atrium, close to the ostium of the left upper pulmonary vein (LUPV), the left lower (LL) PV, the right upper (RU) PV, the right lower (RL) PV, the high interatrial septum (area of Bachmann's bundle) and the low interatrial septum (between the coronary sinus ostium and the RLPV). The interatrial conduction time was assessed between the HD Grid™ and a catheter in the right atrium. Comparison between groups was performed using the Mann-Whitney U-test. A p value < 0.05 was considered significant

Results: Results: In this cohort of 49 patients without evidence of overt left atrial fibrosis undergoing ablation for symptomatic AF, no significant differences could be detected between patients with PX AF and PS AF with respect to local dispersion of refractoriness or interatrial conduction.

Conclusion: Conclusion: In patients with symptomatic AF and no evidence of left atrial fibrosis, local left atrial parameters of refractoriness and conduction did not show any significant differences between the cohort of PS AF and PX AF patients.

7-3

Does conscious sedation with ketamine and midazolam influence inducibility of supraventricular tachycardia prior to catheter ablation?

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Introduction: Background: Catheter ablation has become the standard treatment for many arrhythmias. Despite the possible patient discomfort, many centers perform an electrophysiologic study (EPS) for ablation of documented or suspected supraventricular tachycardia (SVT) without sedation, for the fear to hamper tachycardia inducibility and ablation success. Study aim: To test the hypothesis that during an EPS, a regimen of sedation with ketamine and midazolam is non-inferior to an EPS without sedation with respect to inducibility of sustained SVT prior to catheter ablation.

Methods: Patients and methods: A total of 54 patients undergoing EPS for documented or suspected SVT were studied (24 female, age 54±years, hypertension, N = 16, diabetes, N = 3, coronary artery disease, N = 3). Each patient was serving as his own control. A standard programmed stimulation protocol was performed without sedation and repeated, following conscious sedation with ketamine and midazolam. The protocol included, in a stepwise, more aggressive fashion, until a sustained SVT could be induced or refractoriness was reached: atrial pacing at fixed, increasing rates (S1), pacing at a drive cycle length of 500 ms for 8 beats, then inducing an extra stimulus with a decreasing coupling interval until refractory period is reached (S2), inducing a second extra stimulus with a decreasing coupling interval (S3). If no arrhythmia could be induced by then, isoprenaline was administered. In some patients, SVT was mechanically induced (sinus rhythm). Data are presented as absolute numbers (%). A RMLE analysis was used to assess non-inferiority (arrhythmia inducible while being concscious and while been sedated). A Stuart-Maxwell test was used for comparison of paired ordinal data. Patient comfort was assessed for the conscious and the sedated state, using a scale from 1–7 (1: perfect; 7: horror).

Results: Results: Arrhythmia was inducible in 51 (94.4%) patients without sedation and in 52 (96.3%) patients while beeing sedated. Accepting a - 8% non-inferiority margin, the non-

Tab. 1 Ease of inducibility of SVT in a programmed stimulation protocol; absolute numbers (%), definitions (column 1): see methods; p = 0.656

Inducibility	Conscious	Sedated
Sinus rhythm	2 (3.7%)	2 (3.7%)
S1	1 (1.9%)	1 (1.9%)
S2	35 (65%)	38 (70%)
S3	8 (15%)	6 (11%)
Isoprenaline	5 (9%)	5 (9%)
No sustained SVT inducible	3 (6%)	2 (4%)

inferiority assumption is met (mean difference 0.019 [95% CI −0.019 −0.056]). Induction details, see table. On average, a dose of 4.7 ± 2.8 mg midazolam and 26.3 ± 15.9 mg ketamine was administered. Indication for ablation was AV nodal reentry reentry tachycardia (N = 42, 78%), AV reentry (retrogradely conducting accessory pathway; N = 3, 5.6%) and atrial tachycardia (N = 8, 15%). No ablation: N = 1 (1.9%); unsuccessful ablation (focal atrial tachycardia): N = 3 (5.6%). The median value on the comfort scale was 4 for the conscious state (25. and 75. percentile: 3, 5) and 1 for the sedated state (1, 2), p < 0.01.

Conclusion: Conclusion: A sedation regimen with ketamine and midazolam during EPS was non-inferior to a conscious state with respect to inducibility of sustained SVT. If confirmed for a larger patient cohort, this protocol may improve patient comfort without hampering SVT inducibility.

7-4

EV-ICD in pediatric patients: single center experience

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Einleitung: Seit Jahrzehnten stellt der transvenös implantierte Cardioverter-Defibrillator (ICD) den gerätebasierten Goldstandard in der Therapie maligner Herzrhythmusstörungen zur Prävention des plötzlichen Herztodes dar. Antitachykardes Pacing ist dabei eine wichtige Erweiterung der therapeutischen Möglichkeiten zur Reduktion schmerzhafter und unnötiger Schockabgaben. Die Kehrseite dieses Therapiekonzepts stellen jedoch Komplikationen wie Venenverschlüsse, Infektionen oder Sondenbrüche dar. Der subkutane ICD (Emblem, Boston Scientific) wurde vor etwa 10 Jahren entwickelt, um durch Aussparung des Gefäßsystems die Komplikationsrate zu minimieren. Dabei ist jedoch eine höhere Schockenergie erforderlich, die eine Vergrößerung des Aggregats, eine kürzere Batterielaufzeit und den Verzicht auf antitachykardes Pacing (ATP) bedingen. Der seit September 2023 kommerziell verfügbare extravaskuläre ICD (EV-ICD, Aurora, Medtronic) adressiert diese Limitationen, indem die ICD-Elektrode substernal platziert wird. Durch die Nahebeziehung zum Herzen werden eine Defibrillation mit niedriger Schockenergie, ATP, post-shock-Pacing and ein präventives Pacing bei Pausen ermöglicht. Dabei entsprechen die Aggregatgröße und Batterielaufzeit der von transvenösen ICDs.

Methoden: Insbesondere pädiatrische PatientInnen weisen bei herkömmlichen transvenösen ICDs hohe Device-bedingte Komplikationsraten auf. Sie könnten daher von einem EV-ICD besonders profitieren. Die Anwendung bei Kindern und Jugendlichen wurde bisher jedoch noch nicht struktueriert getestet und ist somit nicht zugelassen. Aufgrund der oben genannten Vorteile wurden an unserem Zentrum bisher bei zwei jugendlichen PatientInnen ein EV-ICD implantiert.

Resultate: n = 2: 17 Jahre, männlich/16 Jahre, weiblich Indikation: hypertrophe CMP/Long QT Syndrom Implantationsdauer: 80 min/143 min Durchleuchtungszeit: 4 min/14,9 min R-Racke: 8,9 mV/3,8 mV Stimulationsimpedanz: 304 Ohm/247 Ohm Schockimpedanz: 63 Ohm/50 Ohm Es traten keine perioperativen Komplikationen auf.

Schlussfolgerungen: Der EV-ICD ist ein neues ICD-System zur Behandlung maligner Herzrhythmusstörungen. Er verhindert Gefäßkomplikationen und ermöglicht ATP bei vergleichsweise kleinem Aggregat mit langer Batterielaufzeit. Junge PatientInnen mit transvenösen ICDs weisen ein erhebliches Komplikationsrisiko auf und könnten von dieser neuen Technologie besonders profitieren. Die Implantation bei zwei minderjährigen Patienten verlief ohne akute Komplikationen. Auffällig war ein vergleichsweise straffes Gewebe beim stumpfen Eingehen ins Mediastinum, problemloses substernales Tunnelieren sowie ausgezeichnete elektrische Messwerte, insbesondere hohe R-Zacken. Ob eine Positionierung der Elektrode im Mediastinum nachteilige Folgen auf lokale Infektionen oder eine notwendige Extraktion haben könnte, ist aktuell nicht geklärt. Bisher wurde kein Fall einer Mediastinitis beschrieben.

7-5

Interactions between antiepileptic drugs and direct oral anticoagulants for primary and secondary stroke prevention in patients with atrial fibrillation

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Introduction: Direct oral anticoagulants (DOAC) are the guideline-recommended therapy for prevention of stroke in atrial fibrillation (AF). DOAC are substrates of permeability glycoprotein (P-gp) and cytochrome P-450 3A4 (CYP3A4). Pharmacokinetic drug-drug interactions (DDI) with DOAC may occur by concomitant intake of drugs which change the activity of P-gp or CYP3A4, and pharmacodynamic DDI with medications affecting function or numbers of platelets. Many antiepileptic drugs (AED) affect the activity of P-gp, CYP3A4 or platelet function. Since up to 15% of patients using DOAC also receive AED, aim of this study was to summarize data about pharmacokinetic and pharmacodynamic DDI of DOAC with AED.

Methods: Methods In PubMed, the search terms "P-glycoprotein", P-gp", "cytochrome P450 3A4", "CYP3A4", CYP 3A4", "platelet", "apixaban", "rivaroxaban", "edoxaban" and "dabigatran", were combined with "antiepileptic drugs" and 49 AED listed in the Anatomical Therapeutic Chemical index.

Results: CYP3A4 activity studies were reported for 29/49 AED: Induction of CYP3A4-activity (n = 14), no effect (n = 11), inhibition (n = 2), controversial data (n = 2). Reports on CYP3A4 activity (n = 40) comprised data from humans (n = 19), in vitro (n = 12), in vivo (n = 3) and of unclear origin (n = 6). P-gp activity studies were reported for 16/49 AED: Induction of P-gp-activity (n = 8), no effect (n = 4), inhibition (n = 3) and controversial data (n = 1). Reports on P-gp activity (n = 31) comprised data from humans (n = 3), in vitro (n = 20), in vivo (n = 7) and of unclear origin (n = 1). Effects on platelets were reported for 21/49 AED: Thrombocytopenia (n = 6), inhibition of aggregation (n = 5), no effect (n = 5), thrombocytosis (n = 1) and controversial data (n = 4). Reports on platelets (n = 35) comprised data from humans (n = 8), in vitro (n = 24), in vivo (n = 2), and ex vivo (n = 1). Overall, for 17/49 AED no data, neither on the activity of P-gp or CYP3A4 nor on platelet number or function were found in the literature. Of 49 AED, only 16 have been investigated regarding DDI with DOAC, mainly by retrospective and case control studies and only by one prospective cohort study. No increased risk for stroke was reported only for topiramate, zonisamide, pregabalin and gabapentin, whereas for the remaining 12 AED conflicting results regarding the risk for stroke and bleeding were found. Further 16 AED have the potential for pharmacodynamic

or pharmacokinetic DDI, but no data regarding DOAC are available. For the remaining 17 A

Conclusion: The knowledge about pharmacokinetic and pharmacodynamic DDI of AED and DOAC is limited and frequently restricted to in vitro and in vivo findings. Since no data about DDI with DOAC are available for 67% of AED and the number of patients with concomitant prescription of DOAC and AED is increasing, there is an urgent need for research on this topic.

7-6

Radioonkologische PatientInnen mit Herzschrittmachern und ICDs – erste Erfahrungen mit einer neuen lokalen SOP

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Einleitung: Die radioonkologische Therapie (RT) ist ein Eckpfeiler in der Behandlung von PatientInnen mit Tumorerkrankungen. Die Zahl der TrägerInnen von implantierbaren elektronischen Devices (CIED, Herzschrittmacher, ICD und CRT), die sich einer RT unterziehen, steigt jährlich an. Die Planung und Durchführung einer Bestrahlung dieser Patienten stellt eine Herausforderung dar, da CIED-Funktionsstörungen durch RT zwar selten auftreten, aber schwerwiegende klinische Folgen haben können. In dieser Analyse berichten wir über unsere Erfahrungen mit der Umsetzung einer SOP zum Management von CIED-TrägerInnen während einer RT in einer multidisziplinären Universitätsklinik.

Methoden: Wir führten eine retrospektive single center Beobachtungsstudie durch, in die alle Patienten mit CIED inkludiert wurden, die sich von Januar 2022 bis Oktober 2023 einer RT unterzogen. Alle Geräte waren MRT-fähig, das Management während der RT und die Frequenz der CIED-Kontrollen erfolgten gemäß einer interdisziplinären SOP auf Basis einer Risikostratifizierung nach Gerätetyp, Beamenergie, Dosis, Dosisleistung und Schrittmacher-Abhängigkeit. Generell wurden die CIED während der RT nicht umprogrammiert und es erfolgte in nur 5 Fällen eine Magnetauflage. Ziel dieser Studie war es, die Sicherheit dieses Algorithmus zu analysieren und etwaige CIED-Fehlfunktionen zu erkennen.

Resultate: Von Januar 2022 bis Oktober 2023 wurden in unserem Zentrum insgesamt 3.278 onkologische Patienten einer RT unterzogen, darunter 52 (1,6 %) CIED-TrägerInnen. Die führende Diagnose war das Prostata-Karzinom (34,6 %) gefolgt von Bronchial- (17,3 %) und Ösophagus-Karzinom (7,7 %). Konventionelle transvenöse Herzschrittmacher stellten den häufigsten CIED-Typ (78,9 %), gefolgt von ICD (13,5 %), CRT-P (3,9 %), CRT-D und sondenlosen Schrittmachern (je 1,9 %). Bei 51/52 PatientInnen (98,1 %) konnten wir an der Telemetrie, den regelmäßigen EKG-Kontrollen und den CIED Follow-ups entsprechend unseres Algorithmus keine Anzeichen einer CIED-Funktionsstörung feststellen. Bei einem Patienten mit einem implantierten VVI-ICD wurde allerdings eine Inaktivierung der Antitachykardie-Therapie am Ende der RT diagnostiziert. Der Funktionsverlust führte zu keinen Symptomen oder klinischem Ereignis und der ICD konnte problemlos re-programmiert werden.

Schlussfolgerungen: Unsere neu eingeführte SOP mit regelmäßigen CIED-Kontrollen erwies sich als sicher. Bei der überwiegenden Mehrheit der Patienten mit CIEDs, die sich einer RT unterzogen, wurde keine Funktionsstörung während und nach der Therapie beobachtet. Regelmäßige Nachuntersuchungen scheinen jedoch notwendig zu sein, da bei einem Einkammer-ICD eine Inaktivierung der Antitachykardie-Therapie beobachtet wurde.

7-7

Ist eine telemedizinische Nachsorge bei Patientinnen und Patienten mit implantierten ICD – Geräten kosteneffektiv?

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Einleitung: Die Implantationsrate des implantierbaren Kardioverter – Defibrillators (ICD) wächst kontinuierlich in Anbetracht der steigenden Lebenserwartung und der Alterung der Menschheit. Infolge steigt auch die erforderliche Nachsorge übermäßig, die üblicherweise halbjährlich in der Schrittmacherambulanz stattfindet (1). Aufgrund der neuen Herausforderungen in der COVID – 19 – Pandemie erlang die Telemedizin mehr Aufmerksamkeit und ist immer attraktiver geworden. Die Hauptaufgabe des ICDs ist die Vermeidung des plötzlichen Herztodes und die daraus resultierende Lebensverlängerung der Patienten*innen (2).

Methoden: Die retrospektive, nicht – interventionelle Kohortenstudie schloss alle Patienten*innen, die im Zeitraum von 01. März 2019–28. Februar 2021 mit einem Device (ICD, CRT – D, S – ICD) im LK Wiener Neustadt versorgt und daraufhin ambulant in der Schrittmacherambulanz oder telemedizinisch betreut worden sind, in die Studie ein. Es resultierte eine Studienpopulation von 186 Patienten*innen, davon sind 113 in der ambulanten und 73 in der telemedizinischen Gruppe nachbetreut worden. Infolge sind die entsprechenden Kosten der Nachsorgen der beiden Kohorten im Beobachtungszeitraum von einem Jahr berechnet und in Vergleich gesetzt worden.

Resultate: Die Gesamtkosten der ambulanten Nachsorge im Beobachtungszeitraum belaufen sich auf 11.924,62 €. Die einzelne ambulante Nachsorge macht 44,33 € und die Kosten pro Patienten*in rund 105,53 € aus. Die gesamten Kosten der telemedizinischen Nachsorge hingegen beziffern sich auf 6.175,19 €, davon kostet die rein telemedizinische Nachsorge 4,22 € und die einberufene telemedizinische Nachsorge 66,08 €. Die Kosten pro telemedizinischen*er Patienten*in lauten 84,59 €. Beim Vergleich der Kosten beider Nachsorgen ist ein t – Test bei unabhängigen Stichproben gerechnet und anschließend eine Welch – Korrektur durchgeführt worden. Als Ergebnis dieses t -Testes resultierte ein p – Wert von 0,042, anhand dieses Resultates kann tatsächlich angenommen werden, dass die durchschnittliche telemedizinische Nachsorge im Vergleich zur durchschnittlichen ambulanten Nachsorge signifikant kostengünstiger war.

Schlussfolgerungen: Aus den Erfahrungen dieser Studie können wir den folgenden Schluss ziehen, dass die Durchführung der telemedizinischen Nachsorge im Vergleich zur halbjährlichen ambulanten Kontrolle bei implantierten ICD – Devices signifikant kostengünstiger, sowohl bei den Einzelkosten der Nachsorgen, als auch bei den durchschnittlichen Kosten pro Patienten*in in dem beobachteten Zeitraum von einem Jahr war. Durchschnittlich konnte eine jährliche Einsparung

von 20,94 € pro Patienten*in aufgezeigt werden. Die Resultate dieser Studie sprechen für einen zukünftig breiteren Einsatz der Telemedizin, da sie vor allem eine kosteneffektivere und zeitsparendere Nachsorge, aber auch eine schnellere, adäquatere und zielgerichtete Therapie für die Patientinnen und Patienten bedeutet. Trotz allem sind weitere groß angelegte, randomisierte, multizentrische Studien nötig, um alle Vorteile der Telemedizin mit ausreichender Power und Signifikanz darstellen zu können.

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7-8

Patients with paroxysmal atrial fibrillation undergoing left atrial appendage closure

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Introduction: There is limited evidence regarding outcome in patients with paroxysmal vs. persistent atrial fibrillation (AF) undergoing left atrial appendage closure (LAAC).

Methods: A retrospective analysis from a multicentre registry including consecutive patients undergoing LAAC was performed, investigating in baseline and outcome differences between patients with paroxysmal and persistent AF. Paroxysmal AF was defined as periprocedural heart rhythm free from atrial arrhythmia. Major short-term complications were defined as any complication necessitating an invasive intervention, or death. Differences in baseline characteristics were adjusted by inverse probability weighting.

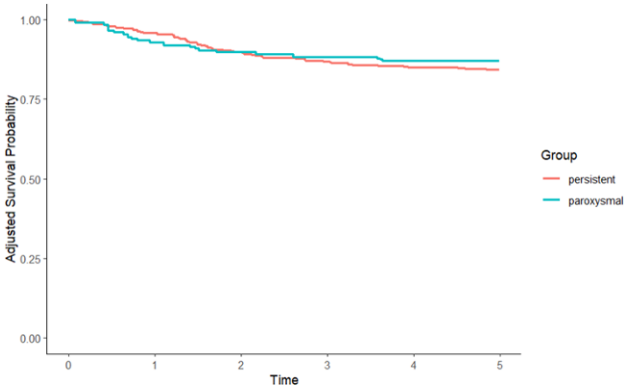

Fig. 1 Adjusted 5-year survival in patients with paroxysmal vs. persistent AF undergoing left atrial appendage closure.

Results: A total of 510 patients from 9 centres were included. Median age was 76 (interquartile range 70–79) years and 35.5% were female. Patients with paroxysmal AF were younger (median 73 vs. 76 years, $p < 0.001$), had more often terminal kidney disease requiring haemodialysis (4.1% vs. 0.6%, $p = 0.008$) but a lower prevalence of reduced left-ventricular ejection fraction (19.3% vs. 28.0%, $p = 0.040$), significant mitral regurgitation (2.9% vs. 7.4%, $p = 0.047$), and significant tricuspid regurgitation (2.8% vs. 8.3%, $p = 0.003$). Furthermore, nt-proBNP levels were lower in patients with paroxysmal AF (median 339 vs. 1380 pg/mL, $p < 0.001$). There were no significant differences in CHA2DS2-VASc (median 4 vs. 5, $p = 0.165$) and HAS-BLED scores (median 3 vs. 3, $p = 0.370$) between both groups. Major procedural complications occurred in 7.0% in patients with paroxysmal AF and in 4.7% in patients with persistent AF ($p = 0.306$). Five-year survival was similar between groups with no trend favouring any subgroup (unadjusted survival 88.9% vs. 82.6%, $p = 0.070$). Adjusted five-year survival was similar between groups (hazard ratio for paroxysmal AF: 0.636, 95% confidence interval 0.375–1.076, $p = 0.092$).

Conclusion: While significant differences in baseline characteristics persist, short- and long-term complications were similar in patients with paroxysmal vs. persistent AF undergoing LAAC.

7-9

Die Rolle einer tragbaren Defibrillator-Weste in Zeiten der optimalen medikamentösen Therapie: Eine österreichische Kohortenvergleichsbeobachtung

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Einleitung: Die ICD-Indikation in der Pimärprophylaxe in Zeiten optimierter medikamentöser Therapie wird derzeit hinterfragt. Neue Substanzen (Sacubitril/Valsartan; SGLT2-Hem-

mer) haben eine verbesserte Behandlung der Herzinsuffizienz ermöglicht, die auch das Risiko des plötzlichen Herztodes (PHT) reduziert. Ziel dieser Studie war es, anhand von Outcome-Vergleichen zweier Patientenkohorten in Österreich zu untersuchen, ob der PHT-Schutz trotz der „phantasischen Vier" noch notwendig ist und ob sich die Rate der ICD-Implantation nach der Tragezeit der Defibrillator Weste (WCD) verändert hat.

Methoden: Wir haben eine retrospektive Analyse aller österreichischen WCD-Patienten zwischen 2020 und 2023 (G_neu) durchgeführt und diese mit einer vergleichbaren Kohorte zwischen 2010 und 2016 (G_alt) verglichen. 1878 Patienten (im Durschschnitt 58 Jahre alt, 21 % weiblich) mit reduzierter Auswurfleistung (LVEF< 35 %) wurden mit 448 Patienten verglichen, die in 48 östrreichischen Zentren einen tragbaren Kardioverter-Defibrillator erhielten.

Resultate: Die mittlere Gesamt-Tragezeit betrug 57 respektive 54 Tage in G_neu und G_alt. Im Median betrug die tägliche Tragezeit 23,5 Stunden in beiden Gruppen. Während der Tragezeit des WCD erhielten 33 Patienten in G_neu (1,78 %) insgesamt 54 adäquate Schocks. In G_alt erhielten 11 Patienten (2,45 %) insgesamt 22 adäquate Schocks (p = 0,067). In beiden Gruppen betrug die Rate der inadäquaten Schocks 0,8 % respektive 0,4 % (p = 0,095). Nach Beendigung der Tragezeit erhielten in G_neu 797 Patienten (42 %) einen ICD, während in G_alt bei 247 Patienten (55 %) eine definitive ICD Implantation erfolgte (p < 0,001).

Schlussfolgerungen: Die Notwendigkeit einer ICD-Implantation wurde bei Trägern einer WCD aufgrund einer anfänglich eingeschränkten Pumpfunktion < 35 % in den letzten Jahren signifikant reduziert, möglicherweise Dank der verbesserten medikamentösen Therapie. Das Risiko, ein arrhythmogenes Ereignis/einen PHT zu erleiden ist dennoch während der Tragezeit und medikamentösen Auftitrierung nach wie vor unverändert.

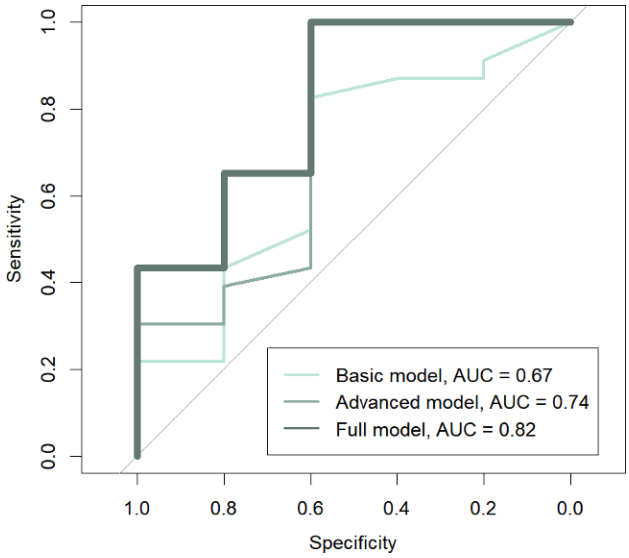

Fig. 1 Receiver Operating Characteristic (ROC) curves

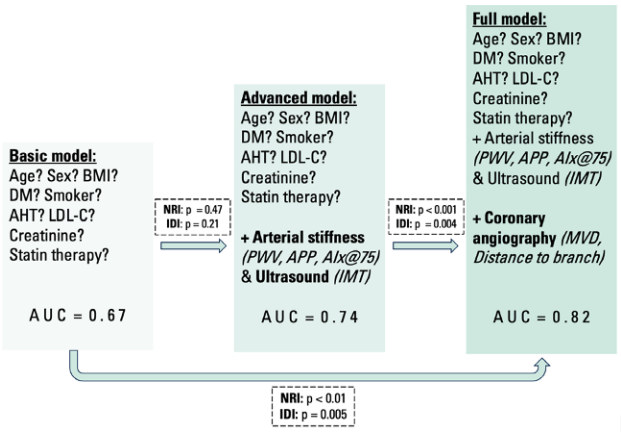

Fig. 2 Model development and reclassification metrics

POSTERSITZUNG 8 – AKUTES KORONARSYNDROM 1

8-1

Machine-learning-based classification of ACS-causing coronary plaque morphologies to accelerate precision management in acute coronary syndrome

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Introduction: Identification and characterization of acute coronary syndrome (ACS)-causing culprit plaques by high-resolution intracoronary optical coherence tomography (OCT) allows personalized management of patients with ACS. This is especially crucial when distinguishing between culprit lesions (CL) with ruptured – (RFC) and intact-fibrous cap (IFC) as such classifications play a pivotal role in clinical decision-making and in evaluating prognosis. While OCT-evaluation of the ACS-causing culprit plaque morphology is rather effective, its invasivity limits broad clinical implementation. The aim of this study was to develop a machine-learning-based model that allows effective differentiation between RFC- and IFC-ACS, utilizing routinely available clinical variables of both routine-invasive and non-invasive diagnostic parameters.

Methods: A representative subset of the OPTICO-ACS study (NCT03129503) was investigated. The dataset was split into a training set (70%) and a test set (30%). The optimum discriminatory cutoff point for age, Body-Mass-Index, LDL-C, creatinine, aortic pulse pressure (APP), pulse wave velocity (PWV), heart rate-corrected augmentation index (AIx@75), intima-media-thickness (IMT) and the distance to the next coronary branch was determined using the Youden's J statistic and included as a binary variable in the prediction models. We used Least Absolute Shrinkage and Selection Operator (LASSO) regressions with 10-fold cross-validation and subsequently assessed their performance using Receiver operating characteristics (ROC) curves and the Area under the Curve (AUC). We established three distinct models: The Basic model, which incorporates regularly available clinical variables; the Advanced model, which adds arterial stiffness metrics and IMT; and the Full model, which further includes angiographic parameters. Derived from the model coefficients, a normalized risk score (0–100) was defined for the classification of RFC and IFC.

Results: In total, 96 patients (81% male) with RFC-ACS (69%) and IFC-ACS (31%), with a median age of 62.0 years were included in this study. The predictive power improved with the addition of arterial stiffness metrics (Advanced model: AUC = 0.74) and improved even further with the subsequent inclusion of angiographic findings (Full model: AUC = 0.82) (Fig. 1). Reclassification analysis revealed that a model containing a combination of clinical covariates, arterial stiffness parameters and angiographic findings significantly outperforms its isolated components (Full vs. Basic model: Net reclassification index (NRI) 0.87 [95% CI 0.46–1.27], p < 0.001), Integrated discrimination improvement (IDI) 0.16 [95% CI 0.05-0.27], p = 0.005; Full vs. Advanced model: NRI 1.13 [95% CI 0.73–1.54], p < 0.001, IDI 0.11 [95% CI 0.03-0.18], p = 0.004) (Fig. 2).

Conclusion: A model that integrates commonly available clinical data, arterial stiffness parameters, and angiographic findings offers potential as an effective tool for differentiating between RFC- and IFC-ACS and therefore allows for the first time for a personalized, pathophysiology-guided management of patients with ACS.

8-2

Circulating nucleases degrade high-molecular-weight cell-free DNA in coronary vessels during acute myocardial infarction

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Introduction: Extracellular cell-free DNA (cfDNA) originates from various biological processes, including cell turnover, apoptosis, necrosis, NETosis, and other forms of cell death. In healthy individuals, highly fragmented cfDNA is elevated in the bloodstream due to infection, cancer, inflammation and thrombosis. In thrombotic vascular diseases, neutrophils release elongated, high-molecular-weight DNA with bioactive and prothrombotic properties in a process termed NETosis. Circulating nucleases are thought to counteract pathogenic properties of NETs. However, attempts to connect total cfDNA concentration to nuclease activity have failed. We aimed to elucidate the in vivo connection between extracellular DNA and circulating nucleases in thrombotic vascular diseases by investigating DNA length as a potential novel biomarker in cardiovascular disease.

Methods: Citrated plasma from healthy volunteers (n = 363) and from ST-elevation myocardial infarction (MI) coronary aspirates (n = 59) and peripheral arterial sites (n = 96) were analyzed for DNA concentration, length, and nuclease activity. Total DNA concentration was measured with a fluorescent DNA binding dye, and elongated DNA assessed using qPCR and Agilent bioanalyzer high-sensitivity DNA chip. Nuclease activity was measured by single radial enzyme-diffusion (SRED) assay. Cardiac MRI assessed infarct size acutely and six months after the event.

Results: Coronary aspirates exhibited an elevation in total DNA, with a significant rise in high-molecular weight cell-free DNA in addition to an increase in sub-nucleosome fragmentation (Fig. 1). Peripheral and coronary plasma samples from individuals with myocardial infarction (MI) showed elevated levels of total and elongated cfDNA. When compared to healthy individuals, the integrity of cfDNA was lower in peripheral samples and higher in coronary aspirates. During myocardial infarction, circulating nuclease activity was elevated systemically but low at the coronary culprit lesion site. Elongated high-molecular-weight cfDNA accumulates primarily in coronary vessels but is also elevated systemically. In coronary aspirates, nuclease activity negatively correlated with elongated DNA and DNA integrity (rs = 0.6255, p < 0.0001).

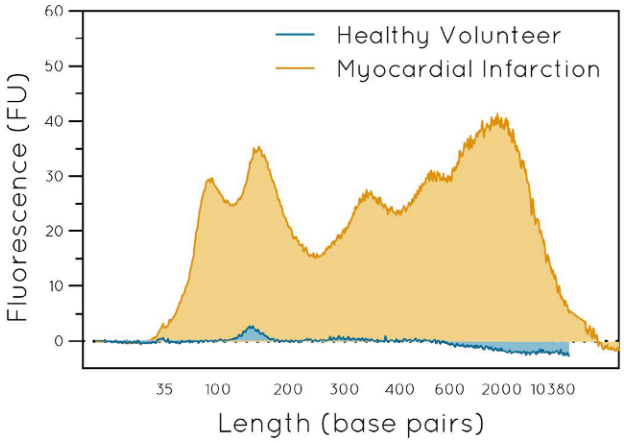

Fig. 1 Coronary culprit site cfDNA length in MI

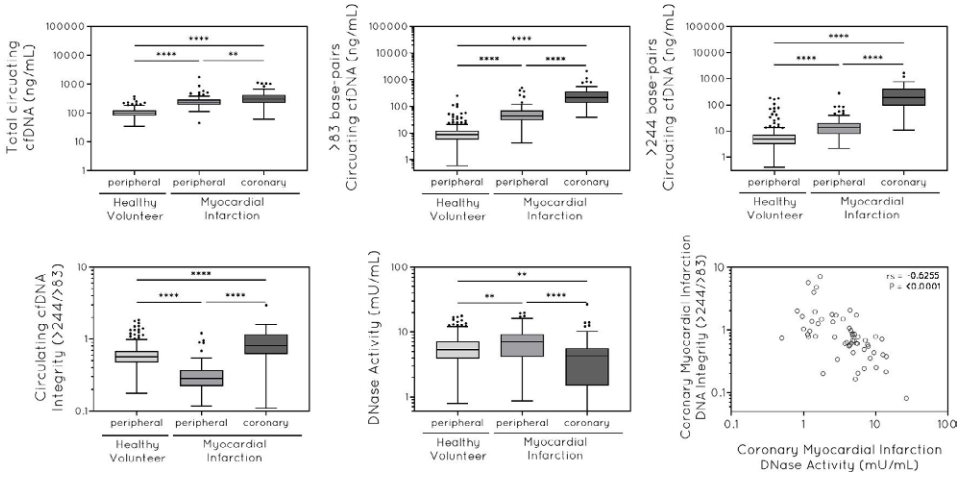

Fig. 2 cfDNA and DNase Activity in MI

Conclusion: Elongated DNA accumulates during MI at the culprit lesion site. Its inverse correlation with nuclease activity underscores the role of nucleases in cleaving elongated DNA to shorter, soluble fragments. This study establishes DNA length and integrity as novel biomarkers in thrombotic cardiovascular disease.

8-3

Superior radiation protection with a ceiling-suspended protection system in emergency PCI for acute myocardial infarction – Data from the OSCAR Registry

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Introduction: Interventional cardiologists (IC) are chronically exposed to occupational scatter radiation (SCR) in the cathlab, causing a significant degree of work-related risks, including cataracts, vascular alterations, and left-sided brain tumors. Conventional lead aprons provide insufficient protection for sensitive organs. Especially in the emergency setting of PCI in acute myocardial infarction (AMI, including STEMI- and NSTEMI) radiation protection does not receive adequate attention. A ceiling-suspended operator radiation protection system (Zero Gravity, CFI Medical Solutions, MI, USA) has shown high efficacy in reducing scatter radiation for the operator. Its performance in the acute PCI setting, however, has not been thoroughly studied.

Methods: We have created a prospective registry for Occupational SCAtter Radiation (OSCAR Registry; clinicaltrials.org identifier NCT04945538) to study predictors of SCR exposure for the IC and sterile assistant (SA) under different conditions [1]. Live-dosimetry was used to quantify the impact of the ZG system on SCR when used in addition to standard X-ray protection (SXP) in patients with AMI. IC and SA were equipped with 5 Unfors RaySafe i3 live-dosimeters (DLD) at prespecified locations. Cardiac procedures were stratified into two groups in which either both IC and SA were using SXP (lead apron, thyroid shield) or the IC was using the ZG system and the SA was wearing SXP.

Results: From a total of 1290 procedures recorded with DLD, 217 were acute PCIs for AMI. 99 PCIs were performed with SXP, 118 with ZG. Compared to SXP, the use of the ZG device reduced the average SCR doses per procedure of the IC recorded at the left lateral head from 27.31 ± 4.40 µSv to 1.36 ± 0.15 µSv (–95%; $p < 0.0001$). The IC's average frontal dose at eye level was reduced from 8.23 ± 1.24 µSv to 0.46 ± 0.06 µSv (–94%; $p < 0.0001$). Consistently, the dose recorded immediately under the IC's left shoulder was reduced from 74.38 ± 8.87 µSv to 1.51 ± 0.28 (–98%; $p < 0.0001$). Furthermore, when the IC used the ZG system, the average SCR dose recorded at the SA's upper neck was reduced from 13.64 ± 1.92 µSv to 3.59 ± 0.42 µSv (–74%, $p < 0.0001$). All SCR dose effects remained significant after correction for total dose-area product (µSv/Gy*cm2). There was no effect of ZG use on procedure duration, contrast use, procedural success rate, time to lesion crossing and patient radiation dose.

Conclusion: The ZG system could swiftly be integrate into emergency PCI procedures in patients with AMI. In 217 acute PCI procedures ZG provided a drastic improvement of SCR protection for ICs and SAs in critical anatomical areas. The common concern that advanced radiation protection could cost too much time in the acute PCI setting in unfounded. These findings, together with a growing number of clinical trial results, call for a greater awareness of SCR protection in interventional cardiology. Advanced radiation protection systems like ZG should be used whenever possible including acute PCI settings and should be implemented in current guidelines for interventional cardiology.

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8-4

Markers of coagulation and early coronary stent thrombosis

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Introduction: Acute stent thrombosis is a rare but deleterious event after percutaneous coronary intervention (PCI). Hemostatic factors such as D-Dimer, fibrinogen, and platelet count have emerged as potential indicators of increased thrombotic risk. However, data regarding the association with early stent thrombosis (ST) is sparse. The aim of this study was to investigate whether markers of coagulation are associated with increased risk of early (< 30 days after PCI) ST.

Methods: Within a prospective single-center registry, we retrospectively analyzed the association between pre-procedural platelet count, plasma levels of fibrinogen and D-Dimer with the occurrence of early ST within 30 days after PCI.

Results: We included 10,714 consecutive patients who underwent percutaneous coronary intervention (PCI) with implantation of drug-eluting stents (DES). Pre-procedural measurements of platelet count, fibrinogen and D-Dimer was available in 6,337, 6,155 and 956 patients, respectively. The number of definite early ST within 30 days was 58 (0.92%). Pre-procedural platelet count ($p < 0.05$) and plasma levels of fibrinogen ($p < 0.05$) were significantly higher in patients with early ST as compared to patients without ST. Whereas D-Dimer was not associated with early ST, patients in the fifth quintile of platelet count had a significant increased risk for early ST (HR 2.43; 95% CI 1.43–4.14; $p = 0.001$) as compared to patients in the lower four quintiles and patients in the fifth quintile of fibrinogen had a significant increased risk for early ST (HR 1.86; 95% CI 1.07–3.26; $p < 0.05$) as compared to patients in the lower four quintiles. These associations were independent of age, gender, glomerular filtration rate (GFR), the presence of acute coronary syndromes and the number of stents.

Conclusion: Pre-procedural platelet count and plasma levels of fibrinogen are associated with the risk of early ST in patients after implantation of DES. Device-level risk factors like stent-type or size and procedure-level risk factors like peri-interventional medication and complications during stent apposition are associated with ST. Platelet count and plasma levels of fibrinogen may be additional patient-level risk factors that have to be taken in account in the development of future personalized strategies to prevent these rare but deleterious events.

8-5

Comparison of rapid test for high-sensitivity troponin I with laboratory high-sensitivity troponin T in patients with acute chest pain – a prospective monocentric study

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Introduction: High-sensitivity troponin (hs-Tn) assays are recommended for routine clinical use for diagnosis of acute coronary syndrome (ACS). However, laboratory hs-TnT can be elevated due to non-cardiac conditions, such as pulmonary embolism, skeletal muscle injury or chronic kidney disease. The aim of our study was to compare the diagnostic accuracy of the bed-side rapid hs-troponin I (hs-TnI) assay with hs-TnT measured by routine laboratory.

Methods: This prospective monocentric study was conducted at a tertiary hospital outpatient cardiac clinic with an emergency clinic for patients with acute symptoms. A total of 129 patients were included between May 2021 and August 2022. Hs-TnI was measured via a bed-side test from whole blood directly in the emergency room, while hs-TnT was measured from plasma through the routine laboratory. Definite ACS was confirmed by coronary angiography. Patients were compared by grouping them into definitive diagnosis of ACS or no ACS. Hs-TnI as well as hs-TnT values were compared for accuracy and predictive values. Routine clinical parameters and comorbidities were documented and compared as well. Agreement between hs-TnI and hs-TnT was assessed by likelihood ratios and Bland Altman plot.

Results: Overall, 129 patients (65.1% male, 61.8 ± 15.6 years) with acute chest pain were analysed. Median hs-TnI was 7.0 ng/L (IQR: 2.7–15.8), while median hs-TnT was 14 ng/L (IQR: 7.0–31.0). Results for TnI were available faster (average: 1:14 h ± 0:54) compared to TnT. Coronary angiography confirmed ACS in 17 patients (13.2%) displaying significant coronary stenoses requiring intervention. The relative risk of ACS patients to have an elevated hs-TnI result was 6.59 compared to that of 2.29 for the hs-TnT test, meaning that a positive hs-TnI test was a better classifier for validated ACS than that of hs-TnT. Hs-TnI exhibited equivalent negative predictive value to hs-TnT (99%) for definite ACS diagnosis, but had comparatively higher positive predictive value (50.0 vs. 25.8%). Bland Altman plot of hs-TnI versus hs-TnT showed an average difference of −4.6 ng/L (95% CI: −12.4 to 3.2) between the tests. In 39 patients with chronic kidney disease (minimum stage 3a CKD) median hs-TnT (27.0 ng/L, IQR: 16.0–55.0) values were higher than hs-TnI (11.2 ng/L, IQR: 7.5–30.7).

Conclusion: Bed-side hs-TnI is comparable to hs-TnT with a high degree of agreement. Measurement of troponin I using the rapid bed-side hs-TnI assay possesses a shorter blood-draw-to-result-time than routine troponin T measurement.

8-6

Impact of Empagliflozin on Cardiac Structure and Function assessed by Echocardiography after Myocardial Infarction: a post-hoc sub-analysis of the EMMY trial

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Introduction: Empagliflozin administered after acute myocardial infarction proofed to improve cardiometabolic parameters and biomarkers, but the impact on cardiac function is still largely unknown. The aim of this post-hoc echocardiographic sub-analysis of the EMMY trial was to provide in-depth echocardiographic analysis on the effects of empagliflozin versus placebo on standard and novel echocardiographic structural and functional parameters after acute myocardial infarction.

Methods: In this post-hoc analysis of the EMMY trial a subset of 313 patients (157 empagliflozin vs. 156 placebo) was enrolled for post-processing analysis of echocardiographic structural and functional parameters. On top of two-dimensional and Doppler parameters, myocardial deformation analyses were performed to assess ventricular and atrial strain values.

Results: Left ventricular volumes showed significant differences in favor of empagliflozin over the course of the trial (change in left ventricular end-diastolic volume median [interquartile range] 8 [−3;19]% versus 13 [0;29]%, p = 0.048; left ventricular end-systolic volume −3 [−15;12]% versus 4 [−12;18]%, p = 0.044). This effect persisted after adjusting for baseline values, age, and sex. Left ventricular systolic and diastolic function overall improved over the course of the trial and parameters for diastolic function showed a distinct trend between groups but did not meet statistical significance in this cohort.

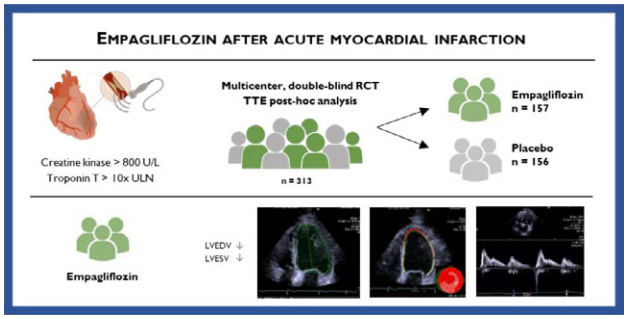

Fig. 1 Graphical Abstract Abbreviations: LVEDV, left ventricular end-diastolic volume; LVESV, left ventricular end-systolic volume; RCT, randomized controlled trial; TTE, transthoracic echocardiography; ULN, upper limit of normal

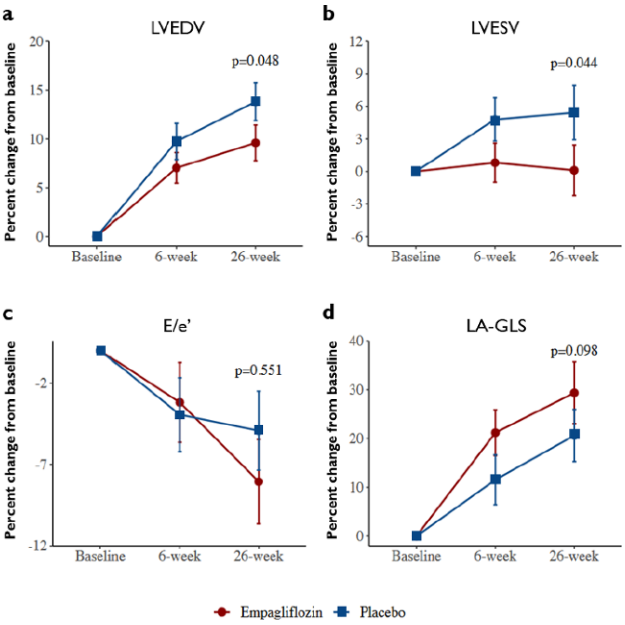

Fig. 2 Changes in echocardiographic parameters by treatment group. (a) LVEDV left-ventricular end-diastolic volume, (b) LVESV left-ventricular end-systolic volume, (c) Ee', and (d) LA-GLS.png: Changes in echocardiographic parameters by treatment group. (a) LVEDV: left-ventricular end-diastolic volume, (b) LVESV: left-ventricular end-systolic volume, (c) E/e', and (d) LA-GLS: left-atrial global longitudinal strain

Conclusion: In this post-hoc analysis among patients with acute myocardial infarction, treatment with empagliflozin resulted in a significant beneficial effect on left ventricular remodeling, as depicted by left ventricular end-diastolic and end-systolic volume, without significantly improving systolic or diastolic function compared to placebo after 26 weeks.

POSTERSITZUNG 9 – BEST CLINICAL CASES 1

9-1

A RARE CASE OF SILENT ATRIA IN 35-YEAR-OLD PATIENT AFTER FEBRILE INFECTION

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Introduction: A 35-old male patient presented to the emergency room (ER), with history of ulcerative colitis and atopic dermatitis, complaining of shortness of breath, abdominal pain, and a distended abdomen, along with leg edema. He reported that these symptoms occurred after a febrile infection (38.5 degree Celsius for 3 days) for the first time. Cardiovascular or respiratory comorbidities were not evident. Following ER admission, he was referred to the cardiology department due to acute right heart failure (HF) (NYHA III) with ascites and bilateral pleural effusions.

Methods: His initial laboratory investigation showed elevated N-terminal pro-B-type natriuretic peptide (NT-proBNP) levels of 369 pg/mL, normal C-reactive protein levels (CRP) of 0.31 mg/dL and normal white blood count of 9.16 G/L. The electrocardiogram (ECG) demonstrated a high junctional escape rhythm at 45 beats per minute (bpm), leading to the initiation of isoproterenol intravenously while additional examinations were conducted. To investigate the cause of right HF, transthoracic echocardiography (TTE) was performed, revealing a high-grade tricuspid insufficiency (TI) (sPAP 58 mmHg), a moderately reduced right ventricular function and moderate mitral regurgitation with normal left ventricular ejection fraction (LVEF). The patient underwent additional tests due to the unclear etiology of the right HF. Further, cardiac magnetic resonance imaging (MRI) was performed, that showed normal LVEF (71.2%) and right ventricular ejection fraction (RVEF) (59.3%), pleural effusions, signs of minimal myocardial edema and late gadolinium enhancement (LGE) in the area of the left atrium which is often indicative of myocardial fibrosis. These findings led to a suspected diagnosis of pure atrial myocarditis. Right heart catheter examination revealed an isolated post-capillary hypertension (mPAP 35 mmHg, mPAWP 28 mmHg, PVR 1.2 WU) and an unusually high v-wave (50 mmHg).

Results: Forced diuresis was initiated which resulted in a weight reduction of 7 kilogram. Despite receiving medication for recompensation of the acute heart failure and the regress in right and left ventricular function, the patient did not present any improvement regarding the low heart rate. The patient continuously showed symptomatic junctional escape beat of around 45 bpm. The indication for a pacemaker implantation was definite in the case of this patient. A biventricular pacemaker (CRT-D) was implanted approximately two weeks after admission, resulting in a NT-proBNP decrease to normal levels (95 pg/mL). After discharge, the patient was readmitted for an elective electrophysiological (EP) study, that showed atrial myopathy with silent atria. An attempt to reposition the atrial probe was not successful as no suitable position was found at the atrial level. Only during EP study atrioventricular block third degree could be detected, which was not evident on ECG. HF therapy and pacemaker implementation significantly improved symptoms. Further, TTE showed a clear improvement in TI. No definite diagnosis of myocarditis could be made, and the etiology of the cardiac arrhythmia remains unknown. Annual CRT-D evaluations are scheduled for further follow-up.

Conclusion: Silent atria, also known as atrial standstill, is a rare condition that is characterized by lack of atrial electrical activity (1). This entity leads to bradycardia (2) and requires cardiac resynchronization therapy. The primary etiology of right HF and cardiac arrhythmia, and thus the patient's final

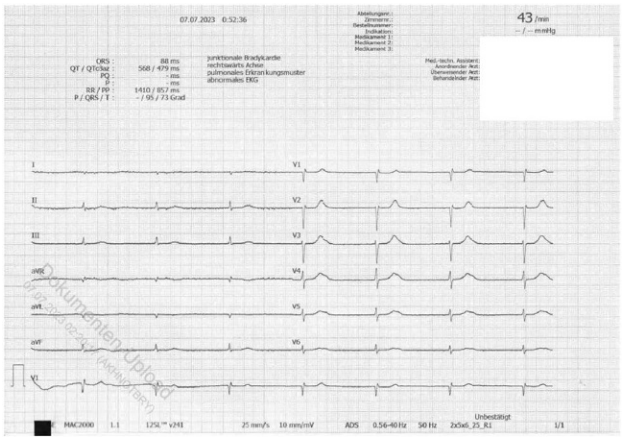

Fig. 1 Electrocardiogram during emergency room admission. Junctional escape rhythm with a frequency of 43 beats per minute

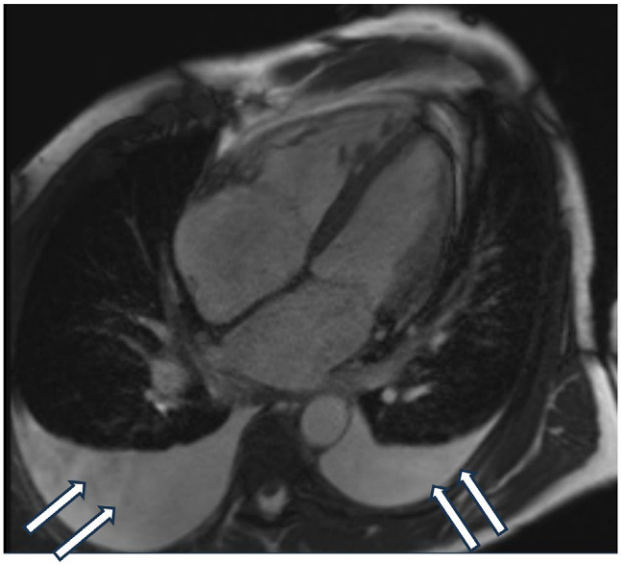

Fig. 2 Cardiac magnetic resonance four chamber view showing bilateral pleural effusion (white arrows) and minimal pericardial effusion

diagnosis, remains unknown. As per the 2023 ESC Guidelines for the management of cardiomyopathies (3), MRI is a recommended diagnostic tool for the detection of myocarditis. In this case, fibrosis of the left atrium in combination with myocardial edema, as revealed by MRI, led to the suspected diagnosis of atrial myocarditis. Finally, CRT-D implementation improved patient's symptoms and quality of life.

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9-2

Case-Report: Transcatheter-edge-to-edge-repair of mitral-regurgitation due to cleft of the anterior-mitral-leaflet

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Introduction: Mitral valve cleft is a rare cause of severe degenerative mitral regurgitation (MR). Due to its congenital nature, most of the affected patients are surgically treated as young adults. For symptomatic patients with MR, whose surgical risk is deemed too high, percutaneous transcatheter-edge-to-edge-repair (TEER) has shown to be a safe treatment alternative, but cleft is considered a very challenging, complex anatomy for this procedure.

Methods: Case-specific data was gathered via the electronic health record of the patient, echo-images were analyzed and exported using Philips® Intellispace Cardiovascular software.

Results: An 84-year-old male patient with exertion dyspnea NYHA III and signs of pulmonary congestion was admitted to our cardiology department for further assessment. Laboratory studies showed a substantially elevated NT-proBNP of 4785 pg/ml (normal range: < 125 pg/ml), a mildly increased hsTroponin-T of 69 ng/l and kidney disease KDOQI 3a with a kreatinin-level of 1,4 mg/dl. Transthoracic echocardiography detected severe MR, in the complementary transesophageal study a cleft of the anterior mitral leaflet and a septum primum defect were documented. Furthermore, angiography showed coronary multi vessel disease (chronical occlusion RCA, 90% stenosis CX, 70% stenosis LAD). With a calculated EuroSCORE II of 11,26% surgical risk was deemed too high and a percutaneous strategy was determined. After successful PCI of the CX and LAD, treatment of the MR with the MitraClip™G4 was planned. In contrast to the proposed "convergent clips strategy" we opted for a single-device approach, positioning a clip from the mildly billowing medial portion of the anterior leaflet to the P2-Segment of the posterior leaflet, resulting in a trace residual MR.

Conclusion: Mitral valve cleft leading to severe MR is a rare form of congenital valvular heart disease; in selected patients with prohibitive surgical risk TEER can be a safe and effective treatment.

9-3

Case-Report: PFO-closure for treating dyspnea in a patient with right-to-left shunt

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Introduction: Right-to-left shunt in absence of elevated pulmonal artery pressure is a rare cause of hypoxemia. Although persisting foramen ovale (PFO) is a fairly common finding (approx. 25–30% of the general population), it is asymptomatic in most cases as the higher left atrial pressure keeps the flap-like defect closed. If the right atrial pressure exceeds the left atrial pressure (e. g. right ventricular infarction, pulmonary embolism, tricuspid regurgitation,..), right-to-left shunt occurs, leading to a reduced lung perfusion and mixture of deoxygenated blood in the left atrium which leads to hypoxemia. In patients with normal intracardiac pressures several hypotheses (e. g. a decrease in right ventricular compliance, flow phenomena occurring with direct flow from the vena cava inferior to the PFO,...) are discussed. Typically, patients present with platypnea and orthodeoxia and do not respond well to additional oxygen therapy. Closing the defect, whether surgically or percutaneous, is the treatment of choice.

Methods: Case-specific data was gathered via the electronic health record. The patient provided a written informed consent.

Results: An 81-year-old male patient with worsening position-dependent dyspnea was admitted to our cardiology department for further evaluation. Blood gas analyses (BGA) showed a substantially lowered oxygen saturation of 88% and a partial pressure of oxygen (PaO2) of 50,9 mmHg (normal range: 83,0–108 mmHg). NT-proBNP was mildly elevated with 340 ng/l (normal range: < 125 pg/ml). Transthoracic echocardiography

showed a preserved left ventricular ejection fraction, coronary angiography only revealed mild sclerosis and in a computed tomography no signs of pulmonary embolism were found. As the patient responded poorly to oxygen supplementation in a hyperoxia-test a shunt was suspected and the final diagnosis of a large PFO was be made by transesophageal echocardiography. During right heart catheterization, a shunt ratio of Qp:Qs of 0,81, expressing right-to-left shunt, was be documented, although pulmonary artery pressures were not elevated (mean pulmonary artery pressure 15 mmHg, pulmonary capillary wedge pressure 5 mmHg). In treating the PFO with a 30 mm GORE™ CARDIOFORM septal occluder the patient experienced immediate relief of his symptoms and PaO2 rose to 73,8 mmHg.

Conclusion: Right-to-left shunt in case of a PFO is a relatively rare cause of dyspnea. Position-dependency of the symptoms and a poor response to oxygen supplementation should raise the suspicion of a shunt in order to offer appropriate diagnostic measures and therapy.

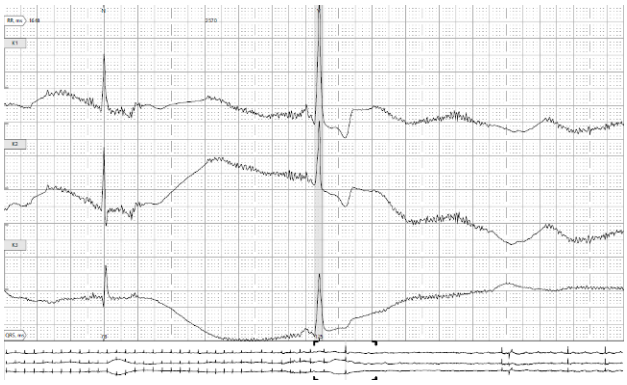

Fig. 1 Movement of the head to the left resuting in intermittent sinusarrest with pauses up to 10 seconds

9-4

Lymph nodal relapse of carcinoma manifesting as carotid sinus syndrome

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Introduction: Pleomorphic adenoma is a very common benign parotic tumour, which rarely progresses into an aggressive malignant carcinoma (carcinoma ex pleomorphic adenoma) with high metastatic potential and low survival. We report one of the first cases of a lymph nodal metastasis from a carcinoma ex pleomorphic adenoma presenting with carotid sinus syndrome (CSS).

Methods: An 83-year-old female was transferred to the emergency department of a peripheral hospital due to a history of progressive dizziness and presyncope for 2 weeks. The clinical examination revealed no suspicious findings. Regarding the past medical history, the patient suffered from a carcinoma ex pleomorphic adenoma one year ago and underwent successful local resection. Troponin T levels were negative and D-Dimer was slightly increased with 1.07 mg/L, however a computed tomography (CT) scan of the thorax showed no pulmonary embolism. The ECG was unremarkable. After excluding relevant organic causes, the patient was discharged with orthostatic dysregulation for further ambulatory exploration. After 1 week, the patient presented at our emergency department due to recurrent syncope with loss of consciousness, amnesia, concurrent dyspnoea and nausea. Clinical examination showed a swelling on the sternocleidomastoid muscle next to the carotidal trigone near the parotid gland was found. For further diagnostic work-up, the patient was transferred to our cardiology telemonitoring ward. Transthoracic echocardiography revealed normal left ventricular ejection fraction and preserved right heart function with normal diameters of all heart chambers and no suspicion for severe valvular dysfunction or pericardial effusion. A cranial CT scan showed no signs of acute intracranial haemorrhage or ischemia.

Results: The patient still suffered from ongoing dizziness and vertigo with recurrent syncope on the ward, especially when moving the head to the left. The telemonitoring showed intermittent sinusarrest with pauses up to 10 seconds when turning the head to the left side (Fig. 1), which rapidly resolved into a normocardic

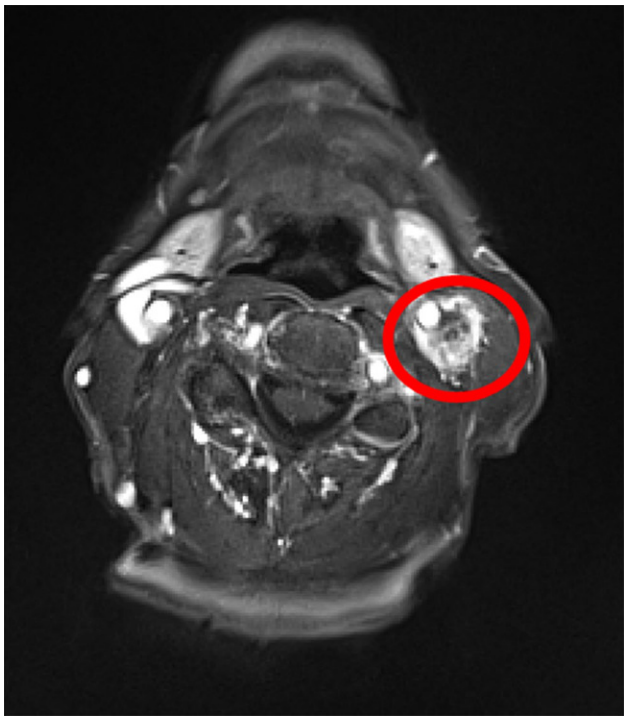

Fig. 2 Lymph nodal relapse of carcinoma ex pleomorphic adenoma with infiltration of the left commune carotidal artery

sinus rhythm when turning the head back. For further exploration, a CT scan was performed showing a sharply bounded soft tissue lesion with circumferential infiltration of the distal commune carotidal artery and dorsal radiation with infiltration of the sternocleidomastoid muscle. An MRI of t he tissue lesion suspected a local recurrent lymph nodal metastasis of the carcinoma ex pleomorphic adenoma (Fig. 2). The PET-Scan revealed no further secondary neoplasia. After consulting the ear, nose, and throat (ENT) specialists, the patient was discussed to be inoperable due to advanced infiltration of the commune carotid artery and a palliative setting was aimed including palliative radiation. After interdisciplinary discussion, the patient received a 2-chamber pacemaker due to irreversible cause of a carotid sinus syndrome. After 14 days at our cardiological ward, the patient was discharged stable without arrhythmias from our department and transferred to a remobilisation centre. The pacemaker showed a normal function one day post-surgery. The patient was included in the mobile palliative team and is currently receiving radiotherapy.

Conclusion: This case emphasises that metastasis from primary tumours may cause acute and severe arrhythmias, both in intra- and extracardiac location, independent of age but with a recent history of malignancy.

9-5

The use of the novel cardiac myosin inhibitor mavacamten in patients declined or ineligible for septal reduction therapy – a case series

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Introduction: So far, the first in class cardiac myosin inhibitor mavacamten has been shown to effectively reduce left ventricular (LV) outflow tract obstruction (LVOTO), improve symptoms and exercise capacity in patients with hypertrophic cardiomyopathy (HCM). HCM is a common cardiomyopathy with a high symptom burden and limited treatment options. The novel concept of myosin inhibition appears to be safe and effective, but virtually no data exists on its efficacy outside the clinical trial population. We herein present six cases of patients who declined, failed or were unsuitable for septal reduction therapy (SRT).

Methods: The case series includes six patients who provided written informed consent to the case report and the treatment. All patients were extensively evaluated including cardiac magnetic resonance imaging (CMR), laboratory testing with genetics, cardiopulmonary exercise tests (CPET) and serial transthoracic echocardiography.

Results: All patients showed clinical and echocardiographic improvement of their obstruction (Table 1) and no adverse events were observed. All patients remained alive and under treatment.

Conclusion: The present case series highlights the potential of cardiac myosin inhibitor mavacamten and raises questions about patient selection in future clinical trials. Future studies and long-term follow-up should systematically evaluate safety, effectiveness, and eligibility to cardiac myosin inhibitor treatment.

9-6

Third-degree atrioventricular block in middle cerebral artery (MCA) ischemic stroke

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Introduction: Bradycardic arrhythmias during the acute phase of stroke may lead to hemodynamic instability and disguise neurological symptoms. We report a case of third-degree atrioventricular (AV) block in middle cerebral artery (MCA) ischemic stroke, delaying diagnosis and therapy of cerebral ischemia.

Methods: A 70-year-old woman initially presented to another hospital with third-degree atrioventricular (AV) block and dizziness following syncope. Comorbidities included arterial hypertension and myasthenia gravis. The patient had undergone thymectomy due to thymoma 6 years before. Two years prior to the event, aortic arch replacement had been performed because of type A aortic dissection. Long-term medication was aspirin, amlodipine, rilmenidine, sertraline, azathioprine and pyridostigmine. After referral to our hospital, the patient presented hemodynamically instable, and transvenous cardiac pacing was implemented. AV block subsequently resolved after 6 hours, followed by normofrequent sinus rhythm. Upon further clinical evaluation after achieving hemodynamic stability, expressive aphasia was detected. CT scan of the cerebrum showed a recent, but demarcated temporoparietal lesion (11 × 3 cm) in the middle cerebral artery (MCA) territory with the pattern of an embolic stroke. A conservative treatment strategy was adopted. Transoesophageal echocardiography (TEE) excluded a thrombus in the left atrial appendix. CT scan of the aorta showed no significant changes in the area of the aortic arch replacement compared to previous images. Before transferral to the neurology department, the patient received an implantable loop recorder (ILR). Three months later, the patient had recovered well following neurological rehabilitation. Device recordings showed no relevant arrhythmias.

Results: Data show an incidence of bradycardic arrhythmias during acute stroke events of up to 8.4%. In 57% of these cases atrial fibrillation with bradycardia was observed, in 24% high grade AV block and in 19% asystole/sinus arrest. In most of the patients, the implantation of a cardiac pacemaker was not necessary. [1] However, developing high grade AV block in acute stroke is correlated to a significantly higher 1-year mortality. [2] In our patient, long-term medication for myasthenia gravis might have favored the occurrence of bradycardia. Cholinesterase inhibitors such as pyridostigmine have been reported to be associated to high grade AV block, in some cases leading to pacemaker implantation. [3] In the setting of an embolic stroke of undetermined source (ESUS) in a patient with pyridostig-

Tab. 1 Baseline characteristics and treatment effects

Patient	Age	Gender	Peak gradient under standard treatment) mmHg	Mavacamten dose	Peak Gradient with Mavacamten (mmHg)	SRT ineligibility
Patient 1 SA	56	Male	168	5	31	Patient declined surgery
Patient 2 WD	37	Male	64	10	23	Patient declined SRT stopped Betablockers
Patient 3 KJ	57	Male	68	5	26	Aortic valve replacement
Patient 4 JP	47	Female	172	10	78	LVOT- and mid-ventricular obstruction
Patient 5 PI	62	Female	169	5	58	Patient declined surgery
Patient 6 KC	54	Male	88	2.5	32	Myectomy 2019

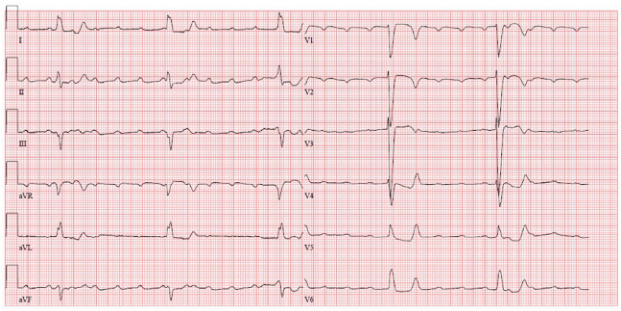

Fig. 1 ECG upon admission: Third-degree AV block

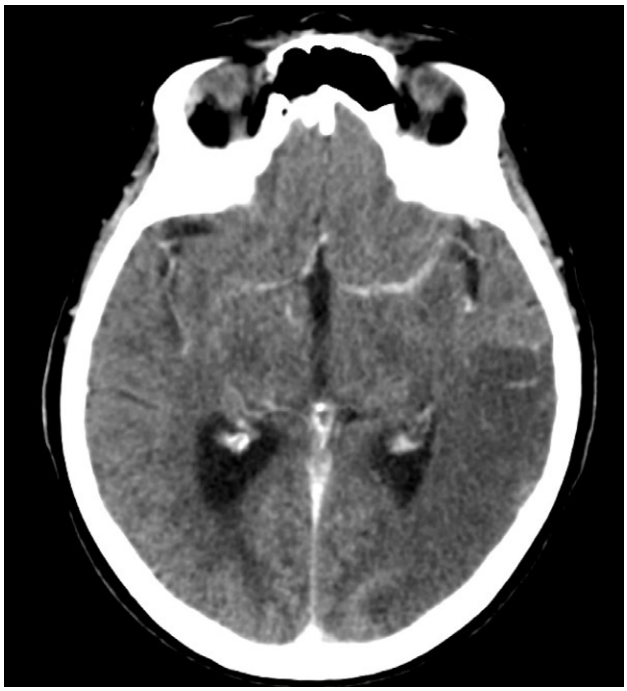

Fig. 2 CT scan image: Temporo-parietal lesion

mine medication, we decided to implant a loop recorder in order to scan for atrial fibrillation as well as to detect further episodes of bradycardia, potentially requiring permanent pacemaker implantation.

Conclusion: Bradycardia can be a symptom of cerebral infarction, in particular during the acute phase of stroke. Early neurological assessment after hemodynamic stabilization is therefore essential for timely diagnosis and therapy. While most bradycardic arrythmias associated with acute stroke are transient, it may be beneficial to continue monitoring patients with predisposing factors (e. g. medication) closely.

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9-7

Schwerwiegender Verlauf einer Staphylococcus Aureus Infektion

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Einleitung: Ein 78-jähriger männlicher Patient wurde aufgrund Schmerzen im Bereich der Brust- und Lendenwirbelsäule an neurologische Abteilung unseres Krankenhauses aufgenommen. Der Patient war kardiorespiratorisch stabil, afebril und grob neurologisch unauffällig. Das Röntgen der Wirbelsäule zeigte keine relevante Pathologie. Im Verlauf entwickelt der Patient zunehmende Dyspnoe und Fieber. Es wurde ein Thorax-Röntgen durchgeführt. In diesem zeigte sich die Pneumonie in den basalen Lungenabschnitten bds. Diesbzgl. erfolgte die Übernahme an unsere medizinische Station. Bei der Übernahme präsentierte sich der Patient im reduzierten Allgemeinzustand, wach, orientiert, adipös. RR von 120/80 mmHg, HF 110/min. Von Vorerkrankungen sind chronische Niereninsuffizienz CKD IV, Diabetes mellitus Typ 2, Hyperurikämie, Adipositas sowie Gastroösophagealer Reflux bekannt. Aufgrund von Fieber, steigender Entzündungswerte sowie Nachweis einer Pneumonie im Thorax-Röntgen wurden die Blutkulturen abgenommen und eine ATB Therapie mit Cefazolin eingeleitet. Trotz Antibiotika-Therapie war der Patient in weiterer Folge zunehmend hämodynamisch instabil. Mit dem Bild eines septischen Schocks wurde der Patient schließlich an unsere Intensivstation verlegt. Bei hämodynamisch relevanter Hypotonie und Tachykardie trotz forcierter intravenöser Volumengabe mussten wir eine Katecholamin-Therapie starten. Die Blutkulturen zeigten einen Nachweis eines Staphylococcus aureus.

Methoden: Als Fokus der Bakteriämie konnte ein Ulcus incarnatus der rechten Großzehe festgestellt werden. Dieser wurde chirurgisch saniert. Die antibiotische Therapie wurde auf Flucloxacillin in nierenadaptierter Dosis umgestellt. Bei steigenden Entzündungswerten und weiterhin bestehenden Schmerzen im LWS und BWS Bereich wurde ein MRT der Wirbelsäule durchgeführt. Eine Spondylodiszitis LWK 3–4 wurde dokumentiert. Aus orthopädischer Sicht bestand keine Indikation für eine operative Sanierung. Die Antibiotika-Therapie mit Flucloxacillin wurde um Daptomycin erweitert. Bei Staph. aureus Sepsis und Verdacht auf Vegetation auf dem posterioren Mitralklappensegel in der transthorakalen Echokardiographie wurde eine TEE Untersuchung durchgeführt. Diese konnte die Endokarditis des posterioren Segels mit einer Vegetation und einer leichtgradigen Mitralklappeninsuffizienz bestätigen. In der transthorakalen Echokardiographie zeigte sich eine deutliche Zunahme der Mitralklappeninsuffizienz von leicht-auf hochgradig. Zusätzlich zeigte sich ein neuaufgetretener minimaler, hämodynamisch nicht wirksamer Perikarderguss. Kein Hinweis für Abszess oder Fistel-Bildung. Es erfolgte erneut eine TEE Untersuchung mit der Progression der Vegetation auf dem posterioren Mitralklappensegel und einer Mitralklappeninsuffizienz mit exzentrischem Jet sowie ein konzentrischer Perikarderguss ohne hämodynamischer Relevanz. Zusätzlich konnte

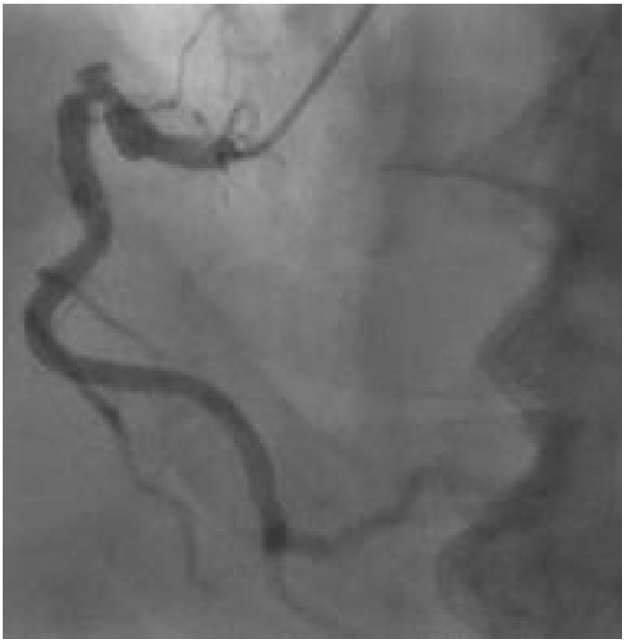

Abb. 1

ein 2 cm großer Thrombus im li. Vorhofsohr dokumentiert werden.

Resultate: Es erfolgte erneute Vorstellung des Patienten der Herzthoraxchirurgie und die Entscheidung für die operative Sanierung wurde getroffen. Vor der Verlegung des Patienten in die Herzthoraxchirurgie des Zentrums erfolgte eine Coronarangiographie durchgeführt, In dieser konnte eine aneurysmatische Ausweitung der proxymalen RCA mit hochgradigem V. a. mykotisches (infektiöses) Aneurysma im Rahmen der Endokarditis dokumentiert werden. Am Folgetag sollte der Patient an die Herzthoraxchirurgie verlegt werden, ist jedoch zunehmend hämodynamisch instabil. Sonographisch zeigt sich zunehmender Perikarderguss sowie ein akutes Nierenversagen mit Hyperkaliämie. Aufgrund des kritischen Zustands mit den Zeichen einer Tamponade erfolgte, vor der Verlegung, eine Perikardpunktion von 750 ml hämorrhagischen Erguss. Als Ultima Ratio wurde der Patient akut zur operativen Sanierung verlegt. Es wurde ein Bypass der aneurysmatisch veränderten RCA sowie einen Mitralklappen-Ersatz mit einer biologischen Prothese durchgeführt. Während der Operation konnte ein endokarditischer Abszess im P1/2 Segment dokumentiert werden. Nach der Beendigung der extrakorporralen Zirkulation war der Patient weiterhin hoch Ketecholamin-pflichtig. Aufgrund der infausten Prognose bei Multiorganversagen und biventrikulären Pumpversagen trotz Höchstdosis der Katecholaminen wurde ein Therapie-Rückzug beschlossen. In weiterer Folge verstirbt der Patient an Multiorganversagen.

Schlussfolgerungen: Dieser Fall zeigt wie schwerwiegend der Verlauf und die Folgen einer Infektion durch Staphylococcus aureus sein kann. Eine rasche Diagnose, Fokussuche und Sanierung sind extrem wichtig, um die Komplikationen zu verhindern. Eine Staphylococcus aureus Endokarditis präsentiert sich meistens als eine akute und destruktive infektiöse Endokarditis. Nach historischer Arbeit von Osler aus dem Jahre 1885 ist der Begriff des mykotischen Aneurysmas für alle Aneurysmen, die als Folge einer bakteriellen Entzündung (außer Spirocheta pallida) entstanden sind, beibehalten worden. Man unterscheidet die mykotischen Aneurysmen von embolischem Typ und solche, die aufgrund einer lokalen bakteriellen Entzündung entstanden sind. Wenngleich mykotische Aneurysmen nicht so selten sind, ist die Zahl der erfolgreich operierten Patienten begrenzt. Die häufigste Lokalisation ist intrakranial mit ca. 2–4 % aller Endokarditiden. Die mykotische (infektiöse) Aneurysmen sind typischerweise fragil mit dünner Wand und hoher Tendenz zur Ruptur und Hämorrhagie. Frühzeitige Detektion und Therapie ist essentiell um die Morbidität und Mortalität zu reduzieren. Rupturierte intrazerebrale Aneurysmen müssen sofort operiert oder interventionell behandelt werden. Unrupturierte Aneurysmen sollten engmaschig mittels Bildgebung überwacht werden. Eine Restitution unter antibiotischer Therapie ist möglich.

POSTERSITZUNG 10 – CHIRURGIE 3

10-1

Blood flow analysis with computational fluid dynamics of a segmentated CT compared with 4D-flow MRI: Evaluation with a 3D print model of a type B dissection

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Introduction: TEVAR intervention is the recommended therapy to treat pathologies of the descending aorta. A remaining challenge is the progression of the aortic disease post-TEVAR due to endoleaks, mainly influenced by the degree of oversizing and the landing zones. While the prediction of the aortic geometry by the surgeon is based on conventional CT-scan, an additional imaging of the intraluminal flows based on these data might be helpful. The aim of the study is to prove, if computational 3D fluid dynamics (CFD) based on a segmentated CT can be compared with the imaging known from 4D MRI flow.

Methods: The geometry of an aorta with type B dissection has been remodeled based on the CT-scan of a patient. The generated 3D-model has been used to study the flow using open source CFD-software (OpenFOAM) and the 3D-print of this model has been perfused inside the MRI of the TU Graz with an ECMO device to receive experimental flow data for comparison. The ECMO-tubes have been 8 m long, as the ECMO-device itself had to stay in the control room of the MRI. To validate the boundary conditions independently of the tube resistance, pressure measuring points at the aortic inlet and outlet have been established.

Results: The results of both imaging procedure match qualitatively and quantitatively. Significant differences can be explained by constraints of the experiment (turbulence due to steps, model deviations, tube resistance, ...). By comparing the results from CFD and 4D-Flow MRI in a 3D-printed flow phantom, we conclude, that an accurate aortic flow based on a con-

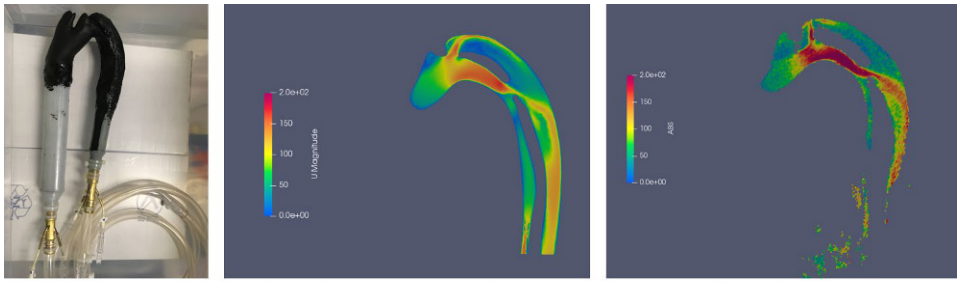

Fig. 1 3D-print, CFD-Result, MRI-Result

ventional CT can be simulated with a free software and is "comparable" to standard 3D-flow MRI imaging.

Conclusion: Hemodynamics in vascular disease is important in pathological conditions, especially in aortic diseases. The numeric analysis of blood flow has gained attention from technicians to physicians. The clinical application of CFD-imaging of CTs to evaluate diagnosis and therapeutic options especially in the acute setting of aortic diseases might be a great step toward risk reduction in interventional options. The next step is to evaluate the maximum wall shear stress to select the optimal stent simulating the interaction of flow and structure.

10-2

Analysis of life quality parameters and circulating biomarkers in a prospective surgical aortic valve replacement study

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Introduction: Surgical aortic valve replacement (SAVR) is followed by reverse remodeling of the myocardium and comprises complex physiological and structural adaptation of the heart after cessation of pressure overload. Before operation patients often experience symptoms such as reduced activity, dyspnea, angina, and dizziness. We aimed to reveal the impact of SAVR on life quality and circulating biomarkers reflecting cardiac damage, myocardial stretch, inflammatory status, kidney, and liver function up to one year after SAVR.

Methods: This prospective single center study was performed on patients older than 18 years of both sexes undergoing elective SAVR with either bioprosthetic or mechanical aortic valves alone or in combination with Bentall-de Bono procedure. Inclusion was based on standard criteria of aortic stenosis. Patients with documented prior myocardial infarction, endocarditis, states necessitating cardiac bypass surgery, electrophysiological device implantation or resuscitation, glomerular filtration rate (GFR) below 60 mL/min/1.73 m2, or evidenced oncologic malignancies were excluded. Heart failure functional scoring was performed according to the recommendations of the New York Heart Association (NYHA) and angina according to the Canadian Cardiovascular Society (CCS) scoring. Kansas City (KCCF) and SF-12 life quality questionnaires were collected. Apart of relevant echocardiographic data, we conducted extensive blood sampling with differential cell count and evaluated the biomarkers reflecting the cardiomyocyte damage (high sensitivity troponin T, HsTnT), general muscular damage (creatine kinase, CK) myocardial stretch (N-terminal B-type natriuretic peptide, NT-proBNP), systemic inflammation (C-reactive protein, CRP), kidney function (creatinine; BUN; GFR) and liver metabolism (alanine aminotransferase – AST; aspartate aminotransferase – ALT, gamma-glutamyl transferase GGT) prior to surgery, 4–6 days, 6 month and 1 year after the SAVR.

Results: We included 95 patients, 15 were lost to the follow up and the observed cohort of 80 comprised 14 females and 66 males (mean age: 69 ± 6 and 63 ± 8 years). We evaluated 71 patients at 6 months and 37 after 1 year. SAVR significantly reduced the maximal ascending aortic flow both in male and female patients (from 4.3 ± 0.9 to 2.3 ± 0.4 m/s and from 4.6 ± 1.2 to 2.3 ± 0.2 m/s, respectively). After SAVR, NYHA and CCS scores decreased significantly. In the NYHA-I their ratio increased from 28% prior SAVR to 86% and to 91% after 6 months and 1 year, respectively. At 1 year neither of the patients belonged to the most severe NYHA-III or IV classes (Fig1). The CCS classification developed analogically. KCCF revealed time-dependent increase of life quality 1 year after SAVR. Concomitantly, the SF-12 questionnaire reported an improvement of mental and physical health in all patients compared to the 6 months. Serum NT-proBNP levels were initially higher and elevated to the greater extent in females early after operation with return to the baseline in both sexes after 1 year (Fig 2). HsTnT and CK were elevated only during the early post-operative phase. AST, ALT, and GGT were higher in men at all timepoints and normalized during the follow up. GFR was higher in men and in some women reached the critically low level at 6 months. Creatinine and BUN were increasing gradually in time-dependently. While leucocytes were higher in men at all timepoints, CRP increased more in women early after SAVR.

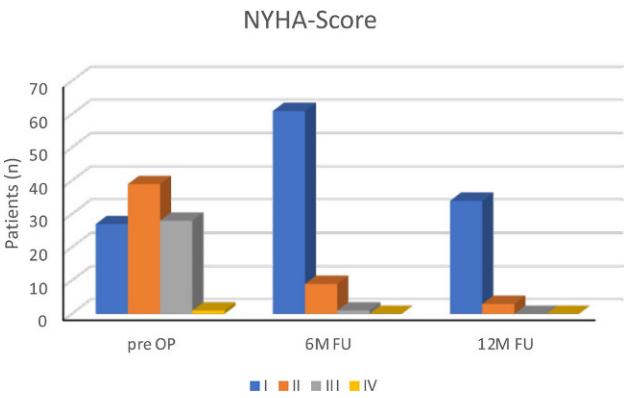

Fig. 1 Results of the New York Heart Association functional classification prior and after surgical aortic valve replacement with one year follow up at University Clinic of St. Pölten

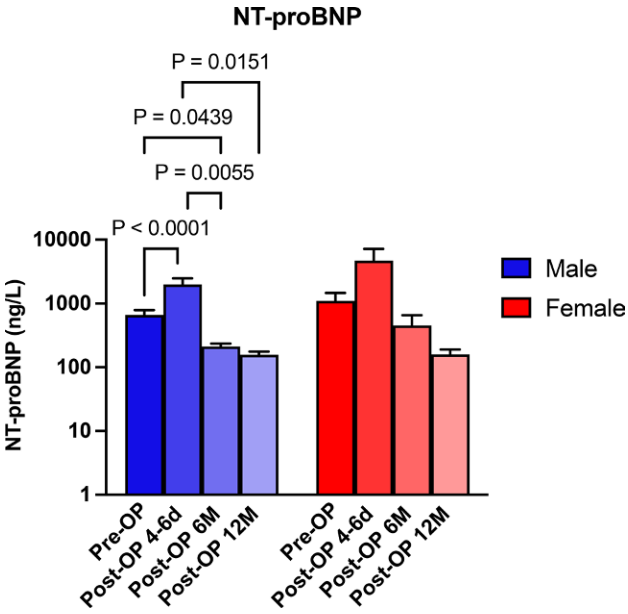

Fig. 2 Time- and sex-dependent change of N-terminal fragment of the pro-B-type natriuretic peptide

Conclusion: Our findings demonstrate that SAVR induces restoration of flow pattern from the left ventricle to the aorta, improves NYHA heart failure and CCS angina classification in patients of both sexes. The life quality questionaries highlighted postoperative increase of physical activities associated with necessary weight loss and improvement of mental health for the whole population. However, our study highlights substantial sex differences in adaptation to the restoration of valve function upon surgical intervention. Women are subjected to SAVR at more advanced age, generally they are more prone to kidney failure and exposed to pressure overload longer, which is also reflected by the GFR and stretch-related NT-proBNP response, respectively. Current data warrant detailed analysis of molecular pattern in fluid biopsies including unbiased, high throughput OMICs techniques followed by detailed bioinformatical evaluation and their correlation to the physiologic measurements, clinical outcomes as well as cardiac biomarkers.

10-3

Portable Digital Drainage reduces Postoperative Atrial Fibrillation, Retained Blood and associated Complications after Surgical Revascularization

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Introduction: Retained blood syndrome (RBS) is potentially dangerous consequence of ineffective drainage after heart surgery. Active chest tube clearance decreased RBS and postoperative atrial fibrillation [1]. The present study assessed if a portable digital drainage confers similar effects on the postoperative outcomes.

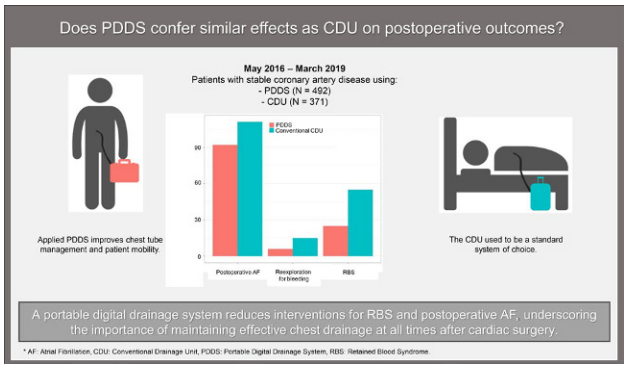

Fig. 1 Graphical Abstract: portable digital versus conventional drainage application in cardiac surgery

Methods: Prospectively collected data from 1042 consecutive patients with sinus rhythm undergoing first-time surgical revascularization using cardiopulmonary bypass were considered and 863 analyzed retrospectively. Patients with conventional drainage were compared to patients with portable digital drainage system. Propensity adjustment including comorbidities, anti-aggregating and preoperative medication, hematocrit, perisurgical parameters including chest tube placement, was applied for outcome assessment.

Results: In propensity-adjusted patients, 14.8% of conventionally drained patients had interventions for RBS, with 4% early reexploration for bleeding. Portable digital drainage patients had RBS in 5.1% with 1.2% of reexploration for bleeding (both $p < 0.001$). Propensity-adjusted patients had 37% reduced incidence of postoperative atrial fibrillation from 29.9% (111 out of 371) in conventional to 18.7% (92 out of 492) in portable digital drainage cohort ($p < 0.001$). Propensity-adjusted in-hospital mortality was 1.6% (6 out of 371) in conventional vs. 0.8% (4 out of 492) in portable digital drainage cohort ($p = 0.221$).

Conclusion: Portable digital drainage system was associated with reduced postoperative atrial fibrillation and RBS interventions. Effective chest drainage immediately at termination of surgery is crucial to minimize intrathoracic RBS associated complications.

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10-4

Transcatheter Tricuspid Valve Replacement using the Vdyne System – the first two successful cases in Austria

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Introduction: Severe tricuspid regurgitation (TR) has been associated with poor long-term outcomes including right heart failure, end-organ damage (mainly renal and liver failure) and mortality[1]. Functional TR due to annular dilatation and leaflet tethering is the most common etiology. The management of functional TR includes surgical and interventional treatment options. However, surgical repair or replacement is associated with a high periprocedural mortality reflecting the baseline high-risk patient profile. Therefore, there is a demand for minimally invasive, off-pump techniques to treat significant TR. Anatomical challenges for transcatheter techniques range from a variable number of leaflets, a variable annulus size, a valvular asymmetry to the potential interaction with the chordal apparatus and the right ventricular septum[2]. These challenges limit the utilization of currently available devices such as TEER repair systems[3]. The transcatheter tricuspid valve replacement (TTVR) system Vdyne (Vdyne Valve, VDyne) is a novel bioprosthesis that intends to preserve the asymmetric shape of the tricuspid annulus. It is a self-expanding, double frame, nitinol prosthesis which contains a 30 mm porcine trileaflet valve that is delivered via a 28-french guiding catheter. The outer frame is designed to fit a tricuspid annulus with a perimeter of up to 180 mm and features unique securement mechanisms for valve stabilization. In addition, a paravalvular pop-off apertur

Methods: We herein describe the first two successful cases of VDyne implantations in Austria.

Results: Two patients (male 76-years, female 78-years) with torrential functional TR due to annular dilatation in the setting of atrial fibrillation were admitted to the Kepler University Hospital. Both patients showed clinical signs of acute right heart decompensation and were in functional class NYHA III. Transesophageal echo cardiography (TOE) after recompensation with furosemide revealed a torrential TR with a central gap > 12 mm, hence, both patients were not eligible for tricuspid TEER. Full-cycle computed-tomography (CT) was used for annular measurements and 3D printing of a right heart model. Both patients showed a favorable anatomy for the TTVR system VDyne. In February 2024 the VDyne prosthesis was implanted via a transfemoral access in both patients. Each step of the procedural valve deployment and annular engagement was confirmed via TOE. TR was reduced from grade 5 (torrential) to grade 0 (none) in both patients. There was no paravalvular leakage. The female patient developed complete heart block (AV block 3rd degree) intraprocedurally with the need of a permanent pacemaker.

Conclusion: The VDyne TTVR system is a novel effective option to treat significant TR.

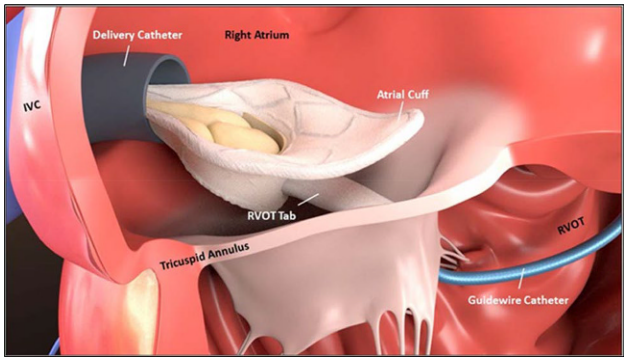

Fig. 1 The VDyne bioprosthesis is delivered via a 28 fr guiding catheter. An Amplatzer Super Stiff guidewire is positioned in the pulmonary artery and the VDyne device is advanced until the RVOT tab and the anterior atrial cuff are engaged at the site of the anterior tricuspid annulus

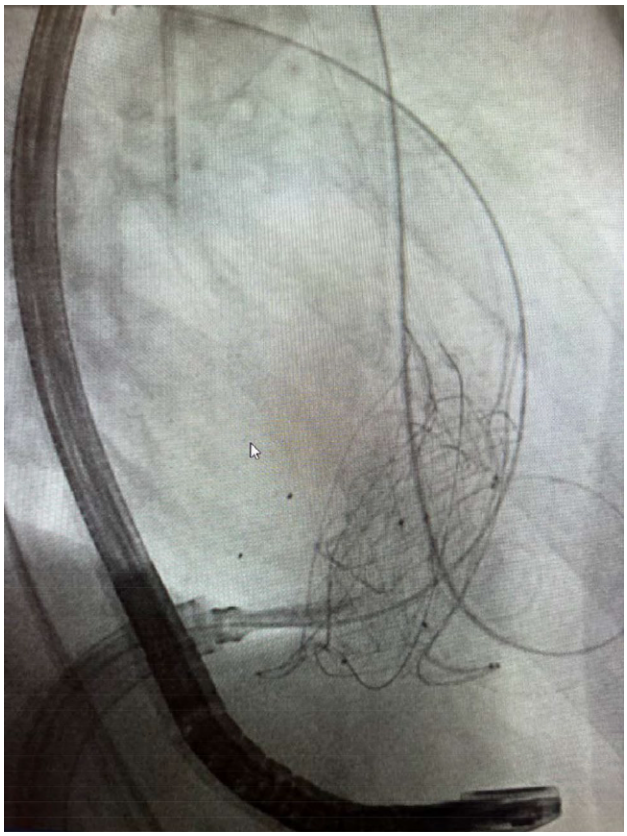

Fig. 1 Fluoroscopic of the implanted VDyne bioprosthesis

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10-5

Biaxial stretch tests to measure stiffening of the ex vivo perfused human thoracic aortas: aortic arch TEVAR intervention versus Dacron prosthesis

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Introduction: The effects of TEVAR on the biomechanical properties of descending aortic tissue have recently been published. The effects of conventional aortic arch surgery with Dacron prosthesis compared to aortic arch TEVARs, both demanding procedures, have not been adequately studied. The aim of the study was to perform biaxial stress tests of the ascending and descending aortic tissue to evaluate wall shear stress and possible reduced distensibility of the remaining aortic tissue.

Methods: After MOCK perfusions of eleven non-diseased human aortas (4 female, 7 male, mean age 67.7 ± 13.5 years) with interventions in the aortic arch (Dacron vs TEVAR), the ascending and descending tissue (n = 40) was dissected into small samples for mechanical testing. A stretch-driven protocol was used with a step an increment of 0.05 stretch to rupture. For every stretch, different stretch ratios in both longitudinal and circumferential directions were conducted to measure the Cauchy stresses.

Results: Fig. 1 illustrates an example of the equibiaxial Cauchy stress-strain responses for non-stented (NS) and stented (ST) samples. Blue illustrates the circumferential response and red illustrates the longitudinal response. Biaxial stress tests can thus be used to make statements about aortic distensibility. In this graph, samples were taken from the descending aorta at two neighboring locations, one with a stent imprint and the other without. It can be seen that in stented sample there is stiffening in both circumferential and longitudinal direction compared to non-stented one.

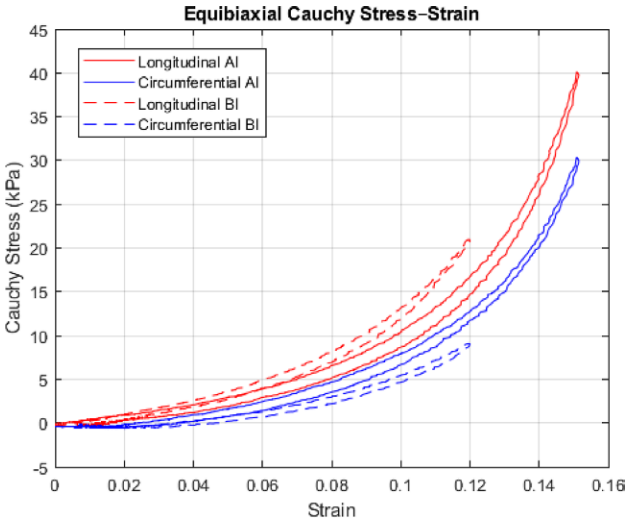

Fig. 1 Equibiaxial Cauchy stress-strain responses for non-stented (NS) and stented (ST) samples

Conclusion: For the first time, dynamic perfusion of explanted human thoracic aortas undergoing in vitro aortic arch Dacron replacement versus TEVAR intervention demonstrated local stiffening of the remaining aortic tissue. Comparisons between human tissues could provide new insights into the interaction between the endograft and Dacron tissue in the ascending and descending aortic wall.

10-6

Der Nutzen von präoperativer Physiotherapie in der elektiven Herzchirurgie in Bezug auf die Intensivstationsaufenthaltsdauer

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Einleitung: Die postoperative Nachbetreuung auf Intensivstationen ist nach elektiven Herzoperationen vielfach notwendig. Der prolongierte Aufenthalt auf einer Intensivstation ist mit einer Vielzahl von negativen funktionellen Outcomes assoziiert. Physiotherapie ist eine kostengünstige und effektive Behandlungsform zur Verbesserung physischer Funktionsfähigkeit nach Operationen. Ziel dieser Arbeit war es, zu evaluieren, ob mithilfe präoperativer Physiotherapie die Intensivstationsaufenthaltsdauer gesenkt werden kann und welche Interventionen hierfür zur Anwendung kommen.

Methoden: Es wurde eine systemtische Literaturrecherche in den Datenbanken PubMed/MEDLINE und ScienceDirect durchgeführt. Die Studienqualität wurde anhand der Bewertungsskala der Physiotherapy Evidence Database (PEDro) beurteilt.

Resultate: Fünf randomisierte Kontrollstudien erfüllten die Einschlusskriterien. Die Studienqualität war moderat (PEDro Scores 5–7/10). In allen Studien wurde eine Reduktion der Aufenthaltsdauer auf Intensivstationen nach präoperativer Physiotherapie (mean 23 h) im Vergleich zur Kontrollgruppe (mean 25 h) beobachtet. Die Ergebnisse waren dabei jedoch nur in einer Publikation statistisch signifikant. Die inkludierten Studien zeigten eine große Heterogenität in Bezug auf ihre Stichprobengröße und Methodik mit sehr breiter Streuung der Ergebnisse. Die physiotherapeutischen Maßnahmen umfassten Ausdauer- und Krafttraining, inspiratorisches Atemmuskeltraining, Edukation sowie Heimübungsprogramme.

Schlussfolgerungen: Präoperative physiotherapeutische Maßnahmen können die Intensivstationsaufenthaltsdauer nach elektiven herzchirurgischen Eingriffen möglicherweise reduzieren. Es benötigt aktuell jedoch weitere methodisch robuste Studien mit ausreichender Probandenzahlen, damit eine valide Aussage über die Effektivität präoperativer Physiotherapie getroffen werden kann.

10-7

Interatrial block is associated with new-onset atrial fibrillation after cardiac surgery

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Introduction: Atrial fibrillation is the most common complication after heart surgery potentially leading to chronic atrial fibrillation, heart failure, stroke, and mortality. The aim of this study was to explore how atrial conduction abnormalities collectively named as interatrial block affect the occurrence of postoperative atrial fibrillation.

Methods: Perioperative 12-channel ECGs of 2374 patients in sinus rhythm, scheduled for myocardial revascularization, aortic, mitral, tricuspid valve surgery or a combination of these procedures were considered and 1350 analysed. Clinical and electrographic parameters in patients with vs. without atrial fibrillation were performed, significant variables were fed into univariate and multivariate logistic regression. Significance level was set at $p < 0.05$.

Results: Perioperative 12-channel ECGs of 2374 patients in sinus rhythm, scheduled for myocardial revascularization, aortic, mitral, tricuspid valve surgery or a combination of these procedures were considered and 1350 analysed. Clinical and electrographic parameters in patients with vs. without atrial fibrillation were performed, significant variables were fed into univariate and multivariate logistic regression. Significance level was set at $p < 0.05$.

Conclusion: Interatrial block and especially typical advanced interatrial block were significantly associated with higher incidence of postoperative atrial fibrillation. ECG-based prediction can further enhance risk stratification of postoperative atrial fibrillation after heart surgery.

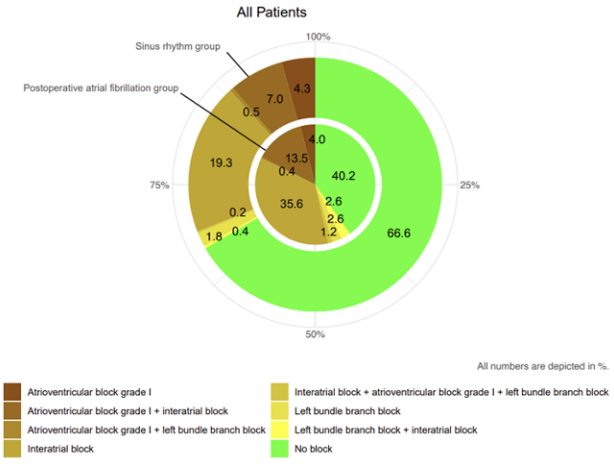

Fig. 1 Interatrial Block and other Rhythm Disturbances in patients with sinus rhythm vs atrial fibrillation after cardiac surgery

10-8

Method for measuring the hemodynamic profile after ex vivo-perfused human thoracic aortas: aortic arch TEVAR intervention versus Dacron prosthesis

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Introduction: The effects of surgical (Dacron prosthesis) or interventional (TEVAR) treatment of the aortic arch on the biomechanical properties of the remaining ascending and descending aortic tissue are not adequately evaluated. The aim of this study was to calculate the hemodynamic profile to assess the outcome of both types of aortic arch treatments in terms of the distensibilty of the remaining aortic tissue.

Methods: During MOCK perfusions of eleven non-diseased human aortas (4 female, 7 male, mean age 67.7 ± 13.5 years) with interventions in the aortic arch (Dacron vs TEVAR) pressure sensors and a video extensometer were used to record pressure values and outer diameters of the inlet and outlet of the aorta, and to measure the circumferential stretch. To show the change in distensibility during the cardiac cycle, the pressure curve and diameter time lines were matched. From these datasets, we calculated pressure-diameter loops for each cardiac cycle at a specific point in the aorta. These loops demonstrate the mechanical behavior of the aortic tissue at corresponding pressures during the cardiac cycle. We calculated loops before and after the intervention.

Results: The figures show an example of how the pressure and circumferential diameter recording for the ascending and descending locations can be evaluated during the MOCK perfusions. The hysteresis loops provide an insight into the viscoelastic and elastic behavior when comparing the diastolic and systolic outer diameters. Therefore, such hemodynamic measurements during MOCK-perfused human aortas can be used to make statements about distensibility and draw conclusion about the possible mismatch between Windkessel effects in Dacron replacement and TEVAR intervention.

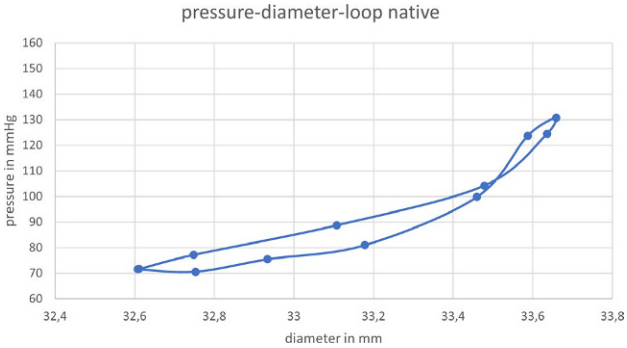

Fig. 1 pressure-diameter-loop native

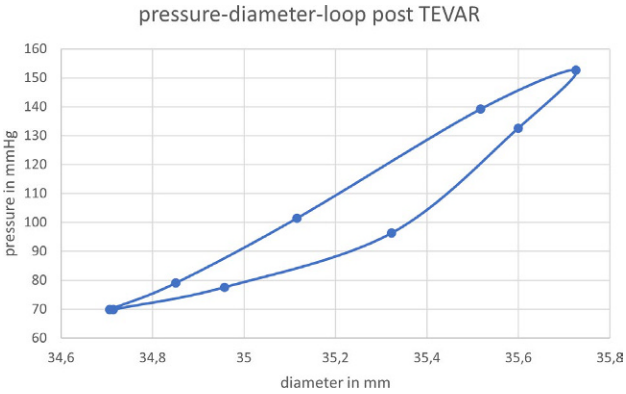

Fig. 2 pressure-diameter-loop post TEVAR

Conclusion: For the first time, elastomechanical data of the ascending and descending remaining aortic tissue can be measured in vitro by dynamic perfusion of explanted human thoracic aortas undergoing Dacron replacement of the aortic arch compared to the TEVAR intervention. These comparisons could provide new insights into the interaction between the endograft and the Dacron tissue in relation to the ascending and descending aortic wall.

POSTERSITZUNG 11 – CHIRURGIE 4

11-1

PET armierter pulmonaler Autograft – 8 Jahre Follow-up

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Einleitung: Die Ross-Operation, vor allem wenn sie als freier Wurzelersatz durchgeführt wird, zeigt bei jugendlichen und erwachsenen Patienten eine Tendenz zur Dilatation. Die Dilatation des pulmonalen Autografts tritt vor allem in der zweiten Dekade nach Operation auf. Um diesem Problem entgegen zu wirken bzw. zuvorzukommen wird von einigen Autoren empfohlen den Autograft mit einer Polyethylenterephtalat (PET) Prothese zu umhüllen. Ziel dieser Studie ist es, zu zeigen, dass diese Methode sicher und gut durchführbar ist, sowie gute kurz- und mittelfristige Resultate zeigt.

Methoden: Von Jänner 2015 bis Oktober 2023 erhielten an unserem Zentrum 81 Patienten (23.5 % weiblich, 25.9 % pädiatrisch) eine Ross-Operation mit PET Verstärkung des pulmonalen Autografts. Das Patientenalter lag zwischen 9.3 und 58.9 Jahren mit einem Median von 27.8 [15.8; 44.4]. Das Einnähen des Autografts in die PET Prothese erfolgt unmittelbar nach Exzision desselben und noch vor der Klemmung der Aorta. Die Prothese wird an die Größe des Autografts angepasst. Eine retrospektive Datenanalyse wurde durchgeführt. Als primärer Endpunkt wurde Tod, und als sekundäre Endpunkte wurden Reoperation in Aortenpositon und frühe Autograftinsuffizienz gewählt.

Resultate: Die mittlere Klemmzeit betrug 102 ± 23.4 Minuten, die mittlere Bypasszeit war 241 ± 45 min. In 78 (96.3 %) Patienten wurde der RVOT mit einem pulmonalen Homograft rekonstruiert in 3 (3.7 %) Patienten wurde ein dezellularisierter porziner Xenograft als RV-PA Konduit verwendet. Ein AV Block III° mit folgender Schrittmacherimplantation trat bei 4 (4.9 %) Patienten auf. Es gab keine perioperative Mortalität. Im Echo vor Entlassung zeigte sich bei 65 (80.3 %) Patienten keine Insuffizienz des pulmonalen Autografts und bei 16 (19.7 %) Patienten wurde eine triviale (≤ 1) Neoaortenklappeninsuffizienz beschrieben. Eine Stenose im Bereich der Autograftklappe trat bei keinem Patienten auf. (Median v-max: 1.6 m/s [1.3;1.9]). Bei einem medianen Follow-up von 3.0 [1.6;5.0;] Jahren, betrug die Gesamtmortalität immer noch 0. Der pulmonale Autograft musste bei einer Patientin (1.2 %) nach 6 Monaten aufgrund einer infizierten PET Prothese, ausgehend von einer Endokarditis des RV-PA Konduits (dezellularsierter porziner Xenograft), ersetzt werden. Zum Zeitpunkt des Follow-up zeigte sich bei keinem Patienten in der Echokardiographie eine Insuffizienz oder Stenose der Autograftklappe von > 1.

Schlussfolgerungen: Das Einnähen des pulmonalen Autografts in eine Polyethylenterephtalatprothese ist eine sichere Methode. Die perioperativen und kurzfristigen Ergebnisse sind vergleichbar mit denen des freien Wurzelersatzes. RV-PA Konduits mit höherem Risiko für Prothesenendokarditis sollten, aufgrund der Kunststoffprothese, vermieden oder sehr zurückhaltend verwendet werden.

11-2

Harnmenge in der Frühphase des kardiogenen Schocks als Prädiktor für die Krankenhaussterblichkeit

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Einleitung: Die Sterblichkeit des kardiogenen Schocks ist nach wie vor hoch. Neben der frühen Revaskularisation stehen weitere interventionelle Therapieoptionen zur Verfügung, für welche aber keine endgültigen Überlebensvorteile nachgewiesen werden konnten. Zusätzlich ist in einem wesentlichen Anteil der Fälle nicht ein unmittelbarer Myokardinfarkt ursächlich. Frühzeitig und verlässlich innerhalb eines insgesamt lebensbedrohlich erkrankten Kollektivs die Patient:innen zu finden, welche noch von einer Therapie profitieren, erweist sich weiterhin als schwierig. Dies könnte der Grund für die stagnierenden Forschungsentwicklungen bezüglich überlebensverbessernder Therapiekonzepte sein. Konkrete Therapieentscheidungen müssen an Verlaufsprädiktoren geknüpft werden, die verlässliche Aussagekraft besitzen und frühzeitig und einfach verfügbar sind. Viele der hinsichtlich der Sterblichkeit publizierten prädiktiven Parameter bzw. deren Kombination erfüllen diese Anforderungen nur teilweise. Bis jetzt fließen vor allem Parameter, welche die azidotischen Verhältnisse bei Hypoperfusion quantifizieren, in die Analysen ein, die Flüssigkeitsbilanzierung ist wenig erforscht. Die Untersuchung der routinemäßig verfügbaren Harnmengenbilanzierung im Zusammenhang der ersten 24 Stunden kann hier den Wissensstand über bereits

publizierte, ähnlich ubiquitär verfügbare Parameter vervollständigen und im Vergleich die klinische Relevanz einordnen.

Methoden: Es wurde eine retrospektive Analyse aller Aufenthalte zwischen Januar 2017 und Dezember 2019 zweier Intensivstationen eines universitären Maximalversorgers, die eine internistisch und die andere kardiologisch durchgeführt. In einer Zwischenerhebung von 847 Patient:innen, wiesen 96 die Kriterien für einen kardiogenen Schock auf und hatten eine vollständig dokumentierte Harnmengenbilanzierung über 24 Stunden nach Aufnahme. Die Kriterien für das Vorliegen eines kardiogenen Schocks waren definiert als: Systolischer Blutdruck < 90 mmHg für > 30 min oder Einsatz von Katecholaminen zur Aufrechterhaltung eines systolischen Blutdrucks > 90 mmHg, klinische bzw. radiologische Zeichen einer pulmonalen Stauung und zumindest ein Zeichen einer reduzierten Endorganperfusion. Ausschlusskriterien waren Alter unter 18 Jahren, Schwangerschaft und Suizidversuch. Der Zusammenhang der durchschnittlichen Harnmengen (ml pro Stunde) von 0–6 Stunden, 6–12 Stunden und 12–24 Stunden nach Aufnahme auf Intensivstation und der Krankenhaussterblichkeit wurden in univariaten logistischen Regressionsmodellen untersucht und jeweils die Area Under Receiver Operating Characteristics Curve (AUROC) berechnet und mittels DeLong-Tests verglichen.

Resultate: Die Krankenhaussterblichkeit der Studienpopulation betrug 36.5 %. Insgesamt war in 45.8 % der kardiogene Schock Myokardinfarkt-bedingt. Die Mehrheit der Patient:innen (71.9 %) waren männlich. Der Altersmedian lag innerhalb der verstorbenen Gruppe bei 68, innerhalb der Überlebenden bei 63 Jahren. Der Simplified Acute Physiology Score 3 (SAPS3) war im Median 81 Punkte in der verstorbenen Gruppe und 66 Punkte in der überlebenden. 35.4 % erhielten im Rahmen des Aufenthalts eine Therapie mittels extrakorporaler Membranoxygenierung. Die durchschnittlichen Harnmengen von 0–6 Stunden, 6–12 Stunden und 12–24 Stunden nach Aufnahme und der SAPS3 waren in der univariaten logistischen Regression signifikante Prädiktoren für die Krankenhaussterblichkeit. Die AUROCs der Harnmengen Parameter waren untereinander vergleichbar, einschließlich der durchschnittlichen Harnmenge der gesamten ersten 24 Stunden, und niedriger im Vergleich zu der von SAPS3. In explorativen multivariaten Modellen mit SAPS3 und jeweils einem der Harnmengenparameter blieb nur die durchschnittliche Harnmenge 6–12 Stunden nach Aufnahme signifikant.

Schlussfolgerungen: Die Ergebnisse unterstreichen die Aussagefähigkeit der frühen Harnmengenbilanzierung innerhalb der ersten 6 beziehungsweise 12 Stunden nach Aufnahme hinsichtlich der Krankenhaussterblichkeit im kardiogenen Schock und betonen die Notwendigkeit sofortiger gezielter Therapiekonzepte. Im Vergleich dazu ist der SAPS3 ist ein umfassenderes, nuancierteres Prognoseinstrument, zugleich aber wesentlich komplexer zu ermitteln und die einfließenden Parameter unterliegen teilweise Interpretationsschwankungen, was seinen unmittelbaren Nutzen im Akutsetting einschränken kann. Die Harnmenge stellt dagegen einen leicht zugänglichen und unmittelbaren Indikator für den Patientenzustand dar. In diesem Zusammenhang scheint die frühe Harnmenge ein ebenso brauchbarer Prädiktor zu sein, wie die gesamte Harnausscheidung nach 24 Stunden. Dies unterstreicht die entscheidende Bedeutung der frühen Phase für die Prognose und die Dringlichkeit einer prompten, wirksamen Therapie. Es erscheint sinnvoll, einfach und früh verfügbare prognostische Indikatoren, wie die Harnausscheidung, und deren Kombination neu zu beleuchten, um die Entscheidungsfindung in dieser kritischen Frühphase zu verbessern. Insbesondere die Harnmenge inner-

	gesamt (n=96)	verstorben (n=35)	überlebt (n=61)
demographische Daten			
männlich	69 (71.9)	23 (65.7)	46 (75.4)
Alter, Jahre	65 [54-72]	68 [60-74]	63 [51-70]
BMI, kg/m²	26.8 [24.1-30.8]	26.2 [24.2-30.5]	26.9 [23.9-30.9]
Kardiogener Schock			
Infarkt-bedingter KS	44 (45.8)	17 (48.6)	27 (44.3)
Herzkreislaufstillstand vor Aufnahme	32 (33.3)	14 (40.0)	18 (29.5)
Intensivstationsaufenthalt			
Aufenthaltsdauer, Tage	9 [4-20]	6 [3-14]	11 [6-23]
elektive Aufnahme	18 (18.8)	4 (11.4)	14 (23.0)
Invasive Beatmung	80 (83.3)	29 (82.9)	51 (83.6)
ECMO Therapie	34 (35.4)	16 (45.7)	18 (29.5)
kont. Nierenersatzverfahren	25 (26.0)	14 (40.0)	11 (18.0)
Aufnahmescoring			
SAPS3	70 [59-82]	81 [70-90]	66 [55-74]
Vorerkrankungen/Patientengeschichte			
aHTN	51 (53.1)	19 (54.3)	32 (52.5)
COPD	9 (9.4)	7 (20.0)	2 (3.3)
CKD	18 (18.8)	8 (22.9)	10 (16.4)
DM	27 (28.1)	11 (31.4)	16 (26.2)
KHK	61 (63.5)	22 (62.9)	39 (63.9)
pAVK/cAVK	15 (15.6)	8 (22.9)	7 (11.5)
Malignom	4 (4.2)	3 (8.6)	1 (1.6)

Fig. 1 Charakteristika der Studienpopulation hinsichtlich der Krankenhausterblichkeit-Sterblichkeit: Werte thr n (%); Median [Interquartilsabstand] BMI =Body Mass Index; KS = kardiogener Schock; ECMO = extrakorporale Membranoxygenierung; kont. = kontinuierliches; SAPS3 = Simplified Acute Physiology Score 3; aHTN = arterielle Hypertonie, COPD = chronisch-obstruktive Lungenerkrankung; CKD = chronische Nierenerkrankung, jegliches Stadium; DM = Diabetes Mellitus; KHK = Koronare Herzerkrankung; pAVK/cAVK = periphere/cerebrale arterielle Verschlusskrankheit

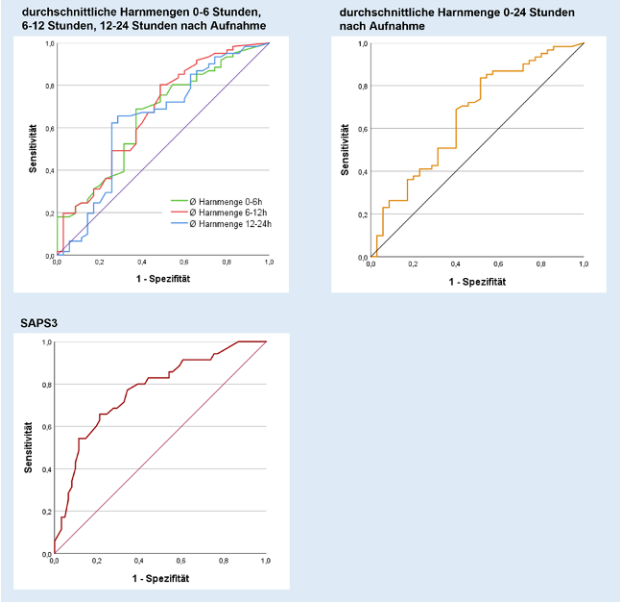

Fig. 2 ROC-Kurven hinsichtlich der Krankenhaussterblichkeit mit Bezugslinie bei einer Area Under the Curve (AUC) von 0.5 fOr die getesteten Harnmengen, SAPS3 and die Harnmenge Ober 24 Stunden: Harnmenge 0-6h AUC 0.65 (95% KI 0.54-0.77) Harnmenge 6-12h AUC 0.67 (95% KI 0.56-0.79) Harnmenge 12-24h AUC 0.64 (95% KI 0.52-0.76) Harnmenge 0-24h AUC 0.66 (95% KI 0.54-0.78) SAPS3 AUC 0.77 (95% KI 0.67-0.87)

halb 6–12 Stunden war trotz der Fallzahl von SAPS3, der viele Confounder enthält, unabhängig und könnte in solche Konzepte einfließen. Weitere Forschung ist erforderlich, um diese Ergebnisse zu bestätigen, zu validieren und ihre Auswirkungen auf die klinische Praxis zu untersuchen.

11-3

AI-Assisted Segmentation of the Aortic Vascular Tree and its Pathologies – Developments and Prospects

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Introduction: Treatment and monitoring of aortic pathologies often require individualized approaches. Vascular segmentations provide valuable information that can assist in this process. However, creating manual segmentations is a time-consuming task, requiring slice-by-slice contouring of CTA scans by well-trained personel. To close this gap AI-assisted automated solutions are promising for closing this gap.

Methods: Manual segmentations of CTA scans of "healthy" aortas for the SEG.A. 2023 project have been provided, in which expert groups around the world, working on automated segmemtions, could test their segmentation-algorithms in a challenge-like setting. Altogether, 21 teams participated in the challenge. Their submitted solutions have been qualitatively and quantitatively reviewed by clinicians and technicians.

Results: The automated solutions showed promising results as compared to the manually performed segmentations. Overall reconstruction of the aortic vascular tree was satisfactorily achieved with the best-performing algorithms. For clinical use, further improvements in terms of accuracy, detection and attribution of artifacts as well as reliability still have to be adressed and could be enhanced with bigger ground-truth datasets.

Conclusion: AI-assited image analysis is a rapidly developing and improving entity as demonstrated by the SEG.A. 2023 project. Clinical integration may only be years apart, potentially improving clinicals worflows and patient outcomes.

11-4

Surgical Closure of Patent Ductus Arteriosus in Low-Birth Weight Premature Neonates: A Single-Centre Analysis

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Introduction: The feasibility of surgical patent ductus arteriosus (PDA) closure in premature infants, especially in patients with low birth weight, has been viewed as critical due to the potential comorbidities. Until now, this form of therapy was often considered a kind of "ultima ratio" treatment option, without specific data regarding its success rate. Therefore, the aim of this study was to shed some light on the applicability of surgical PDA closure in low-birth weight patients at our own institution.

Methods: All premature neonates with undergoing surgical PDA ligation from 2009 to 2024 including surgical complications, intensive care unit stay and 30-day mortality have been investigated.

Results: 26 neonates with a mean birth weight of 1.170 (± 900) grams underwent PDA ligation. The patients' age at the time of cardiac surgical intervention was 26 days (± 19) with fifteen (57.7%) patients suffering from concomitant gastrointestinal malformations and three of those (11.5%) requiring stoma surgery prior to cardiac surgical intervention. Three (11.5%) patients suffered from congenital lung bleeding, three (11.5%) from congenital intraventricular hemorrhage. The cardiac procedures in all patients could successfully be performed within the incubator under sterile condition without further mobilization or transfer. The mechanical ventilator support could be stopped on postoperative day 13 (± 15). Only three (11.5%) patients suffered from a recurrent laryngeal nerve injury in relation to the surgical procedure. No patient died intraoperatively; the 30-day all-cause mortality was 3.84% due to one multi-organ failure. One (3.84%) patient died due to respiratory failure caused by viral infection unrelated to the intervention 52 days after the procedure. The longtime follow-up was 2.378 days (± 1.673).

Conclusion: In this single-center investigation study, surgical PDA ligation showed no interventional or periprocedural mortality rates and only one case of 30-day-all-cause mortality. A very low incidence rate of postoperative complications allowed for rapid discontinuation of mechanical ventilation therapy. Especially in high-risk patients, who often have undergone multiple surgeries, and given the safety of this intervention, surgical PDA ligation may be considered as feasible form of therapy in low birth weight preterm neonates suffering from a PDA.

11-5

Effect of E-Cigarette vape and Cigarette smoke on Human Vascular Tissue and Cells

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Introduction: Cigarette smoking remains to be one of the main preventable cardiovascular risk factors. Alternatively, e-cigarettes have become popular recently as a promoted "healthier" way of smoking, Therefore the aim of the study was to analyse the effect of e-cigarette vape extract on human vessels and smooth muscle cells.

Methods: Human saphenous veins were collected from 54 patients (n = 54) as well as cells from human saphenous veins (n = 18) undergoing coronary artery bypass grafting surgery. Samples were randomized into three treatment groups (consisting of a control and four interventional group per treatment group): a) n = 18 were treated with tobacco cigarettes (Marlboro Red™), groups b) and c) (n = 18 per group) were treated with two different e-cigarette (JUUL™ and nikoBlue™) devices using a specially designed smoking machine. After treatment, the cellular and structural integrity of the cultured vessels were investigated. Likewise, isolated venous smooth muscle cells were treated with smoke- and vape- extract and subjected to cell viability analyses.

Results: Regardless of the tested nicotine-delivery device, all treated veins exhibited unchanged tissue integrity and number of cell nuclei. Marlboro Red™ treated veins showed a significant reduction in smooth muscle cell actin content with a significant increase in the amount of oxidized proteins. No such chances were detectable in e-cigarette vape extract treated veins. Incubation of isolated smooth muscle cells with Marlboro Red™ and nikoBlue™ smoke- and vape-extract respectively, resulted in a significantly impaired metabolic activity of the cells. Such a change in metabolic activity was not present in cells after treatment with JUUL™ vape extract. Marlboro Red™ treated cells showed a significant increase in apoptosis after 48 h incubation, JUUL™ treatment after 96 h incubation, and nikoBlue™ treatment showed no apoptosis at all. None of the devices examined showed a significant and apoptosis typical depolarisation of the mitochondrial membrane potential compared to control. Plasma membrane integrity, as an indication of necrotic cell death, was significantly impaired in Marlboro Red™ treated cells, but not in JUUL™ or nikoBlue™ treated cells. Moreover, DNA damage in smooth muscle cells was induced by conventional cigarettes as well as e-cigarette vape.

Conclusion: Although the effect of e-cigarette vapour extract appears to be less severe in terms of cell death compared to conventional cigarettes, data on induced DNA damage by e-cigarettes show a hazard even at low concentrations. The exact effects of e-cigarette vaping on smooth muscle cells need to be further investigated.

11-6

Association of preoperative NT-proBNP levels with 30-day and five-year mortality after cardiac surgery

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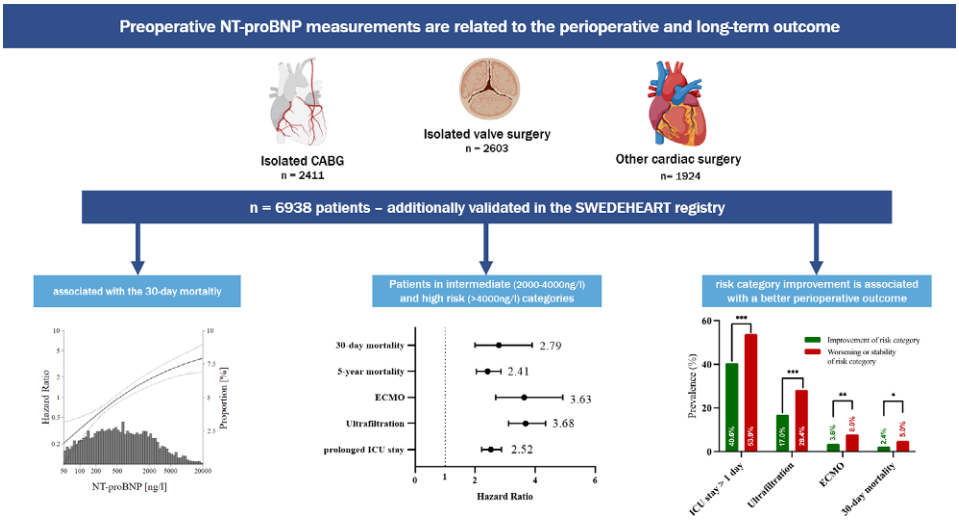

Fig. 1 Preoperative NT-proBNP measurements are related to the perioperative and long-term outcome

Introduction: High levels of N-terminal prohormone of brain natriuretic peptide (NT-proBNP) reflect poor cardiac status in heart failure patients. In this study, we analyzed the association of preoperative NT-pro-BNP levels with 30-day and five-year mortality after cardiac surgery.

Methods: A consecutive cohort of 6938 patients undergoing cardiac surgery was analyzed retrospectively. The relationship between preoperative NT-proBNP levels and 30-day and five-year mortality adjusted for EuroSCORE II was explored with a Cox proportional hazards model. The dynamics of preoperative NT-proBNP levels were analyzed by comparing the values at diagnosis or assignment to surgery with the values on the day before surgery (n = 4739). Results were validated in an external cohort from the SWEDEHEART registry (n = 3117).

Results: Median preoperative NT-proBNP concentration was 552 ng/l. Death within 30 days occurred in 2.1% of the patients. High preoperative NT-proBNP levels were associated with higher 30-day and 5-year mortality rates. Preoperative NT-proBNP concentration thresholds for identifying patients at high risk (> 4000 ng/l), intermediate risk (2000–4000 ng/l) and low risk (< 2000 ng/l) of dying within 30 days of surgery were determined. Patients in the intermediate and high-risk categories had a higher risk of a prolonged ICU stay (OR 2.52), ultrafiltration (OR 3.68), ECMO (OR 3.63), and of death within 30 days (HR 2.79) and five years (HR 2.41) (all p-values < 0.001). Patients whose NT-proBNP risk improved before surgery had better survival at 30 days and five years.

Conclusion: Preoperative NT-proBNP levels are independently associated with 30-day and five-year mortality after cardiac surgery. Decreasing NT-proBNP levels before surgery may decrease 30-day and five-year mortality after cardiac surgery.

11-7

A non-invasive and algorithm driven medical decive for the quatification of cardiac kinematics

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Introduction: To date, the assessment of the right ventricle (RV) mechanical performance during open chest surgery is still based on invasive cardiac catheterization, transesophageal echocardiography, and the qualitative eye-balling evaluation of surgeons. The extrapolation of kinematic parameters from videos acquired at high temporal resolution has been demonstrated in previous studies. In this work, we take advantage of the non-invasive Videocardiograph (VCG) to precisely evaluate the right ventricle 3D kinematics, compared with invasive right heart PV-loop assessment in pigs. The aim of this work was to evaluate whether an algorithm-driven approach might assist surgeons in the assessment of the RV function.

Methods: In 5 Landrace pigs (51.40 ± 6.9) we performed a series of increasing degrees of pulmonary artery (PA) banding to induce RV overload alone or following dobutamine administration until life-threatening conditions (i. e. near occlusion of PA). Animals were acutely instrumented closed-chest under fluoroscopic guidance with a pulmonary artery flotation catheter (Swan Ganz, pediatric, 5 F, Edwards Lifesciences connected to Vigilance II, Edwards Lifesciences, Irvine, CA, USA) and a LV conductance catheter (5F, 12 electrodes, 7-mm spacing; MPVS Ultra, Millar Instruments, Houston, TX, USA). We employed the VCG, an innovative medical device, which enables the clinician to investigate and quantify the RV mechanical performance in real time using a 3D high-speed camera (60fps) and a proprietary software.

Results: The different degrees of PA bandings determined a steadily rise of ventricular fatigue as demonstrated by the increase of both stroke work (i. e. the work performed by the RV) and pressure-volume area (i. e. mechanical energy generated by the RV). The VCG finely distinguished and measured the velocities in both systolic and diastolic phases at different frequencies and during the hemodynamic alterations of the protocol. In detail, we observed an increase of the systolic velocity at each step of PA banding, until a decrease occurred at the last step with a near complete occlusion of the artery. Notably, at the last degree of banding, we observed an increase in the velocity of the diastolic phase as it occurred earlier due to the uncomplete ejection of the systole. This observation was in line with the increased end-diastolic volume measured invasively. Remarkably, the hemodynamic parameter of end-systolic elastance displayed the exact same trend, namely, increasing with the severity of PA banding until a decrease occurred at the near occlusion of the artery. Finally, we also observed an increase in the velocities following dobutamine administration.

Conclusion: We demonstrated that the VCG is able to provide quantitative data on RV mechanical performance. It might be employed to monitor RV function during cardiac procedures as AV-surgery, congenital heart disease and LVAD implantation. The benefits of the VCG are the non-invasiveness, real-time evaluation, and algorithm-driven quantification. We highly appreciate the support of the developing company for the opportunity to start the first tests. They developed the VCG, an innovative non-invasive medical device that could revolutionize intraoperative RV-failure diagnosis.

11-8

Contemporary Single Centre Experience of 124 Consecutive Patients undergoing complete Aortic Arch Replacement employing the Frozen Elephant Trunk Technique

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Introduction: The frozen elephant trunk (FET) procedure, which combines conventional surgery with endovascular techniques, offers a single stage treatment to patients with extensive aortic pathologies. Since experience with this hybrid procedure has increased substantially in the last decade, reports on modern-era patient cohorts can provide insights into the changing landscape of the frozen elephant trunk procedure. This study aims to identify trends in short- and mid-term outcomes, focusing on the underlying pathologies and surgical strategies.

Methods: Between January 2017 and January 2024, 124 consecutive patients (thoracic aortic aneurysm (TAA), n = 28;

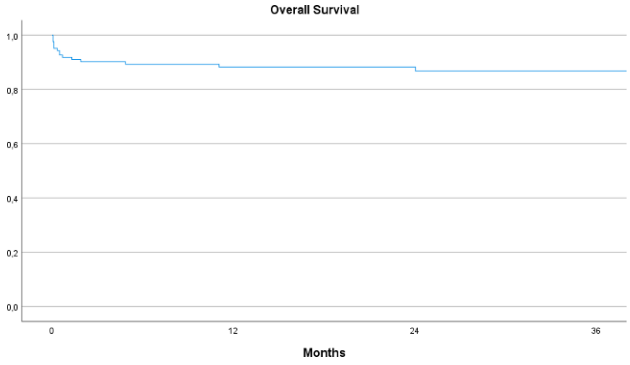

Fig. 1

acute aortic dissection (AAD), n = 31; or chronic aortic dissection (CAD), n = 65) underwent complete aortic arch replacement using the FET procedure. Employed hybrid prosthesis included the E-vita Open Plus (Jotec GmbH, Hechingen, Germany; n = 45) the E-vita Open NEO (Jotec GmbH, Hechingen, Germany; n = 72) and the Thoraflex-Hybrid (Terumo Aortic, Inchinnan, UK; n = 7). In-hospital data was collected prospectively and included pre-& intraoperative details as well as follow-up results.

Results: Mean cardiopulmonary bypass time, cardiac ischemia time, and selective antegrade cerebral perfusion time were 190.9 ± 54.6, 95.9 ± 34.3 and 47.8 ± 14.7 minutes, respectively. In-hospital mortality in this patient cohort was 8.9% (n = 11). Although the majority of patients with CAD underwent the FET procedure as reoperation (55.4%), in-hospital mortality was lowest among this particular subgroup at 6.2%. Patients with TAA however, who seldomly received the FET procedure as reoperation, had a considerably higher mortality rate (17.9%). This might be due to the poorer preoperative status and higher age at the time of surgery, which is also indicated by the high rate of required concomitant procedures in this subgroup. The rate of postoperative neurological complications was 7.3% (n = 9) for perioperative stroke and 1.6% (n = 2) for permanent spinal cord injury. Six patients (4.8%) required hemofiltration at the time of discharge due to postoperative kidney injury. Endovascular repair of the downstream aorta after primary FET procedure was necessary in 49 patients (39.5%), with 23 (18.5%) performed as planned staged procedure and 26 (21.0%) performed after indication was confirmed on a follow-up CT scan. Six patients (4.8%) required open aortic surgical repair after primary FET procedure. The median time to reintervention was 113 (42–790) days. Median follow-up time was 23 (8– 50) months, and overall survival rates at 12, 24, and 36 months were 88%, 88%, and 87%, respectively.

Conclusion: Our data aligns with current reports, affirming the efficacy of the Frozen Elephant Trunk procedure as a valuable tool in managing extensive aortic arch pathologies. When executed by a specialized aortic team, our study underscores the procedure's commendable safety profile. Acute aortic dissection and emergency surgeries continue to be associated with significantly worse outcomes, whereas the FET procedure can be performed with exceptional results, even in cases requiring aortic reoperation. Furthermore, for patients necessitating downstream aortic repair, the FET prosthesis offers an ideal landing zone for subsequent endovascular aortic interventions.

POSTERSITZUNG 12 – DIVERSE 1

12-1

Lipoprotein(a) levels in patients with cryptogenic stroke and persistent foramen ovale

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Introduction: Elevated levels of lipoprotein(a) [Lp(a)] are an independent risk factor for the development of atherosclerotic cardiovascular disease (ASCVD). However, it is not known whether high Lp(a) is associated with cryptogenic stroke.

Methods: We included 478 patients with cryoptogenic stroke that underwent closure of a persistent foramen ovale and had Lp(a) measurement available. These patients were matched according age and gender in a 1:3 ratio to 1434 controls.

Results: Mean age of patients was and 49.9 +/−12.9 years and 275 patients (57.4%) were male. Median Lp(a) levels were significantly higher in cases (26 IQR 13–87 nmol/L) as compared to controls (16 IQR 2–61 nmol/L; $p < 0.00001$). Lp(a) levels > 200 nmol/L were significantly more frequent in patients with cryptogenic stroke as compared to controls (10.0% vs. 7.0%; $p < 0.05$). The odds-ratio for an increase of Lp(a) by 50 nmol/L was 1.09 (95% CI 1.03–1.15) independent of age and gender.

Conclusion: Patients with cryptogenic stroke and persistent foramen ovale showed significantly higher plasma levels of Lp(a) and an increase of Lp(a) was associated with a significant increased risk for cryptogenic stroke. Whether high Lp(a) increases risk for deep vein thrombosis leading to embolization or for arterial thrombosis has to be elucidated in further studies.

12-2

Psycho-soziale Einflussfaktoren auf das subjektive Schmerzempfinden bei Patient*innen mit akutem Myokardinfarkt

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Einleitung: Angst wird öfters mit einer schlechteren Prognose bei Herzkrankheiten in Verbindung gebracht. Soziale Unterstützung hat einen weiteren Einfluss auf die psychische Gesundheit der Menschen und somit die Entwicklung von Krankheiten. Diese psychische, aber auch soziale Stabilität ist während der COVID-19-Pandemie in großem Umfang beeinträchtigt worden, wobei Maßnahmen zur Minimierung der Infektionsrate und zur Selbstisolierung zu Unsicherheiten und

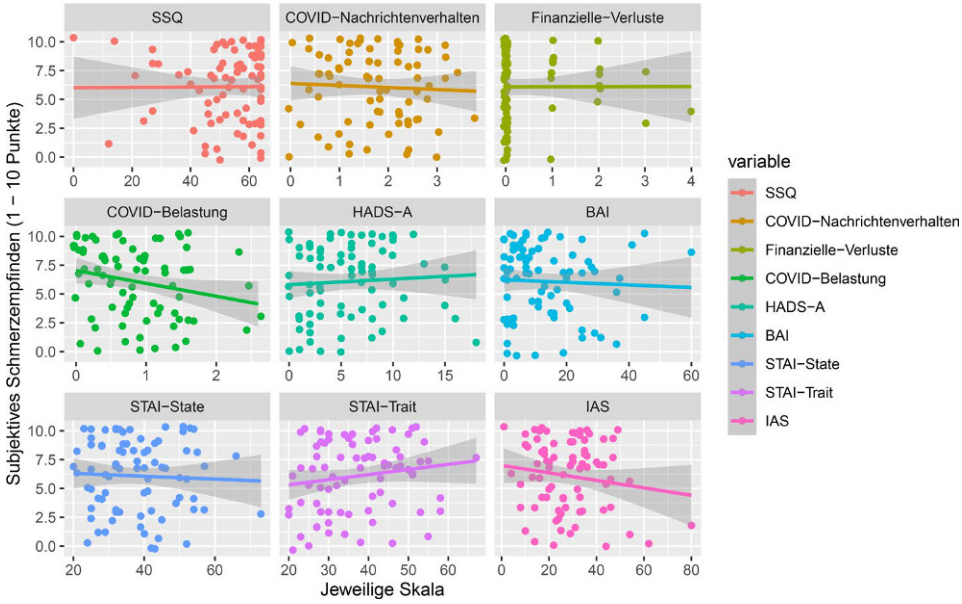

Fig. 1 Individuelle Einflussnahme der Prädiktoren auf das subjektive Schmerzempfinden bei Patient*innen mit akutem Myokardinfarkt

möglicherweise zu psychischen und physischen negativen Folgen geführt haben. Im Rahmen dieser Untersuchung soll daher die direkte Vorhersagekraft von psychischen, aber auch sozialen Faktoren auf das Schmerzempfinden als körperlichen Faktor im Rahmen eines akuten Myokardinfarkts (AMI) genauer untersucht.

Methoden: AMI-Patient*innen werden im Zuge ihres stationären Aufenthaltes auf das empfundene Schmerzempfinden während des AMI befragt. Psychische Stressoren in Bezug auf COVID-19 werden durch eine modifizierte Version der Severity Measure for Specific Phobia (SPQ) und die soziale Unterstützung durch den Social Support Questionnaire (SSQ) erhoben. Weiters werden finanzielle Verluste im Zuge der COVID-19-Pandemie und der Nachrichtenkonsum in Bezug auf die Pandemie quantitativ abgefragt. Die Erfassung von Angstsymptome gelingt durch das State-Trait-Anxiety Inventory (STAI), die Hospital Anxiety Scale (HADS-A), den Illness Attitude Scale (IAS) und dem Beck Anxiety Inventory (BAI). Für die Analyse der Vorhersage des empfundenen Schmerzes auf Basis von sozialen & angstbezogenen Prädiktoren wird eine multiple lineare Regressionsanalyse berechnet.

Resultate: Die Datenerhebung wurde zwischen April 2020 und Juni 2021 durchgeführt. Insgesamt wurden 80 AMI-Patient*-innen in die Untersuchung eingeschlossen. Die statistische Analyse ergab, dass die Angst als Persönlichkeitseigenschaft das Schmerzempfinden signifikant erhöht. Andererseits reduzieren situative momentan vorhandene Ängste das Schmerzempfinden, genau wie auch höhere psychische Belastungen durch COVID-19 und COVID-19 bedingte finanzielle Einbußen (siehe Graphik 1).

Schlussfolgerungen: Höhere psychische Belastungen, soziale Einbußen und hohes momentanes Angstempfinden kann ein geringeres Schmerzempfinden im Rahmen des AMI vorhersagen, was auch den Langzeitverlauf von akuten Herzerkrankungen stark negativ beeinflussen kann. Möglicherweise sind psychologische, aber auch soziale Stressoren im Sinne einer Ablenkung zu verstehen und können die rasche Erkennung des AMI verzögern. Künftige Studien sollten weitere Möglichkeiten zur Vorhersage von Schmerzempfinden und damit auch zur Früherkennung eines AMI untersuchen.

12-3

Prevalence of carcinoid heart disease in patients with gastrointestinal neuroendocrine tumors in a single-center prospective registry

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Introduction: Carcinoid heart disease (CHD) caused by neuroendocrine tumors (NET) is associated with increased morbidity and mortality due to valvular dysfunction and right-sided heart failure. This study aims to assess the prevalence and one-year incidence of CHD in NET patients. Tumor characteristics, laboratory measurements, and echocardiographic findings were examined to identify predictors of CHD development.

Methods: The study was an investigator-initiated, monocentric, prospective trial. Patients with gastroenterological NET without previously diagnosed CHD were included and underwent oncological and cardiological diagnostics. Transthoracic echocardiography (TTE) and blood test were performed at baseline.

Results: Thirty-nine NET patients (mean age 67 ± 11 years) were enrolled into the study and received TTE. A total of four patients exhibited signs of CHD (mean age 68.75 ± 8.5 years). Three patients showed classical right sided carcinoid heart disease with high-grade tricuspid regurgitation. One of these patients also exhibited moderate pulmonary regurgitation along with moderate right ventricular dysfunction. One patient is suspected to suffer from left-sided carcinoid heart disease with aortic stenosis and mitral regurgitation. NT-proBNP was significantly elevated in CHD patients compared to NET patients without CHD (663.7 pg/mL ± 661.5 vs. 220.6 pg/mL ± 154.1, p = 0.02) as was 5-Hydroxyindoleacetic acid (5-HIAA) in 24 h urine (67 mg ± 26 vs. 11 mg ± 8, p = 0.002) and Troponin T (20 ng/L ± 8 vs. 10 ng/L ± 4, p = 0.011). Chromogranin A showed no significant difference (889.25 ng/mL ± 1040.93 vs. 584.54 ng/mL ± 1066.76, p = 0.64) between groups.

Conclusion: 10.26% (n = 4) of NET patients showed signs of CHD, the majority of which showed right-sided carcinoid heart disease (n = 3). CHD patients exhibited significantly elevated cardiac biomarkers such as proBNP and troponin T, as well as increased 5-HIAA in 24 h urine.

12-4

NT-proBNP reflects left ventricular hypertrophy rather than dilatation or dysfunction in patients with Fabry disease

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Introduction: The diagnosis and follow-up of cardiac involvement in Fabry disease constitutes an important challenge for clinicians, caring for affected patients. Combining cardiac imaging markers and laboratory biomarkers within a multi-modal approach appears most appropriate. We therefore examined the use of NT-proBNP and its association with imaging findings in patients with Fabry disease.

Methods: For this purpose, we analyzed cardiac MRI and echocardiography data, as well as laboratory results from a single-center prospective registry.

Results: Repetitive follow-ups of 36 Fabry dis-ease patients, of whom 19 presented with left ventricular hypertrophy (LVH) at the time of base-line examination revealed a correlation of NT-proBNP with left ventricular (LV) interventricular septal thickness, LV maximum wall thickness, LV and right ventricular (RV) mass index and trabecular mass in the general cohort as well as in the subgroup of patients with LVH but not in patients without LVH. Conversely, we could not detect an association between NT-proBNP and LV and RV ejection fraction or diastolic volume.

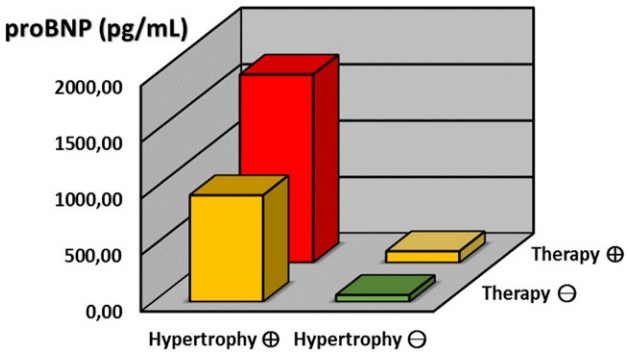

Fig. 1 Sub-group comparison of NT-proBNP in Fabry disease patients with or withouth left ventricular hypertrophy (LVH) or specific therapy

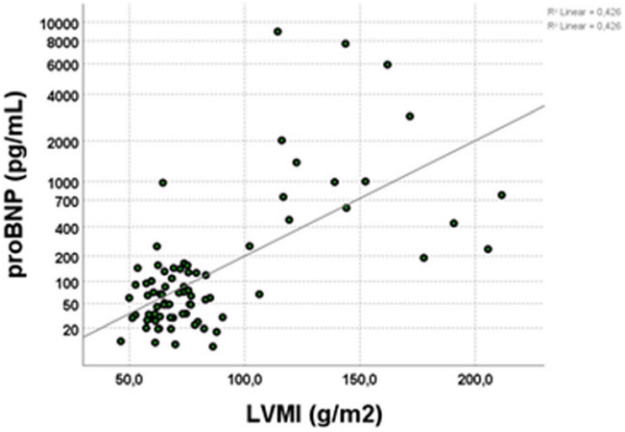

Fig. 2 Correlation of NT-proBNP and left ventricular mass index (LVMI)

Conclusion: In conclusion, NT-proBNP is a valuable biomarker for the estimation of cardiac involvement in patients with Fabry disease reflecting rather LVH than ventricular dysfunction, while its prognostic value appears limited in the pre-hypertrophic stage.

12-5

Efficient circulating anti-spike protein levels reduce severity and magnitude of multi-organ long covid symptoms

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Introduction: Patients with long covid syndrome present with various symptoms extending in several organs with prevailing cardiovascular, pulmologic and neurologic symptoms. Vaccination before or after SARS-CoV-2 infection seems to reduce incidence of long covid and not deteriorate symptoms. However, the effect of vaccination on multi-organ long covid symptom magnitude is unclear. Moreover, the role of circulating anti-spike protein levels on multi-organ symptom magnitude is not yet elaborated.

Methods: In this prospective cohort study we included patients fulfilling definition criteria of the long covid syndrome, who had their anti-spike protein levels determined upon first clinical presentation. Symptoms were quantified based on number of involved organs and a classification system was presented. We compared vaccinated and non-vaccinated patients regardless of the timing of vaccination relative to the infection time. The anti-spike protein levels were compared, and a cutoff value was found to characterize vaccinated and non-vaccinated long covid patients. Finally, infection and vaccination time correlations with anti-spike protein levels and time-to-event statistics for keeping efficient anti-spike protein were performed.

Results: From 198 patients in this study, 41.4% had symptoms in four or five organs and 14.1% in more than five organs. From 138 vaccinated patients, 83.3% of patients have had their vaccination against SARS-CoV-2 after an infection, and the oth-

Variable	Vaccinated n = 138	Non-Vaccinated n = 60	Total n = 198	p-Value
Age (years)	45.5 ± 14.7	44.3 ± 13.2	45.1 ± 14.2	0.603
Female (%)	96 (69.6)	43 (71.7)	139 (70.2)	0.766
BMI (kg/m^2)	24.9 ± 4.9	26.2 ± 5.8	25.3 ± 5.2	0.165
Hypertension (%)	53 (38.4)	20 (33.3)	73 (36.9)	0.497
Diabetes mellitus (%)	7 (5.1)	2 (1.7)	8 (4.0)	0.263
Hyperlipidemia (%)	38 (27.5)	17 (28.3)	55 (27.8)	0.908
Family history for CVD (%)	21 (15.2)	8 (13.3)	29 (14.6)	0.730
Symptom Class (%)				**0.014**
I	69 (50.0)	19 (31.7)	88 (44.4)	
II	55 (39.9)	27 (45.0)	82 (41.4)	
III	14 (10.1)	14 (23.3)	28 (14.1)	
Anti-SARS-CoV2-spike (BAU/mL)	1925 ± 938	481 ± 768	1487 ± 1109	**<0.001**
Days from infection to sampling (d)	269 ± 151	193 ± 140	246 ± 152	**0.001**
Days from infection to vaccination (d)	110 ± 167			
Vaccine prior to infection (%)	23 (16.7)	0 (0)	23 (11.6)	-
Vaccine doses (%)				**<0.001**
0	0 (0.0)	60 (100)	60 (30.3)	
1	43 (31.2)		43 (21.7)	
2	57 (41.3)		57 (28.8)	
3	34 (24.6)		34 (17.2)	
4	4 (2.9)		4 (2.0)	
First vaccine type (%)	20 (14.5)		20 (10.1)	
AstraZeneca	2 (1.4)		2 (1.0)	
Janssen	12 (8.7)		12 (6.1)	
Moderna	104 (74.4)		104 (52.5)	
Pfizer-BioNTech				
proBNP (mg/dL)	94.8 ± 184.5	76.4 ± 104.4	89.1 ± 164	0.425
CRP (ug/mL)	0.2 ± 0.32	0.21 ± 0.28	0.2 ± 0.3	0.668
TSH (mIU/L)	1.53 ± 0.83	1.49 ± 0.78	1.52 ± 0.81	*0.812*
IgG (mg/dL)	1104 ± 239	1177 ± 404	1126 ± 300	*0.115*
Cholesterol (mg/dL)	197 ± 42	202 ± 41	199 ± 42	*0.527*
Triglycerides (mg/dL)	108 ± 71	134 ± 91	115.65 ± 78.15	0.122
Lp(a) (mg/dL)	55 ± 82	36 ± 53	49 ± 75	0.346
CK (U/L)	96 ± 51	106 ± 72	99 ± 58	0.801
Procalcitonin (ng/mL)	0.03 ± 0.02	0.03 ± 0.03	0.03 ± 0.03	0.930
Ferritin (ng/mL)	122 ± 125	111 ± 116	118 ± 122	0.250
D-Dimer (mg/L FEU)	0.31 ± 0.42	0.18 ± 0.21	0.27 ± 0.38	0.086
IgA (mg/dL)	204 ± 101	217 ± 97	207 ± 100	0.348
ADAMTS-13 (%)	103.21 ± 25.02	108.71 ± 30.32	104.77 ± 26.66	0.345
Fibrinogen (mg/dL)	320 ± 69	318 ± 63	319 ± 67	0.964

Fig. 1 Baseline characteristics

ers had breakthrough infections. The vaccinated patients had less class II and class III multi-organ symptoms (Class II 39.9% vs 45.0%; Class III 10.1% vs 23.3%, p-value 0.014). A circulating anti-spike protein cutoff of 665.5 BAU/mL could divide two groups based on vaccination status, which negatively correlated with multi-organ symptom class (p-Value 0.016; CI −1.229 to −0.126). The high anti-spike protein level patients had mostly two vaccine doses and a mean anti-spike of 2270 ± 514 BAU/mL, while low anti-spike protein patients had a mean of 147 ± 166 BAU/mL. A sharp decrease of anti-spike protein levels was inspected in non-vaccinated patients, with a steep fall around 150–250days after infection.

Conclusion: In the present study, we classified the symptoms using the number of organs they originated from, enabling a more objective symptom quantification. Using this system, we found that the multi-organ symptoms were less expressed in the vaccinated long covid population, independently whether the first vaccination was given before or after a SARS-CoV-2 infection. An anti-spike protein value lower than 665.5 BAU/mL would indicate a higher multi-organ symptom magnitude and be used in combination with symptom classification in clinical practice. Vaccination and efficient anti-SARS-CoV-2 spike protein levels (over 665.5 BAU/mL) protect from a higher multi-organ symptom magnitude in long covid patients. Dedicated studies are needed to confirm the findings.

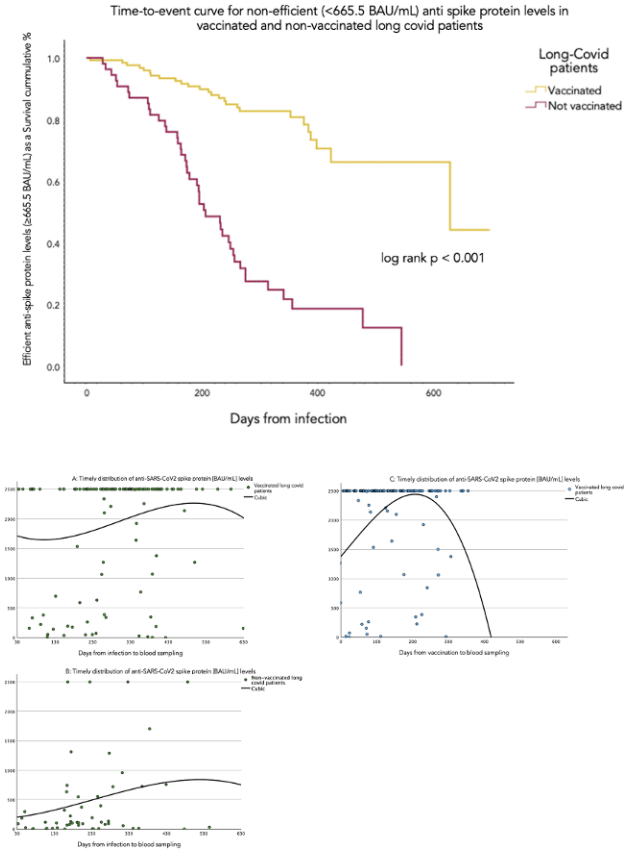

Fig. 2 Time to event graphs comparing vaccinated and non-vaccinated patients

12-6

Gender difference in Emergency medicine – A Study of Admission Trends in a Metropolitan Emergency Department

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Introduction: Background: Gender disparities in healthcare have been a subject of ongoing research, with various studies highlighting differences in access, treatment, and outcomes. In emergency medicine, understanding gender-specific patterns of admission is crucial for delivering equitable care. This study aimed to investigate gender-specific types of admission in a metropolitan emergency department. Additionally, the study assessed whether there were differences in illness severity, measured using the Manchester Triage System categories, and age upon arrival.

Methods: A retrospective analysis of admission data was conducted over a 16-day period (February/March 2024) encompassing 1178 patients in the Emergency Department of a Metropolitan Clinic in Vienna, Austria. Demographic information, including gender, age and mode of admission, was collected from an implemented software tool. Severity of illness upon admission was assessed using the Manchester Triage System categories. Statistical analysis, Chi-square test and independent samples t-tests were performed to assess the significance of

Tab. 1 German

Geschlecht * Selbstkommer Kreuztabelle					
			Selbstkommer		
			Rettung	Selbst-kommer	Gesamt
Geschlecht	Weiblich	Anzahl	402	246	648
		Erwartete Anzahl	399,9	248,1	648,0
		% von Geschlecht	62,0%	38,0%	100,0%
	Männlich	Anzahl	325	205	530
		Erwartete Anzahl	327,1	202,9	530,0
		% von Geschlecht	61,3%	38,7%	100,0%
Gesamt		Anzahl	727	451	1178
		Erwartete Anzahl	727,0	451,0	1178,0
		% von Geschlecht	61,7%	38,3%	100,0%

Chi-Quadrat-Tests					
	Wert	df	Asymptotische Signifikanz (zweiseitig)	Exakte Sig. (zweiseitig)	Exakte Sig. (einseitig)
Pearson-Chi-Quadrat	,063[a]	1	,801		
Kontinuitätskorrekturb	,037	1	,848		
Likelihood-Quotient	,063	1			
Exakter Test nach Fisher				,810	,424
Zusammenhang linear-mit-linear	,063	1	,801		
Anzahl der gültigen Fälle	1178				

a. 0 Zellen (0,0%) haben eine erwartete Häufigkeit kleiner 5. Die minimale erwartete Häufigkeit ist 202,91.
b. Wird nur für eine 2x2-Tabelle berechnet

Chi-Quadrat-Tests			
	Wert	df	Asymptotische Signifikanz (zweiseitig)
Pearson-Chi-Quadrat	8,080[a]	4	,089
Likelihood-Quotient	8,055	4	,090
Zusammenhang linear-mit-linear	,131	1	,717
Anzahl der gültigen Fälle	1178		

a. 0 Zellen (0,0%) haben eine erwartete Häufigkeit kleiner 5. Die minimale erwartete Häufigkeit ist 26,99.

Statistiken[a]		
Alter		
N	Gültig	648
	Fehlend	0
Median		53,00
Perzentile	25	35,00
	50	53,00
	75	74,00

a. Geschlecht = Weiblich

Statistiken[a]		
Alter		
N	Gültig	524
	Fehlend	6
Median		55,00
Perzentile	25	37,25
	50	55,00
	75	70,00

a. Geschlecht = Männlich

Gruppen-statistiken					
	Ge-schlecht	N	Mittel-wert	Std.-Abwei-chung	Standardfehler des Mittel-wertes
Alter	Weiblich	648	54,37	21,574	,848
	Männlich	524	54,26	20,301	,887

Geschlecht * Manchester_Codierung Kreuztabelle								
			Manchester_Codierung					
			Sofort	Sehr dringend	Dringend	Normal	Nicht dringend	Gesamt
Geschlecht	Weiblich	Anzahl	33	29	220	335	31	648
		Erwartete Anzahl	34,1	33,0	223,3	317,4	40,2	648,0
		% von Geschlecht	5,1%	4,5%	34,0%	51,7%	4,8%	100,0%
	Männlich	Anzahl	29	31	186	242	42	530
		Erwartete Anzahl	27,9	27,0	182,7	259,6	32,8	530,0
		% von Geschlecht	5,5%	5,8%	35,1%	45,7%	7,9%	100,0%
Gesamt		Anzahl	62	60	406	577	73	1178
		Erwartete Anzahl	62,0	60,0	406,0	577,0	73,0	1178,0
		% von Geschlecht	5,3%	5,1%	34,5%	49,0%	6,2%	100,0%

Test bei unabhängigen Stichproben											
		Levene-Test der Varianz-gleichheit		t-Test für die Mittelwertgleichheit							
						Signifikanz				95% Konfidenzintervall der Differenz	
		F	Sig.	T	df	Einseitiges p	Zweiseitiges p	Mittlere Differenz	Differenz für Standardfehler	Unterer Wert	Oberer Wert
Alter	Varianzen sind gleich	6,016	,014	,092	1170	,463	,927	,114	1,235	–2,308	2,536
	Varianzen sind nicht gleich			,093	1143,511	,463	,926	,114	1,227	–2,293	2,521

Effektgrößen bei unabhängigen Stichproben					
				95% Konfidenz-intervall	
		Standardi-sierer[a]	Punk-tschätzung	Unterer Wert	Oberer Wert
Alter	Cohen's d	21,015	,005	–,110	,121
	Hedges' Korrektur	21,028	,005	–,110	,120
	Glass' Delta	20,301	,006	–,110	,121

a. Der bei der Schätzung der Effektgrößen verwendete Nenner.
Für 'Cohen d' wird die zusammengefasste Standardabweichung verwendet.
Für die Hedges-Korrektur wird die zusammengefasste Standardabweichung mit einem Korrekturfaktor verwendet.
Für das Glass-Delta wird die Standardabweichung der Stichprobe der Kontrollgruppe (d. h. der zweiten Gruppe) verwendet.

gender differences in admission types, severity of illness, and age upon arrival.

Results: Women had a higher rate of total admission to the emergency department with 55% (n = 648) compared to 45% (n = 530) of men. Our analysis revealed no significant gender difference in admission patterns between men and women. 62% of women arrived via emergency medical services, compared to 61,3% of men (p = 0.801). In addition, there was no significant difference in illness severity measured by Manchester Triage System categories between genders (p = 0.089), indicating that women were not disproportionately affected by more severe illnesses in this study. Regardless of admission mode, the median age of women was 53 (IQR: 35–75) and 55 (IQR: 37–70) in men at arrival at the hospital, without any statistically significant difference (p = 0,926).

Conclusion: The findings of this study underscore the absence of significant gender-specific disparities in emergency department admissions, despite a higher proportion of women being admitted overall. Notably, the study revealed comparable rates of admission between genders, with no significant differences in illness severity. Moreover, our analysis suggests that gender did not influence the mode of arrival to the emergency department, as evidenced by similar proportions of women and men arriving via emergency medical services. These results emphasize the importance of addressing gender-specific patterns in emergency medicine to ensure equitable healthcare delivery. While this study did not find substantial gender-based discrepancies in admission trends, further exploration into healthcare-seeking behaviors and access to care is warranted.

12-7

Sex differences in cardiac autonomic function after acute ST-elevation myocardial infarction: a longitudinal observation

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Introduction: Periodic Repolarization Dynamics (PRD) and Deceleration Capacity are ECG-based risk markers that quantify sympathetic-activity associated low-frequency modulations

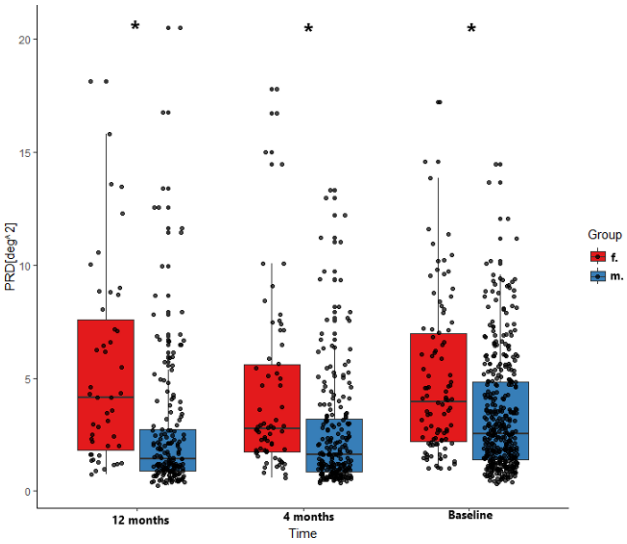

Fig. 1 PRD values male (m) versus female (f) at Baseline, 4 months and 12 months after myocardial infarction

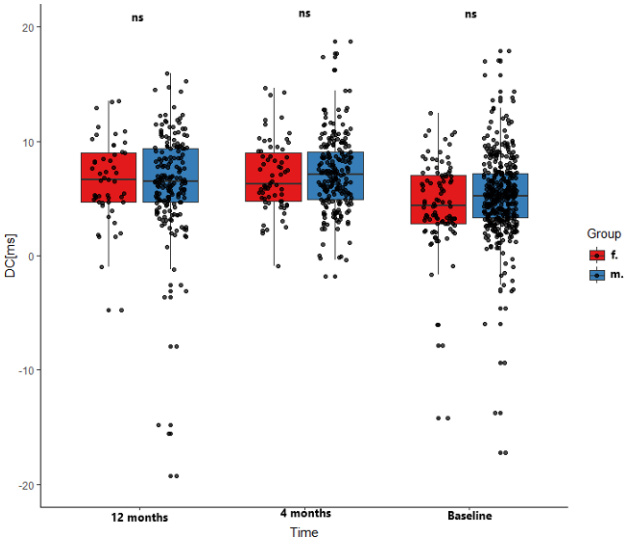

Fig. 2 DC values male (m) versus female (f) at Baseline, 4 months and 12 months after myocardial infarction

of repolarization instability and vagally mediated regulations of heart rate, respectively. Previous research links increased sympathetic and decreased vagal activity after-myocardial infarction (MI) to a higher risk of malignant arrhythmias and overall mortality. Furthermore, studies showed that women show worse prognosis after MI than men do.

Methods: Consecutive patients with acute ST-elevation myocardial infarction (STEMI) presenting to the cardiology department were included. All patients underwent a 30-minute biosignal recording by a high-resolution (1000 Hz) electrocardiogram after successful coronary intervention (at 2–5 days, 4 months and 12 months after MI). PRD and DC were calculated using established methods.

Results: 491 patients were included (391 male vs. 100 female). PRD values at baseline, 4 months and 12 months differed significantly between sexes (mean [IQR]): 4.86 [2.18–6.96] vs. 3.33 [1.38–4.84] ($p < .001$), 4.27 [1.74–5.60] vs. 2.50 [0.86–3.20] ($p < .001$) and 5.28 [1.81–7.60] vs. 2.61 [0.87–2.73] ($p < .001$), respectively, at a corrected significance level of $\alpha < .016$. In contrast, DC values were not different between sexes at any time-

point: 4.30 [2.81–7.00] vs. 5.43 [3.27–7.20] (p = .043), 6.92 [4.73–9.01] vs. 7.14 [4.92–9.06] (p = .61) and 6.55 [4.692–8.96] vs. 6.10 [4.68–9.30] (p < .51), respectively.

Conclusion: Elevated PRD values in women after STEMI indicate a more pronounced cardiac autonomic dysfunction and might account for the worse prognosis after STEMI in women.

12-8

Kardiogenetik – Klinische Bedeutung für Diagnose, Prognose und Therapie von Herzerkrankungen

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Einleitung: Die Kardiogenetik kombiniert das Fach Kardiologie mit dem Fach Humangenetik und untersucht den Zusammenhang zwischen kardiovaskulären Erkrankungen und genetischen Abnormalitäten. Vor allem die hypertrophe, dilatative und arrhyhmogene rechtsventrikuläre Kardiomyopathie und Ionenkanalerkrankungen wie das Long-QT-Syndrom, Brugada Syndrom und die katecholaminerge polymorphe Kammertachykardie zeigen häufig einen genetischen Ursprung.

Methoden: Die Datenerhebung erfolgte im Zeitraum von 01.01.2019 bis 31.08.2023 am Ordensklinikum Elisabethinen Linz. Es wurden 63 Patienten in die retrospektive Studie eingeschlossen. Die Daten wurden sortiert und je nach Krankheitsbild in Kategorien eingeteilt, um die Verteilung der jeweiligen Erkrankungen in verschiedene Richtungen zu analysieren.

Resultate: 44 der 63 Patienten sind männlich, 19 weiblich. Bei 36,85 % der weiblichen Patienten und 47,73 % der männlichen Patienten konnte eine Mutation nachgewiesen werden. Bei 44,44 % der Patienten ist somit ein Mutationsnachweis gelungen. 35 der getesteten Patienten haben einen unauffälligen Befund. Bei ihnen konnte keine Mutation nachgewiesen werden. Führende Verdachtsdiagnosen für die Zuweisungen zur Gendiagnostik sind Kardiomyopathien mit 65,08 % und Ionenkanalerkrankungen mit 23,81 %. 4,76 % haben als Zuweisungsgrund einen erfolgten Herzstillstand oder Kammerflimmern. 6,35 % der Patienten werden mit sonstigen Gründen einer Gendiagnostik unterzogen. Dominierend bei den Kardiomyopathien sind die dilatative und arrhythmogene rechtsventrikuläre Kardiomyopathie mit 31,7 % und 21,95 %. 88,89 % der ARVC-Patienten sind männlich, bei 66,67 % konnte eine pathogenetische Mutation festgestellt werden. 13 der 41 Patienten sind mit Verdacht auf dilatative Kardiomyopathie getestet worden, 80 % davon sind männlich. Bei den Ionenkanalerkrankungen führend war das Brugada-Syndrom mit 53,33 % und einer Geschlechterverteilung von 62,5 % männlich und 37,5 % weiblich. Ein Mutationsnachweis ist lediglich bei einem Patienten gelungen. Dieser hat die dafür klassische Mutation im SCN5A. 20 % der Patienten wurden unspezifisch auf eine Pathologie des Ionenkanals gescreent. 2 Patienten davon haben eine Mutation im KCNA5 und PRDM16. Beim Rest konnte keine Mutation detektiert werden.

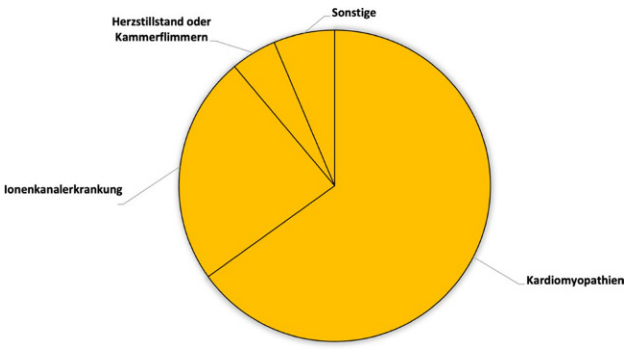

Fig. 1 Übersicht der Zuweisungsdiagnosen für die kardiologische Gendiagnostik

Schlussfolgerungen: Die Ergebnisse und Erkenntnisse der retrospektiven Datenanalyse bestätigen trotz der kleinen Stichprobe von lediglich 63 Patienten viele der bisherigen Studienergebnisse. Mutationen in einem Gen können mehrere Erkrankungen hervorrufen. Beispielsweise kann eine Pathologie im SCN5A ein Long-QT-Syndrom, Brugada Syndrom, Vorhofflimmern, aber auch eine dilatative Kardiomyopathie auslösen. Entscheidend zur Differenzierung ist deshalb eine ausführliche Anamnese, die Klinik und das EKG des Patienten.

POSTERSITZUNG 13 – HERZINSUFFIZIENZ 2

13-1

Incidence of acute cardiovascular hospitalizations and association with hemodynamic biomarkers in cancer patients treated with Immune Checkpoint Inhibitor therapy

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Introduction: Immune checkpoint inhibitors (ICI) have significantly improved outcomes for several malignancies. Despite these benefits, patients with cancer face an increased risk for the development of cardiovascular disease due to mutual risk factors, similar biological mechanisms, as well as cardiotoxic

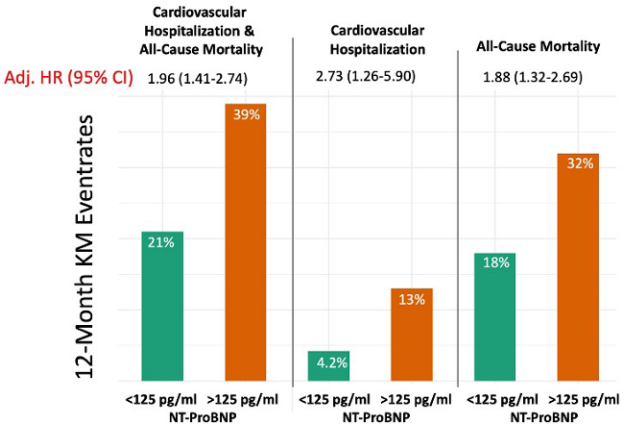

Fig. 1

side effects of therapy. Therefore, there is a pressing need for effective risk stratification strategies.

Methods: Purpose: This study aimed to explore the association between NT-proBNP levels and the risk of acute cardiovascular hospitalizations and death in patients who receive ICI. Methods: We used electronic health records of patients treated with ICI who had available baseline NT-proBNP levels at Vienna General Hospital and Medical University of Vienna, a tertiary academic center, between January 2017 and July 2022. The primary outcome of interest was the composite of acute cardiovascular hospitalization or death. The associations between NT-proBNP and outcomes were analyzed using cox regression models adjusted for age, sex, serum creatinine, diabetes, HF, CAD, hypertension, AF, LDL-C, and CRP.

Results: Results: In total, 550 patients (35% female, median age 65 yrs) were included in the study. The median NT-proBNP levels were 272 pg/mL (IQR 102–742 pg/mL) and 388 (71%) patients had NT-proBNP levels ≥ 125 pg/mL. During a median FU of 67 weeks, 190 patients (35%) died, and 103 CV hospitalizations occurred in 76 patients (14%). Compared with patients with NT-proBNP concentrations < 125, those with NT-proBNP concentrations ≥ 125 pg/ml had significantly higher event rates of the combined endpoint (12-Month KM event rates: 38% vs 21%, P < 0.001). After multivariable adjustment, NT-proBNP remained independently associated with an increased risk of cardiovascular hospitalization and death (Adjusted HR for 1-SD increase in log-transformed biomarker 1.64, 95% CI 1.24 to 2.14; Figure).

Conclusion: Conclusion: These data highlight NT-proBNP levels as a valuable marker for identifying patients at increased risk of cardiovascular complications during ICI therapy.

13-2

SGLT2i therapy in patients with wild-type ATTR-CM

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Introduction: SGLT2-inhibitors have been shown to benefit disease course in patients with heart failure and chronic kidney function. The effect of SGLT2i in patients with transthyretin amyloidosis cardiomyopathy (ATTR-CM) is not well known. We aimed to determine SGLT2i-based treatment effects on cardiac biomarkers in patients with wild-type ATTR-CM (wtATTR-CM). We furthermore compared them with heart failure with preserved ejection fraction (HFpEF) patients treated with SGLT2-inhibitors.

Methods: Overall, SGLT2i therapy was initiated in 121 non-diabetic patients (left ventricular ejection fraction: 52 ± 11%), comprising 33 patients with stable diease wtATTR-CM on tafamidis treatment and 88 HFpEF patients. These patients were prospectively monitored before and after 6 months of treatment with SGLT2i therapy.

Results: Our analyses showed a significant decrease in estimated glomerular filtration rate (eGFR) [baseline (BL): 58.0 (IQR:41.3–67.9) vs follow-up (FUP): 49.8 (IQR:34.9–52.6) mL/min/1.73 m2, p:0.006] and a rise in creatinine [BL:1.2 (IQR:1.0–1.4) mg/dL vs FUP:1.4 (IQR:1.2–1.6) mg/dL, p:0.007] in patients

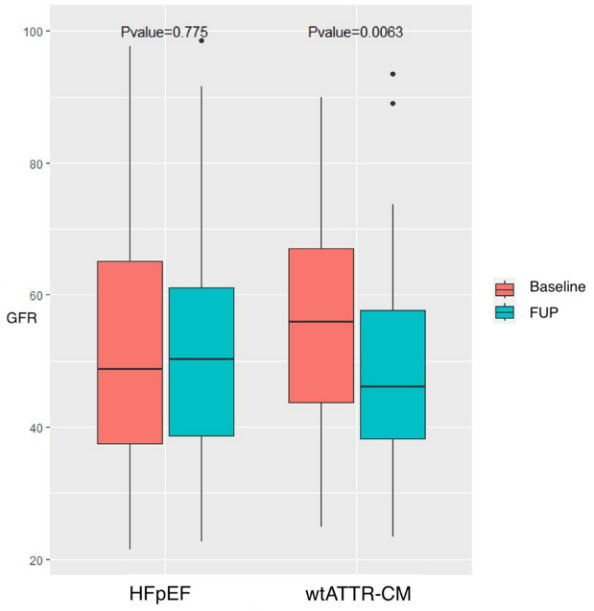

Fig. 1 Differences in eGFR between HFpEF and wtATTR-CM

with wtATTR-CM, while no significant change was found regarding to eGFR or creatinine levels in patients with HFpEF (0.780 vs 0.990, respectively). Furthermore, at FUP, median NT-pro BNP decreased in both group of wtATTR-CM and HFpEF patients, however the results indicated that NT-pro BNP was not significantly different in both group of patients at FUP [BL:1660.0 (IQR:1100.0–3245.5) pg/mL, FUP:1375.0 (IQR:901.5–3107.5) pg/mL, p:0.74 vs BL:1064.0 (IQR:288.0–1671.8) pg/mL, FUP:674.0 (IQR:330.0–1913.0) pg/mL, p:0.35, respectively]. Moreover, six-minute walk distance (6MWD) remained stable in patients with wtATTR-CM as well as with HFpEF (p:0.20 vs p:0.44, respectively).

Conclusion: Our analyses showed that eGFR reduced in patients with wtATTR-CM compared to HFpEF patients at FUP under SGLT2i therapy, while NT-pro BNP levels as well as 6MWD remained stable over time.

13-3

Up-titration of guideline directed medical therapy (GDMT) and the occurrence of side effects in heart failure with reduced ejection fraction (HFrEF)

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Introduction: The ESC Guidelines recommend early, full-dose use of heart failure (HF) medications to enhance survival, but real-world application often faces delays and inconsistencies. Clinicians often fear side effects during up-titration to the recommended target dose (TD), i. e. hypotension, bradycardia, renal impairment, and hyperkalemia (HK). The dependency

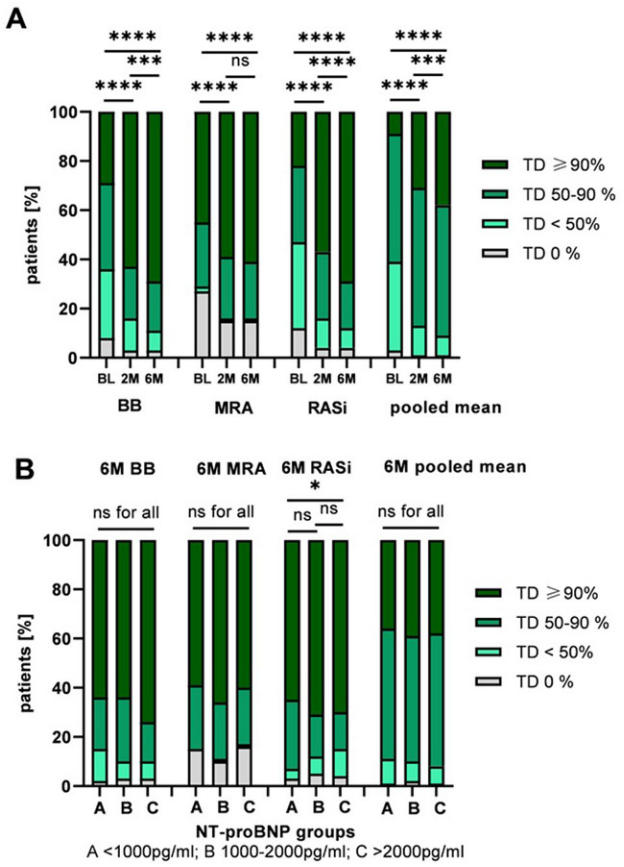

Fig. 1 Up-titration of HF medication and comparison of the titration goal between NT-proBNP groups in a HFrEF cohort at a tertiary care center during 6 months. The proportion of patients receiving the achieved % of the recommended TDs of betablockers (BB), mineralocorticoid receptor antagonists (MRA), renin-angiotensin-system inhibitors (RASi) and the pooled mean TD of BB, MRA and RASi are shown (A) for the total cohort at BL, at 2M and 6M during up-titration and (B) at 6M according to NT-proBNP groups (low-risk <1000pg/ml, medium-risk 1000-2000pg/ml, high-risk >2000pg/m1). Data was compared by the McNemar-Bowker test and chi-squared test. Levels of significance are indicated in the respective figure. ns=not significant; * p<0.05; ** p<0.01; *** p<0.001; **** p<0.0001

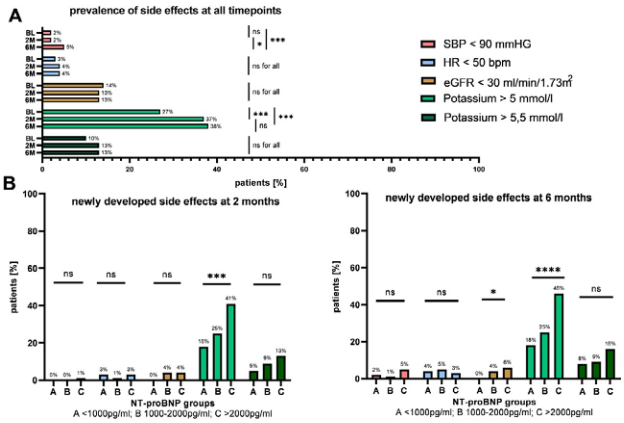

Fig. 2 Prevalence of side effects and distribution of newly development side effects according to NT-proBNP groups. The percentage of patients who developed side effects at baseline (BL), after 2 months (2M) and 6 months (6M) (A) and percentage of patients who developed new side effects (B) at 2M, 6M according to NT-proBNP groups (low-risk <1000pg/ml, medium-risk 1000-2000pg/ml, high-risk >2000pg/m1) are shown. Depicted is the percentage of patients experiencing systolic blood pressure (SBP) < 90 mmHG, heart rate (HR) < 50 beats per minute (bpm), estimated glomerular filtration rate (eGFR) < 30 ml/min/1.73 m2, potassium (K) > 5mmol/l and K > 5,5mmo1/1. Data was compared by the McNemar-Bowker test and Fishers's exact test. Levels of significance are indicated in the respective figure. ns=not significant; * p<0.05; ** p<0.01; *** p<0.001; **** p<0.0001

of side effects during dose escalation from the severity of HF remains unclear. This study aimed to evaluate the relationship between the occurrence of side effects during up-titration of HF medication and HF severity reflected by N-terminal pro B-type natriuretic peptide (NT-proBNP).

Methods: 425 patients with HFrEF and a complete data set of patient characteristics, medications and laboratory values at baseline (BL), 2 months (2M), and 6 months (6M) were included from our outpatient HF unit's prospective registry. Significant side effects were defined as: systolic blood pressure (SBP) < 90 mmHg, heart rate (HR) < 50 beats per minute (bpm), potassium (K) > 5.0 mmol/l or K > 5,5 mmol/l and estimated glomerular filtration rate (eGFR) < 30 ml/min/1.73 m2. Patients were categorized into three risk groups based on their NT-proBNP levels, i. e. low-risk with NT-proBNP < 1000 pg/ml, medium-risk with NT-proBNP 1000–2000 pg/ml or high-risk with NT-proBNP > 2000 pg/ml. The occurrence of side effects was recorded and the development compared among the HF risk groups.

Results: Fig. 1 shows up-titration of HF medication. Mean daily dosages of betablockers (BB), mineralocorticoid receptor antagonists (MRA) and renin-angiotensin-system inhibitors (RASi) increased significantly during follow-up (BL vs 2M and BL vs 6M, p < 0.001 for all). The majority of patients received ≥ 50% of the recommended TDs at 6M (89% for BB, 83% for MRA, 88% for RASi and 91% for total mean TDs ≥ 50%), and the achieved daily dosages at 6M were largely comparable across the HF risk groups at 6M, except for RASi (p = 0.030). Fig. 2 depicts the side effects. Side effects developed almost exclusively at short-term within 2M except for lower SBP (Fig. 2A). Newly developed side effects occurring after up-titration (2B) were even more rare and predominantly occurred within the highest NT-proBNP group. The occurrence of hypotension and bradycardia was infrequent and comparable within the HF risk groups. Renal dysfunction (at 6M p = 0,041) and HK occurred predominantly in higher risk patients (HK at 2M p = 0,001 and at 6M p < 0,001).

Conclusion: Up-titration of HF medications is highly feasible, particularly in low- and medium-risk patients. Despite rare side effects such as hyperkalemia and renal impairment, up-titration remains unimpeded, especially in patients with NT-proBNP levels below 2000 pg/ml. These findings emphasize the safety of up-titration in HF.

13-4

Abdominal Obesity and Outcomes in Heart Failure with Preserved Ejection Fraction: The PARAGON-HF Trial

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Introduction: Obesity affects a substantial proportion of patients with HFpEF. While body mass index (BMI) remains the most common anthropometric measure, the prognostic value of newer indices like waist-to-height ratio (WHtR), better accounting for body fat distribution and sex differences, remains unclear in HFpEF.

Methods: The PARAGON-HF trial randomized 4,796 patients with HF and LVEF ≥45% to valsartan or sacubitril/valsartan. We characterized the associations between anthropometric indices including BMI and WHtR and outcomes. The primary outcome was a composite of total HF hospitalizations and cardiovascular (CV) death.

Results: Both higher BMI and WHtR were associated with higher covariate-adjusted risk of the primary outcome, with the association for WHtR remaining significant in models additionally incorporating BMI ($P < 0.001$). Indications of lower mortality with higher BMI were attenuated after multivariable adjustment, and no obesity-survival paradox was observed for WHtR with or without adjustment. While there was a suggestion of potentially attenuated relative benefits of sacubitril/valsartan on the primary composite with lower BMI (Pinteraction = 0.06), the treatment effect was not significantly modified across the range of WHtR (Pinteraction = 0.52).

Conclusion: In PARAGON-HF, greater abdominal adiposity (as assessed by WHtR) was associated with a higher risk of HF hospitalizations and CV death, with no evidence for an obesity-survival paradox, or modification of the treatment effect.

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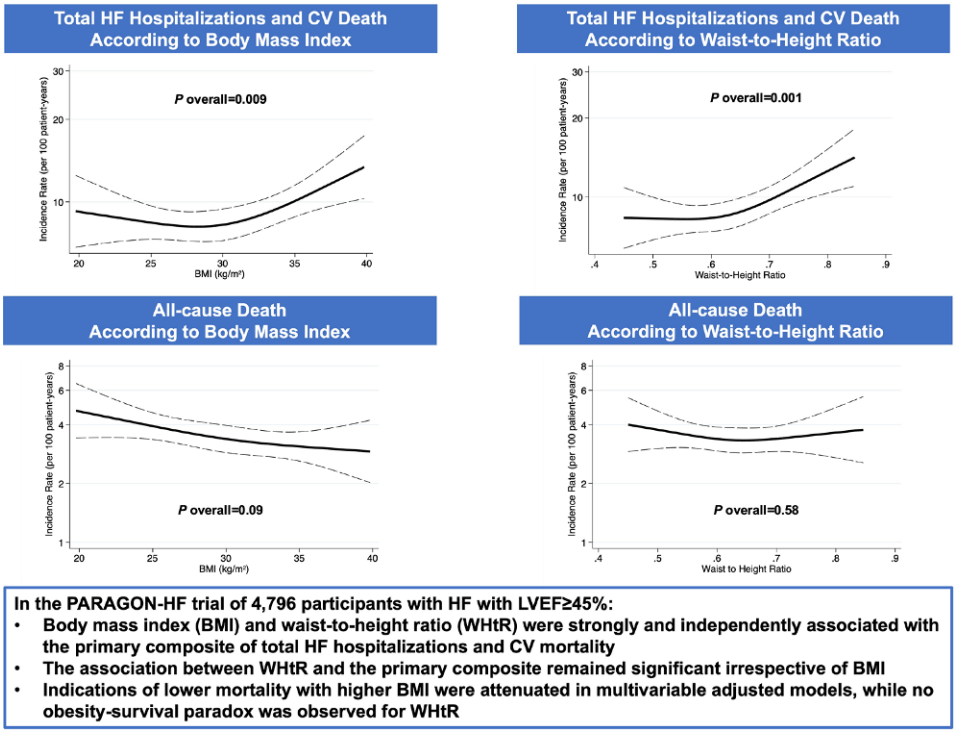

Fig. 1

13-5

Leukocyte indices as markers of inflammation and predictors of outcome in heart failure with preserved ejection fraction: insights from a prospective patient registry

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Introduction: The pathophysiology of heart failure (HF) with preserved ejection fraction (HFpEF) is suggested to be influenced by systemic inflammation. Therefore, it may be hypothesized that the neutrophil-lymphocyte ratio (NLR), the monocyte-lymphocyte ratio (MLR), and the pan-immune inflammation value (PIV) as markers of systemic inflammation predict outcome in HFpEF.

Methods: Patients presenting to a tertiary referral center for HFpEF in Vienna, Austria, between December 2010 and May 2023 were included in this cohort study. Cox regression analysis was utilized to test the predictive value of the NLR, the MLR, and the PIV for all-cause mortality. In addition to all-cause mortality, HF-related hospitalization and a composite of both endpoints were analyzed.

Results: 479 patients (73 ± 8 years, 27.8% male) with HFpEF met the inclusion criteria and were observed for 57.6 (interquartile range: 30.8–88.7) months. Within the follow-up period, 179 (41.1%) patients deceased. Per standard deviation, the NLR [Hazard ratio (HR): 1.542, 95%-confidence interval (CI): 1.383–1.718], the MLR (HR: 1.318, 95%-CI: 1.229–1.414), and the PIV (HR: 1.360, 95%-CI: 1.238–1.493, $p = < 0.001$ for all) predicted all-cause mortality. After adaption for age, sex, biomarkers of HF, concomitant disease, and the HFA-PEFF score, the NLR (HR: 1.378, 95%-CI: 1.210–1.570), the MLR (HR: 1.242, 95%-CI: 1.139–1.355), and the PIV (HR: 1.270, 95%-CI: 1.136–1.420, $p = < 0.001$ for all) remained highly significant predictors of all-cause mortality. After similar adjustment, the NLR (HR: 1.218, 95%-CI: 1.085–1.367), the MLR (HR: 1.173, 95%-CI: 1.079–1.274, $p = < 0.001$ for both), and the PIV (HR: 1.162, 95%-CI: 1.042–1.295, $p = 0.007$) predicted the combined endpoint of all-cause mortality and HF-related hospitalizations.

Conclusion: The NLR, the MLR, and the PIV are independent predictors of outcome in HFpEF.

13-6

Neurodegeneration is highly associated with comorbidity burden in HFrEF patients

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Introduction: Heart failure (HF) is associated with cognitive decline and risk for dementia. Blood levels of amyloid beta 40 and 42 (Aβ40, Aβ42), tau protein (tau), and neurofilament light chain (NfL) have been found to be altered in neurodegenerative disease. Previous research has established a clear association between these neuromarkers and the risk of developing cognitive dysfunction and mortality in the general population. The aim of this study was to investigate the association between the respective neuromarkers and comorbidity burden, as well as to explore whether comorbidity burden impacts the relationship between neuromarkers and outcome in HF patients.

Methods: Plasma levels of Aβ40, Aβ42, tau, and NfL were quantified using a single-molecule array assay. The primary outcome parameter was all-cause mortality.

Results: A total of 470 HFrEF patients were enrolled in the study, with a median age of 62 years (IQR: 52–72); 77% were male. Median NT-proBNP concentration was 1812 pg/ml (IQR: 718–3881). Elevated levels of all biomarkers were closely associated with comorbidity burden (Fig. 1). All neuromarkers showed increased levels in individuals with chronic kidney disease (CKD) and known carotid artery stenosis (CAS), except for Aβ40, which did not show significant elevation in CAS (NfL: $p < 0.001$ for both; t-tau: $p < 0.001$ and $p = 0.041$; Aβ40: $p < 0.001$ and $p = 0.050$; Aβ42: $p < 0.001$ and $p = 0.033$, respectively). In patients with type 2 diabetes mellitus (T2 DM) and coronary artery disease (CAD), only NfL levels were significantly elevated

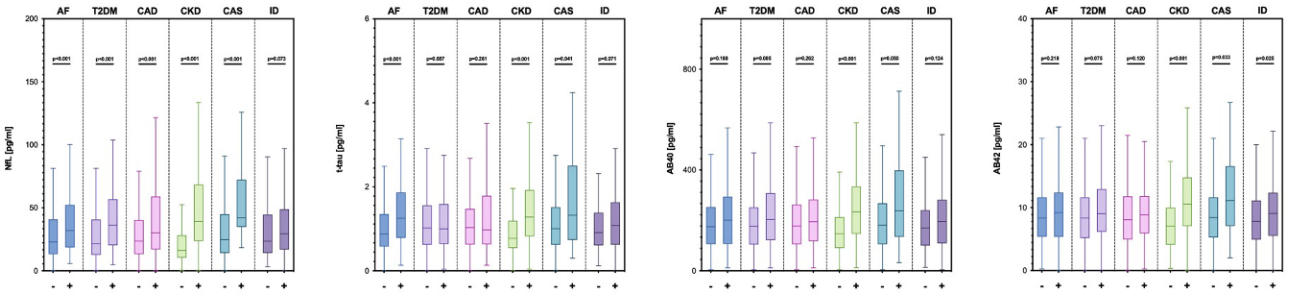

Fig. 1 Association of the neuromarkers neurofilament light chain (NfL), total tau protein (t-tau), amyloid β40 and amyloid β42 with comorbidities. Tukey-boxplots and group comparisons are shown for the association between neuromarkers and the comorbidities atrial fibrillation (AF), type 2 diabetes mellitus (T2 DM), coronary artery disease (CAD), chronic kidney disease (CKD), carotid artery stenosis (CAS) and iron deficiency (ID). Comparisons were made by the Mann-Whitney test and p-values are indicated in the graph

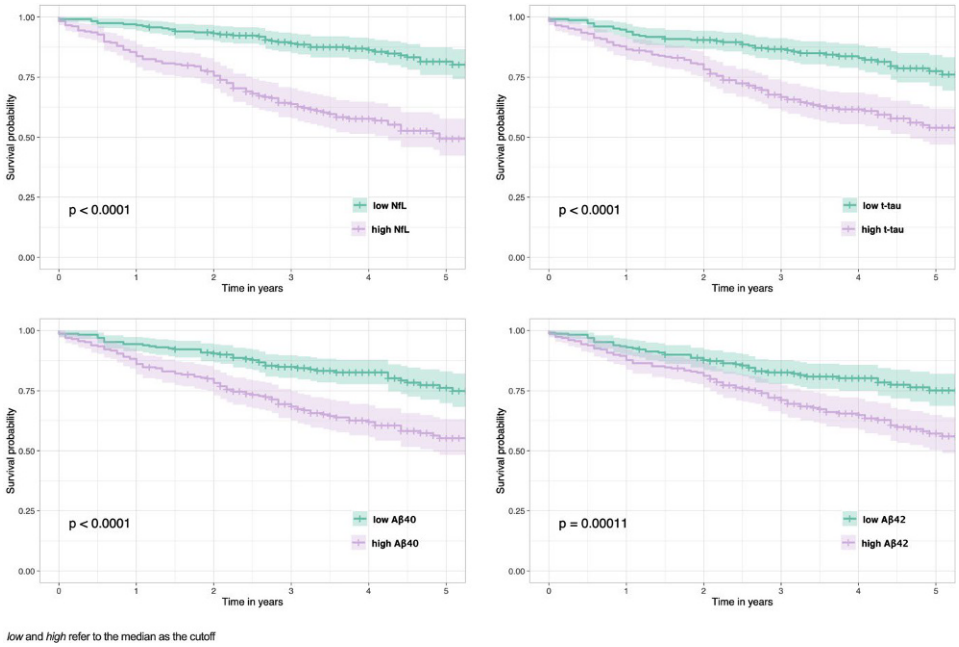

Fig. 2 Association of the neuromarkers neurofilament light chain (NfL), total tau protein (t-tau), amyloid β40 and amyloid β42 with all-cause mortality as illustrated by Kaplan Meier analysis. With the median of the respective neuromarkers as the cut-off value. Comparison was calculated by the log-rank test

(p < 0.001 for both), whereas atrial fibrillation (AF) was associated with higher levels of NfL and t-tau (p < 0.001 for both). In individuals with iron deficiency, only Aβ42 levels were significantly higher (p = 0.025). All biomarkers showed significant associations with all-cause mortality [crude HR for an increase in 1-log unit (95%CI): NfL 4.44 (3.02–6.53), t-tau 5.04 (2.97–8.58), Aβ40 3.90 (2.27–6.72), Aβ42 5.14 (2.84–9.32); p < 0.001 for all] (Fig. 2). These associations remained statistically significant after adjusting for comorbidity burden including AF, T2 DM, CAD, CKD, CAS and ID [adjusted HR for an increase in 1-log unit (95%CI): NfL 3.28 (1.93–5.57), t-tau 3.96 (2.07–7.57), Aβ40 2.42 (1.34–4.38), Aβ42 3.05 (1.56–5.97); p < 0.01 for all].

Conclusion: The findings suggest a close connection between elevated levels of markers of neurodegeneration and increased comorbidity burden in HFrEF patients. While this association may indicate the cumulative risk leading to neuronal injury and HFrEF progression, a causal relationship cannot be excluded. The observed accelerated neurodegeneration in HFrEF underscores the need for further investigation into this complex interplay.

13-7

Drug-drug interactions of empagliflozin and dapagliflozin

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Introduction: The sodium glucose co-transporter2-inhibitors dapagliflozin (Dapa) and empagliflozin (Empa), initially developed as antihyperglycemic agents, are increasingly also prescribed for non-diabetic patients with heart failure (HF). Glucuronidation by uridine-diphosphate glucuronosyltransferase (UGT)1A9 is the main mechanism of metabolism of Dapa, whereas Empa is eliminated mainly by excretion. Both Dapa and Empa are substrates of P-glycoprotein. The risk for drug-drug interactions (DDI) of Empa and Dapa is assumed to be low. Aim of this study was to summarize reports of DDI of Empa and Dapa from the literature.

Methods: Search-terms in PubMed were "drug-drug interaction" and AND "sodium glucose co-transporter2-inhibitors" OR "SGLT2" OR "dapagliflozin" OR "empagliflozin". The drugs were classified according the Anatomical Therapeutic Chemical (ATC) system. Included were randomized trials, pharmacovigilance studies, case series, case reports, studies in healthy sub-

Drug	ATC	Empagliflozin	Dapagliflozin
Glimepiride	A	CS=	HSM= *†
Linagliptin	A	HSM= *†	HSM= *†
Metformin	A	HSM= *†	HSM= *†
Pioglitazone	A	HSM= *†	HSM= *†
Sitagliptin	A	HSM = *†	HSM= *†
Ferric carboxymaltose	B	sRCT; increase of cell-iron availability *†	NR
Warfarin	B	HSM= *†	HSM = *†
Bumetanide	C	CS; synergistic diuretic effect *†	HSM; natriuretic synergy *†
Digoxin	C	HSM= *†	HSM= *†
Gemfibrozil	C	HSM= *†	NR
Hydrochlorothiazid	C	CS= *†	HSM= *†
Ramipril	C	HSM= *†	NR
Sacubitril-Valsartan	C	NR	CR; severe hypotension
Simvastatin	C	PV; HSM= *†	PV; HSM= *†
Sparsentan	C	NR	HSM = *†
Torasemide	C	CS= *†	NR
Valsartan	C	NR	HSM= *†
Verapamil	C	HSM= *†	NR
Ethinylestradiol	G	HSM= *†	NR
Levonorgestrel	G	HSM= *†	NR
Linezolid	J	NR	CS; pancytopenia
Rifampicin	J	HSM= *†	HSM; reduction in exposure to Dapagliflozin *†
Donafenib	L	NR	*In vivo*; increased exposure to donafenib
IL-17 Inhibitor	L	CR; severe infection	CR; severe infection
Tacrolimus	L	CS=	CR; septic shock
Mefenamic acid	M	NR	HSM; increase in exposure to dapagliflozin *†
Probenecid	M	HSM= *†	NR
Lithium	N	CR; reduction in exposure to lithium	NR
Valproic acid	N	CR; increase in exposure to valproic acid	NR

ATC = Anatomical Therapeutic Chemical classification; NR= Search in PubMed did not retrieve any data; CR = Case report; CS = Case series; HSM = study in healthy subjects, carried out by the manufacturer of dapagliflozin or empagliflozin; PV = Pharmacovigilance study; sRCT = Subgroup analysis of a randomized controlled trial; * = Funded by a pharmaceutical company marketing dapagliflozin or empagliflozin; † = Authors with conflicts of interest with pharmaceutical companies marketing dapagliflozin or empagliflozin; = = no effect.

Fig. 1 Drugs investigated for interactions with empagliflozin and dapagliflozin

jects and in vivo data. The funding of the study and the disclosures of the authors were registered.

Results: In 45 reports DDI of Empa and Dapa with 29 drugs were described (Table). According to the ATC system, these were drugs for the alimentary tract and metabolism (n = 5), blood and blood forming organs (n = 2), cardiovascular system (n = 11), genitourinary system and sex hormones (n = 2), antiinfectives (n = 2), antineoplastic and immunomodulating agents (n = 3), musculo-skeletal system (n = 2) and nervous system (n = 2). The reports comprised studies in healthy subjects (n = 28), case reports (n = 7), case series (n = 6), pharmacovigilance studies (n = 2), a subgroup analysis of a randomized trial (n = 1) and in vivo data (n = 1). Most of the reports found no clinically relevant DDI (n = 32). Dapa and Empa both had a synergistic diuretic effect with bumetanide, and led to severe infections when combined with the interleukin-17-inhibitors secukinumab or ixekizumab. Empa administered with intravenous iron was reported to increase cell-iron availability, with lithium to reduce lithium exposure and with valproate to increase valproate exposure. Dapa administered with sacubitril-valsartan was reported to lead to severe hypotension, with linezolid to pancytopenia, with donafenib to an increased exposure to donafenib, with rifampicin to a reduction and mefenamic acid to an increase in Dapa exposure. Of the 45 reports, 33 were funded by a pharmaceutical company marketing Dapa or Empa and 33 had authors with conflicts of interest with pharmaceutical companies marketing Dapa or Empa.

Conclusion: Most data about DDI of Empa and Dapa derive from studies in healthy subjects and from the marketing companies. The clinical relevance DDI of Empa and Dapa in polymorbid patients with polymedication is largely unknown. There is an urgent need for independent studies on DDI of these drugs in diabetic and non-diabetic patients with HF.

13-8

Prognostic impact of SGLT2-inhibitor therapy on survival in patients with transthyretin amyloid cardiomyopathy

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Introduction: Sodium-glucose co-transporter 2 inhibitors (SGLT2i) significantly improve cardiovascular outcomes in patients with heart failure across the whole spectrum of ejection fraction. Recently published data indicates the safety and tolerability of SGLT2i therapy in patients with transthyretin amyloid cardiomyopathy (ATTR-CM). However, there is a lack of evidence regarding the impact of SGLT2i therapy on clinical outcomes in those patients. This study aims to investigate the association between SGLT2i therapy and clinical outcomes in patients with ATTR-CM.

Methods: This is an analysis of a prospective registry conducted at an expert center for hypertrophic cardiomyopathies. We included all participants with a confirmed diagnosis of ATTR-CM, who were enrolled until December 2022. Prior and concomitant SGLT2i treatment was systemically assessed

	Total n=116	SGLT2i n=51	no SGLT2i n=65	p-value*
Age, *years*	80 (76-82)	80 (76-82)	79 (76-82)	0.650
Female, *n (%)*	17 (15)	5 (10)	12 (19)	0.191
NT-proBNP, *pg/ml*	2844 (1519-5033)	3224 (1949-4738)	2718 (1182-5050)	0.401
Troponin T, *pg/ml*	56 (34-83)	59 (36-87)	56 (31-81	0.543
eGFR, *ml/min/1,73m2*	58 (46-69)	58 (39-68)	59 (48-70)	0.478

Fig. 1 Baseline characteristics by treatment group. Values in median (interquartile range). *P-values derived from Wilcoxon-ranks sum tests. NT-proBNP: N-terminal pro-brain natriuretic peptide, eGFR: estimated glomerular filtration rate

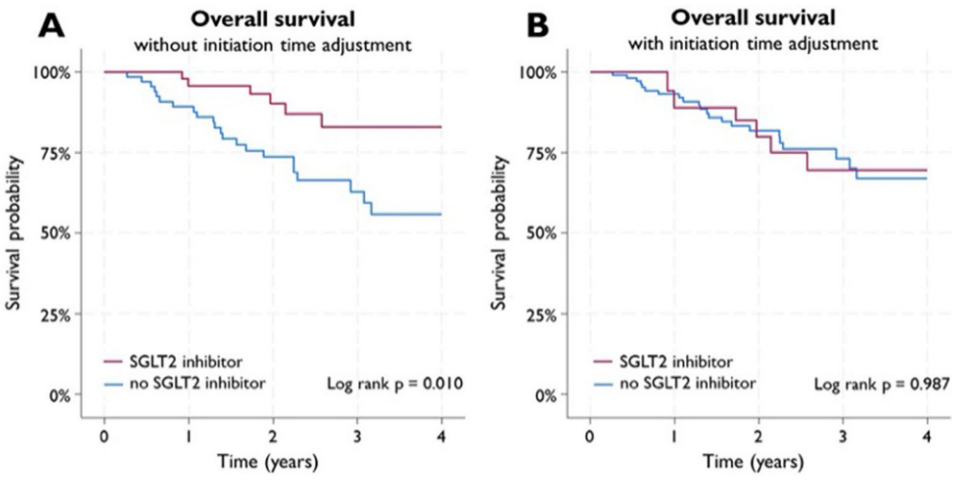

Fig. 2 Cumulative survival probability according to treatment group, (A) unadjusted and (B) adjusted for treatment initiation time. SGLT2: Sodium-glucose co-transporter 2

according to the patient interview and medical records. Patients' outcomes were retrieved from local medical and health insurance records.

Results: We enrolled 116 patients, of whom 7 patients (6%) were treated with SGLT2i at inclusion and 44 patients (38%) were started on SGLT2i therapy during the observational period while 65 patients (56%) were SGLT2i-naïve. There were no significant differences in baseline characteristics between groups, as shown in the table. Median (interquartile range) age was 80 (76–82) years with 15% females. Median N-terminal pro-brain natriuretic peptide (NT-proBNP) was 2844 (1519–5033) pg/ml, median troponin T 56 (34–83) pg/ml, and median estimated glomerular filtration rate (eGFR) 58 (46–69) ml/min/1,73 m2. During a median follow-up of 2.6 (1.8–3.7) years, 28 patients (24%) died, of whom 6 patients (5%) were in the treatment group and 22 patients (19%) in the control group. In univariate Cox-regression analysis, SGLT2i treatment was significantly associated with a lower mortality (HR 0.325, 95%CI 0.132-0.802, p = 0.015). This association persisted after adjusting for age and sex (HR 0.347, 95%CI 0.139-0.867, p = 0.023). However, when treatment initiation time was considered, the benefit did not remain statistically significant. No significant associations between SGLT2i treatment and worsening heart failure hospitalizations or cardiovascular death were observed.

Conclusion: In a prospective registry-based cohort of patients with ATTR-CM, SGLT2i therapy was associated with significantly better survival, with a potential treatment initiation time bias. These results suggest that SGLT2i may exert beneficial effects in patients with ATTR-CM and warrant a randomized controlled trial.

POSTERSITZUNG 14 – RISIKOFAKTOREN/ STOFFWECHSEL/LIPIDE 1

14-1

Biomarkers of Personalised Medicine (BioPersMed): a single-center prospective observational cohort study

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Introduction: Cardiovascular, endocrine, and metabolic diseases represent the most important causes of disability and premature death worldwide. For instance, the prevalence of heart failure is ever increasing over the past decades, as well as numbers of type 2 diabetes mellitus. Primary prevention has the potential to avoid both onset and progression of cardiovascular and metabolic diseases, as well as related complications.

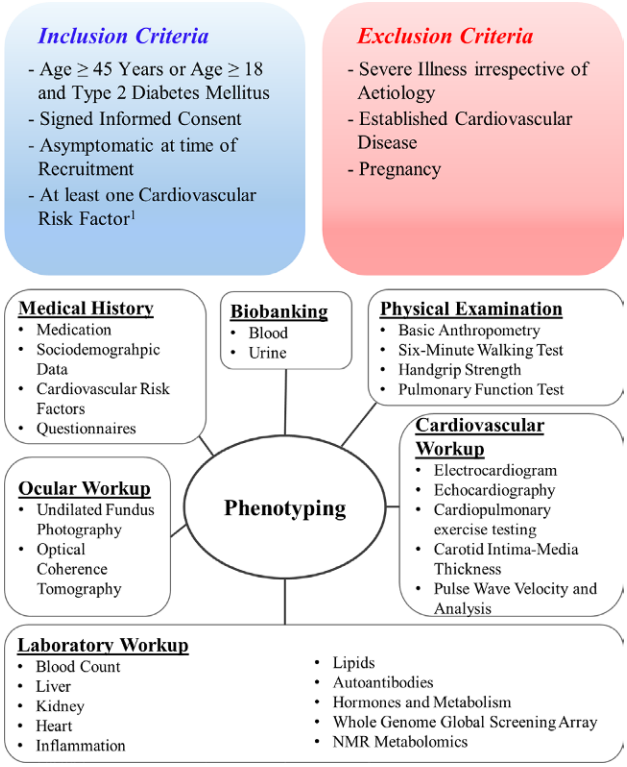

Fig. 1 Phenotyping and biosampling of the BioPersMed cohort

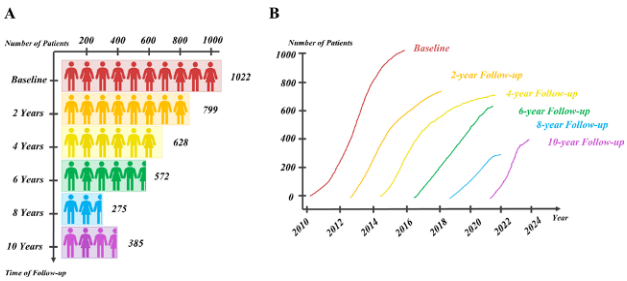

Fig. 2 Recruitment and follow-up status of participants over time

Therefore, early detection of asymptomatic patients at high cardiovascular and/or metabolic risk is a crucial step to minimize cardiovascular and metabolic related morbidity and mortality. New biomarkers are warranted to enhance the understanding of underlying mechanisms in disease development and to establish a precise estimation of individual risk. We present the design and methods of the Biomarkers of Personalised Medicine (BioPersMed) prospective observational cohort study.

Methods: The BioPersMed study is a single-center prospective observational cohort study. Between 2010 and 2016, a total of 1022 regional individuals aged 45 or older were enrolled. Only subjects without diagnosed cardiovascular disease but with at least one traditional cardiovascular risk factor according to the European Guidelines on Cardiovascular Disease Prevention [1] were eligible to participate (Fig. 1). In-depth phenotyping was performed at baseline and repeated every 2 years, in addition to interim telephone visits in between. Procedures comprised medical history, various questionnaires, physical examination, exercise testing, echocardiographic examination, assessment of vascular status, pulmonary function testing, ophthalmologic examination, and bone and hormonal biomark-

ers. Furthermore, blood- and urine-sampling was performed at each visit, and samples are stored at a local biobanking facility in aliquots at –80 °C (Fig. 1).

Results: The study currently covers a follow-up period of 10 years, 385 (38%) participants have completed the latest follow-up until March 2024 (Fig. 2). In accordance with the study design, participants will be followed up for the next decades and clinical outcomes will be determined prospectively. Multiple scientific cooperations with national and international partners are ongoing.

Conclusion: We present the BioPersMed study, a single-center prospective observational cohort, comprising participants with at least one cardiovascular risk factor at baseline, with a current follow-up period of up to 10 years. The study comprises the joint evaluation of both cardiovascular, endocrine, and metabolic phenotyping, including a broad spectrum of laboratory, imaging, and functional tests. This variety of assessed biomarkers allows an extensive phenotyping of individuals at risk. Stored blood- and urine-samples will serve for future biomarker assessment for individual cardiovascular and metabolic risk estimation to conduct innovative cross-sectional and longitudinal epidemiological analyses.

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14-2

"Remnant" Cholesterol predicts Residual Risk for Mortality and Non-Fatal Events in Coronary Artery Disease

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Introduction: Remnant cholesterol (RC), defined as serum non-HDL-non-LDL cholesterol, has attracted recent scientific interest as a candidate lipid factor to assess residual cardiovascular risk. Despite a rising amount of epidemiologic information, there are imprecisions because data are gained from non-fasting, frozen and calculated samples.

Methods: We enrolled 1481 consecutive patients with angiographically proven CAD and measured RC in strictly fasting, non-frozen samples using a direct assay for LDL-C. Prospectively, all-cause mortality, cardiovascular mortality, and major adverse cardiovascular events (MACE) were recorded over a mean follow-up period of 11.6 ± 5.0 years, covering 17180 patient years.

Results: During follow-up, CAD patients had a rate of all-cause mortality of 52.2% (n = 773), of cardiovascular mortality of 20.5% (n = 303), and an incidence of major adverse cardiovascular events (MACE) of 39.0% (n = 578). Prospectively, RC predicted all-cause mortality (HR 1.12 [1.03–1.23], p = 0.009), cardiovascular mortality (HR 1.20 [1.06–1.36], p = 0.005), and MACE (HR 1.10 [1.01–1.21], p = 0.033) in COX regression analyses across various levels of adjustment (age, sex, smoking, LDL-C, HDL-C, hypertension, T2 DM, and BMI). Findings did not differ between women and men. Furthermore, there was no discernible influence of statin treatment.

Conclusion: From our data we conclude that RC is a predictor for all-cause mortality, cardiovascular mortality, and MACE in patients with established coronary artery disease. Proper pre-analytic and analytic methods provided, RC represents a reliable indicator of residual risk with a moderate hazard ratio.

14-3

Telemedizinisches Management der parenteralen Antilipid Therapie: ein kooperatives Pilotprojekt

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Einleitung: In rezent publizierten Leitlinien der ESC wird, basierend auf großen Anti -Lipid Studien, explizit auf eine fortlaufende intensivierte Cholesterin Kontrolle und anzupassende Therapie bei Hoch Risiko KHK Patienten in der Sekundärprävention hingewiesen. Die Möglichkeiten einer effektiven Cholesterinsenkung wurden zuletzt durch die Zulassung einer parenteralen Antikörper basierten Therapie erheblich verbessert. Aufgrund der kritischen post pandemischen personellen und logistischen Situation vieler Krankenhausambulanzen wurde, in Kooperation mit niedergelassenen Facharztkollegen und der Tiroler Ärztekammer, ein Pilot Projekt zur telemedizinischen Prüfung und Empfehlung einer parenteralen Anti-Lipidtherapie erstellt.

Methoden: Das telemedizinische Konzept wurde in 6 kooperative Arbeitsschritte aufgeteilt: 1)digitaler Bezug des Formulars (homepage Univ. Klinik Innsbruck Kardiologie/Angiologie: www.inneremed3.tirol-kliniken.at) 2)Ausfüllen des Formulars mit Diagnosen, rezenten Lipidwerte, aktueller Antilipidtherapie und möglicher Indikation für parenterale Therapie 3)Fax oder digitale Übermittlung an die kardiologische Ambulanz 4) Prüfung der Daten und gegebenfalls Bestätigung der parenteralen Lipidtherapie durch das Team der kardiologischen Ambulanz mit Rücksendung an die Niederlassung 5)Einholen der Bewilligung des Rezepts über den chefärztlichen Dienst durch die zuweisende Ordination 6)Terminvereinbarung mit dem Patienten zur Erstverabreichung und Aufklärung in der zuweisenden Ordination

Resultate: In einer interimistischen Auswertung des Pilotprojekts wurden Machbarkeit und Qualität der ersten 125 Patienten bezüglich Leitlinien gerechter Diagnose, aktuellem LDL-C Wert, Diskrepanz zum zu erreichenden Zielwert und bestehender Therapie in Hinblick auf die korrekte Indikation für parenterale Antilipidtherapie geprüft. 7/125 (5,6 %) Patienten

hatten den Zielwert von 55 mg/dl erreicht, jedoch gleichzeitig eine Statinintoleranz. Alle anderen Patienten hatten, trotz hoch dosierter Statin/Ezetimibe (94 %) und/oder Bempedoinsäure (16 %) den Zielwert nicht erreicht. Die korrekte Diagnose lag in 125 Patienten vor (100 %). Die Statinintoleranzrate lag bei hohen 63 %.

Schlussfolgerungen: Eine rasche, logistisch unkomplizierte telemedizinische Optimierung der medikamentösen Lipidtherapie für Hochrisikopatienten mit bestehender Hyperlipidämie und nicht Erreichen der leitiniengerechten Zielwerte ist möglich und kann qualitätsgesichert durchgeführt werden. Die Kooperation mit dem niedergelassenen Bereich könnte durch dieses Konzept zu einer Entlastung der Krankenhausambulanzen sowie zu einer effektiveren Therapie durch Reduzierung der Patientenwege führen.

14-4

Blood Pressure Response During Exercise Testing in individuals with and without hypertension: the value of the recovery phase

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Introduction: Hypertension and exercise testing are important for cardiovascular risk assessment. However, an exact description of blood pressure (BP) in patients with a hypertensive response during exercise (HRE), especially in the recovery phase are lacking. Recovery offers insight in cardiovascular health and function.This cohort study aimed to analyze BP and heart rate during exercise testing and recovery in patients with a HRE.

Methods: 800 patients aged 17–90 were recruited from the cardiology center of Zurich with a HRE during a standardized bicycle ergometry test with ramp protocols. Systolic and diastolic BP and heart rate were meticulously measured at rest, during various stages until maximal exercise and recovery. Furthermore, date on age, sex, cardiac disease history, and medication prescription was collected.

Results: Of the 800 patients included in this study 497 (63%) were previously diagnosed with hypertension. Patients with hypertension were older (62 vs. 52 years), more often male (69 vs. 57%), had a higher prevalence of coronary artery disease (52 vs. 23%), and were more often on antihypertensive medication. Using analysis of covariance, we found a significant faster systolic (β [95% CI] 8.0 [4.9–11.1]) and diastolic (2.4 [0.4–4.4]) BP recovery 3 minutes after maximal exercise in patients without hypertension in univariable models. These results remained robust in fully adjusted models taking into account age, sex, body mass index, cardiovascular disease, and antihypertensive treatment for systolic (5.3 [1.2–9.4]) and diastolic BP (4.5 [1.9–7.0]). Furthermore, patients with hypertension displayed higher systolic BP during maximal exercise in univariable (3.8 [0.1–7.5]) and fully adjusted (5.5 [1.1–10.0]) models. There was no difference in maximum diastolic BP between groups.

Tab. 1 Baseline characteristics for patients with and without hypertension (n = 800)

	With hypertension n = 497 (62%)	Without hypertension n = 303 (38%)	p-value
Patient characteristics			
Age (years)	62 (20–90)	52 (17–88)	< 0.001
Male	341 (69%)	173 (57%)	< 0.001
BMI (kg/m2)	28.8 (17.6–57.1)	27.0 (15.5–56.2)	< 0.001
Height (cm)	169 (119–197)	170 (148–194)	0.26
Weight (kg)	83 (44–176)	78 (39–174)	< 0.001
Medical history			
Coronary artery disease	259 (52%)	71 (23%)	< 0.001
Heart failure	55 (11%)	25 (8%)	0.20
Valvular heart disease	119 (24%)	73 (24%)	0.96
Diabetes mellitus Type 1 and 2	129 (26%)	24 (8%)	< 0.001
Obstructive sleep apnea syndrome	22 (4%)	10 (3%)	0.43
Positive family history for hypertension	100 (20%)	51 (17%)	0.40
Medication history			
ACE-I/ARB	387 (78%)	63 (21%)	< 0.001
Antiplatelet agents	305 (61%)	109 (36%)	< 0.001
Statins	300 (60%)	92 (30%)	< 0.001
Beta blockers	294 (59%)	82 (27%)	< 0.001
Diuretics	195 (39%)	31 (10%)	< 0.001
Calcium channel blocker	175 (35%)	13 (4%)	< 0.001
Oral anticoagulants	71 (14%)	35 (12%)	0.40

Data are shown as mean and standard deviation or median and interquartile range if skewed. Categorical data are shown as numbers and percentages. p-values are based on Mann-Whitney-U-test, ANOVA, chi square tests, or Fischer's exact test as appropriate.
Abbreviations: ACE-I = angiotensin converting enzyme inhibitor, ARB = angiotensin receptor blocker, BMI = body mass index

Conclusion: In this large cohort study, there was a faster systolic and diastolic BP recovery and lower maximal systolic BP in patients without hypertension, even when considering antihypertensive medication. Overall, this study provides new insights into cardiovascular health during recovery phase.

Tab. 2 Exercise test parameters for patients with and without hypertension (n = 800)

	With hypertension n = 497 (62%)	Without hypertension n = 303 (38%)	p-value
Systolic blood pressure (mmHg)			
Syst. BP at rest ≥ 140 mmHg	213 (43%)	61 (21%)	< 0.001
Syst. BP at rest	136 (± 19)	126 (± 17)	< 0.001
Syst. BP ex. 1 min.	144 (± 21) *	132 (± 18) *	< 0.001
Syst. BP ex. 3 min.	164 (± 26) *	151 (± 23) *	< 0.001
Syst. BP ex. peak	208 (± 24)	201 (± 23)	< 0.001
Syst. BP rec. 1 min.	190 (± 30) *	181 (± 27) *	< 0.001
Syst. BP rec. 3 min.	173 (± 26) *	160 (± 24) *	< 0.001
Diastolic blood pressure (mmHg)			
Dia. BP at rest ≥ 90 mmHg	129 (26%)	55 (18%)	< 0.001
Dia. BP at rest	85 (± 13) *	80 (± 11)	0.16
Dia. BP ex. 1 min	82 (± 15) *	78 (± 11) *	< 0.001
Dia. BP ex. 3 min	85 (± 14) *	82 (± 14) *	0.01
Dia. BP ex. peak	97 (± 20) *	94 (± 19) *	0.67
Dia. BP rec. 1 min	86 (± 15) *	84 (± 15) *	0.03
Dia. BP rec. 3 min	80 (± 14) *	77 (±12) *	0.006
Heart rate (bpm)			
HR rest	75 (± 15)	77 (± 14) *	0.001
HR at 1 min. ex.	89 (± 16)	92 (± 16)	< 0.001
HR at 3 min. ex.	103 (± 19) *	106 (± 18) *	< 0.001
Peak HR (bpm)	138 (± 25)	151 (± 24)	< 0.001
Peak HR % calc. max.	93 (± 17)	95 (± 15)	0.10
HR at 1 min. rec.	113 (± 23) *	124 (± 22)	0.43
HR at 3 min. rec.	96 (± 20) *	104 (± 19) *	< 0.001
Heart rate recovery (bpm)			
at 1 min (fast)	25 (± 19) *	26 (± 16) *	0.001
at 3 min (slow)	42 (±20 *	47 (± 17) *	< 0.001
Rate pressure product			
Syst BP at rest x HR at rest (mmHg/min)	10135 (± 2520) **	9793 (± 2396) **	0.08
peak Syst. BP x peak HR (mmHg/min)	28824 (± 6586) **	30400 (± 5966) **	< 0.001
Rate pressure quotient	2.97 (± 0.88)	3.25 (± 0.89)	< 0.001
Performance			
Max. Watt (W)	126 (± 46) **	129 (± 50) **	0.01
Max. Watt in % of calc. max.	83 (± 24) **	93 (± 29) **	< 0.001

Data are shown as mean and standard deviation. Categorical data are shown as numbers and percentages. p-values are based on ANOVA, chi square tests, or Fischer's exact test as appropriate.
Abbreviations: BP = blood pressure, bpm = beats per minute, Dia. = diastolic, ex = exercise, HR = heart rate, rec = recovery, Syst. = systolic, W = watt
* = due to methodical and technical issues some patients did not have complete BP measurements at certain points in time, accounting on average in each group 4.2%.
** = due to methodical and technical issues some patients did not have complete BP or HR measurements at rest.

14-5

Neuropathy, excess ventilation and autonomic dysfunction in ATTR-CM

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Introduction: Transthyretin amyloidosis with cardiomyopathy (ATTR-CM) is a complex infiltrative disorder that impacts the heart and nervous system. Progressive neuropathy (AN) is common in those patients and in close relation to autonomic dysfunction (AD). Reduced ventilatory efficiency in heart failure, depicted by a high minute ventilation to carbon dioxide production slope (VE/VCO2) can be partly linked to chemoreceptor hypersensitivity and consecutively AD. Therefore, we hypothesize a correlation between AN and VE/VCO2 Slope in patients with ATTR-CM displaying a surrogate for AD.

Methods: Patients with ATTR-CM underwent cardiopulmonary exercise testing (CPET) evaluating VE/VCO2 slope and electroneurography (ENG) evaluating AN. Spearman correlations for CPET and ENG parameters were calculated, followed by grouping into prognostic significant VE/VCO2 slope cutoffs above and below 40.

Results: The study included 20 patients, with a mean age of 77 years, 95% male, with a mean body mass index of 25, received optimal medical treatment, including disease-specific therapy. The median of N-terminal prohormone of brain natriuretic peptide levels was 1387 ng/l (190–6300) and the mean troponin T levels were 46 ng/dl (± 27). Comorbidities include atrial fibrillation (65%), carpal tunnel syndrome (45%) and Diabetes Mel-

Demographics, comorbidities, medical history and medication in ATTR-CM patients undergoing CPET and ENG testing.	
Demographics (n=20)	
Age, mean (SD)	77 (6)
Male sex, n (%)	19 (95)
Hight, cm, mean (SD)	172 (8)
Weight, kg, mean (SD)	76 (12)
BMI, kg/m2, mean (SD)	25 (3)
NT-proBNP, ng/l, median (range)	1387 (190-6300)
Troponin, ng/dl, mean (SD)	46 (27)
Comorbidities and medical history (n=20)	
Atrial fibrillation, n (%)	13 (65)
Diabetes mellitus, n (%)	4 (20)
Carpal tunnel syndrome, n (%)	9 (45)
Medication (n=20)	
Tafamidis, n (%)	20 (100)
Beta receptor antagonists, n (%)	6 (30)
ACEi/AT1i, n (%)	10 (50)
Mineralocorticoid receptor antagonists, n (%)	7 (35)
Pregabalin, n (%)	2 (10)

Fig. 1 Demographics; CPET, cardiopulmonary exerrise testing; ATTR-CM, transthyretin amyloid cardiontyopathy; ENG, electroneurography; ACEi, angiotensin convening enzyme inhibitor; Am, angiotensin receptor I inhibitor; BMI, body-mass index; SD, standard deviation; NT-proBNP, N-terminal prohormone of brain nalriuretic peptide; A7TRwt, transthyretin-amyloidosis wild type with cardiomyopathy

litus (20%). Spearman correlation showed a coefficient for VE/CO2 slope and tibial nerve conduction velocity of 0.03 [p-value 0.9], compound muscle action potential (CMAP) proximal tibial amplitude of 0.038 [p-value 0.875], CMAP distal tibial amplitude of 0.099 [p-value 0.679] and sensory nerve action potential (SNAP) sural amplitude of 0.217 [p-value 0.359]. Patients with a VE/VCO2 slope < 40 had a CMAP proximal tibial amplitude of 7.3 mV, a CMAP distal tibial amplitude of 10.9 mV and a SNAP sural amplitude of 7.5 μV compared to patients with a VE/VCO2 slope > 40 with 5.3 mV, 8 mV and a 9.7 μV respectively.

Conclusion: Evaluating polyneuropathy additionally to ventilatory efficiency in patients with ATTR-CM may allow identification of mechanisms influencing autonomic dysfunction.

14-6

A Comparative Analysis of Open Heart Surgery, Minimally Invasive Cardiac Surgery, and Percutaneous Procedures in Exercise-Based Cardiac Rehabilitation

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Introduction: Historically, the majority of patients admitted to inpatient exercise-based cardiac rehabilitation (EBCR) have undergone open heart surgery (OHS). However, with advances in minimally invasive cardiac surgery (MICS) and percutaneous procedures (PP), these patient groups are also increasingly referred for inpatient EBCR. Herein, we aimed to compare the progress of these groups during rehabilitation.

Methods: In this prospective, nonrandomized study, 480 inpatient EBCR patients were recruited from December 2022 until September 2023 and stratified into three groups: OHS, MICS, and PP. Participants completed a 3-4-week certified EBCR program. The primary endpoint was defined as a change in the 6-minute walk test (6 MWT). Moreover, a comprehensive panel of quality-of-life (QoL) assessments were performed at admission and discharge.

Results: At baseline, patients with PP were older (73 years [interquartile range (IQR) 59–81]), more often male (68%), and underwent emergency/urgent procedures more often (67%) than patients with OHS (66 years [IQR 59–72], 83% male, 20% emergency/urgent operation) and MICS (63 years, 75% male, 8% emergency/urgent operation). Furthermore, patients with MICS showed a better 6 MWT at admission (426 meters [IQR 336–483]) compared to patients with OHS (381 meters [IQR 299–453]) or PP (388 meters [IQR 260–530]). While all patients were able to increase the distance in the 6 MWT, regression analyses in fully adjusted models showed significantly smaller improvements in patients with PP than in patients with OHS (β 33, 95% CI, 10 – 56, p = 0.006) and MICS (β 38, 95% CI, 12–65, p = 0.004). Improvements in the 6 MWT for patients after OHS and MICS did not differ. Moreover, during EBCR, we observed significant improvements in all QoL measures in all groups.

Conclusion: In this study, improvements in fitness, as assessed by the 6WMT were observed in all groups, but were more pronounced in patients after OHS and MICS. Furthermore, multiple QoL measures improved equally across all groups. These encouraging results emphasize the importance of EBCR.

14-7

Exercise-Based Cardiac Rehabilitation for Eosinophilic Granulomatosis with Polyangiitis associated Eosinophilic Myocarditis: A Case Report

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Introduction: Eosinophilic granulomatosis with polyangiitis (Churg-Strauss, EGPA) is a rare systemic necrotizing vasculitis often characterized by asthma, hypereosinophilia and peripheral neuropathy. This case documents exercise-based cardiac rehabilitation (CR) for EGPA-associated eosinophilic myocarditis (EM) and thus provides the first evidence on safety and efficacy of moderate physical activity for EGPA-associated EM.

Methods: A 61-year-old man was referred for exercise-based CR due to EGPA-associated EM. Echocardiography revealed heart failure with a reduced ejection fraction (HFrEF) of 40%. The patient also suffered from eosinophilic bronchial asthma. At admission, the patient reported reduced physical performance. Laboratory chemistry initially showed a significantly elevated level of N-terminal pro-B-type natriuretic peptide (NT-proBNP) of 7895 ng/l. Immunosuppressive therapy with prednisolone, cyclophosphamide, and mesna was administered. In addition, heart failure therapy was increased to the maximal tolerated dose. The exercise-based CR lasted 31 days and included progressively increased endurance units on cycle ergometer, outdoor walks, gymnastics, and individualized strength training units. All training sessions were carried out at moderate intensity corresponding to level 12–13 on the Borg's rating of perceived exertion scale.

Results: During a 6-minute walk test, the patient reached 561 m at admission and 642 m at discharge. Furthermore, an improvement in EF to 50% and a reduction in NT-proBNP of more than 50% were observed at discharge.

Conclusion: We present a case of one-month exercise-based CR for EGPA-associated EM. The case suggests that supervised moderate-intensity physical exercise can be safely performed by patients with EGPA-associated EM and leads to significant positive changes in relevant disease-specific parameters.

POSTERSITZUNG 15 – AKUTES KORONARSYNDROM 2

15-1

Growth Differentiation Factor 15 Is Associated with Platelet Reactivity in Patients with Acute Coronary Syndrome

Mutschlechner D.[1,2,3], Tscharre M.[4,2], Wadowski P.[5], Pultar J.[6], Weikert C.[5], Lee S. [5], Eichelberger B.[5], Panzer S. [5], Perkmann T.[5], Gremmel T.[1,3,3]

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Introduction: Bleeding events in patients with acute coronary syndrome (ACS) are a risk factor for adverse outcomes, including mortality. We investigated the association of growth differentiation factor (GDF)-15, an established predictor of bleeding complications (1), with on-treatment platelet reactivity in 206 ACS patients undergoing coronary stenting receiving prasugrel or ticagrelor.

Methods: Platelet aggregation was measured by multiple electrode aggregometry (MEA) in response to adenosine diphosphate (ADP), arachidonic acid (AA), thrombin receptor-activating peptide (TRAP, a protease-activated receptor-1 (PAR-1) agonist), AYPGKF (a PAR-4 agonist) and collagen (COL). GDF-15 levels were measured using a commercially available assay.

Results: GDF-15 correlated inversely with MEA ADP ($r=-0.202$, $p=0.004$), MEA AA ($r=-0.139$, $p=0.048$) and MEA TRAP ($r=-0.190$, $p=0.007$). After adjustment, GDF-15 was significantly associated with MEA TRAP ($b=-0.150$, $p=0.044$), whereas no significant associations were detectable for the other agonists. Patients with low platelet reactivity in response to ADP had significantly higher GDF-15 levels ($p=0.005$).

Conclusion: In conclusion, GDF-15 is inversely associated with TRAP-inducible platelet aggregation in ACS patients treated with state-of-the-art antiplatelet therapy and significantly elevated in patients with low platelet reactivity in response to ADP.

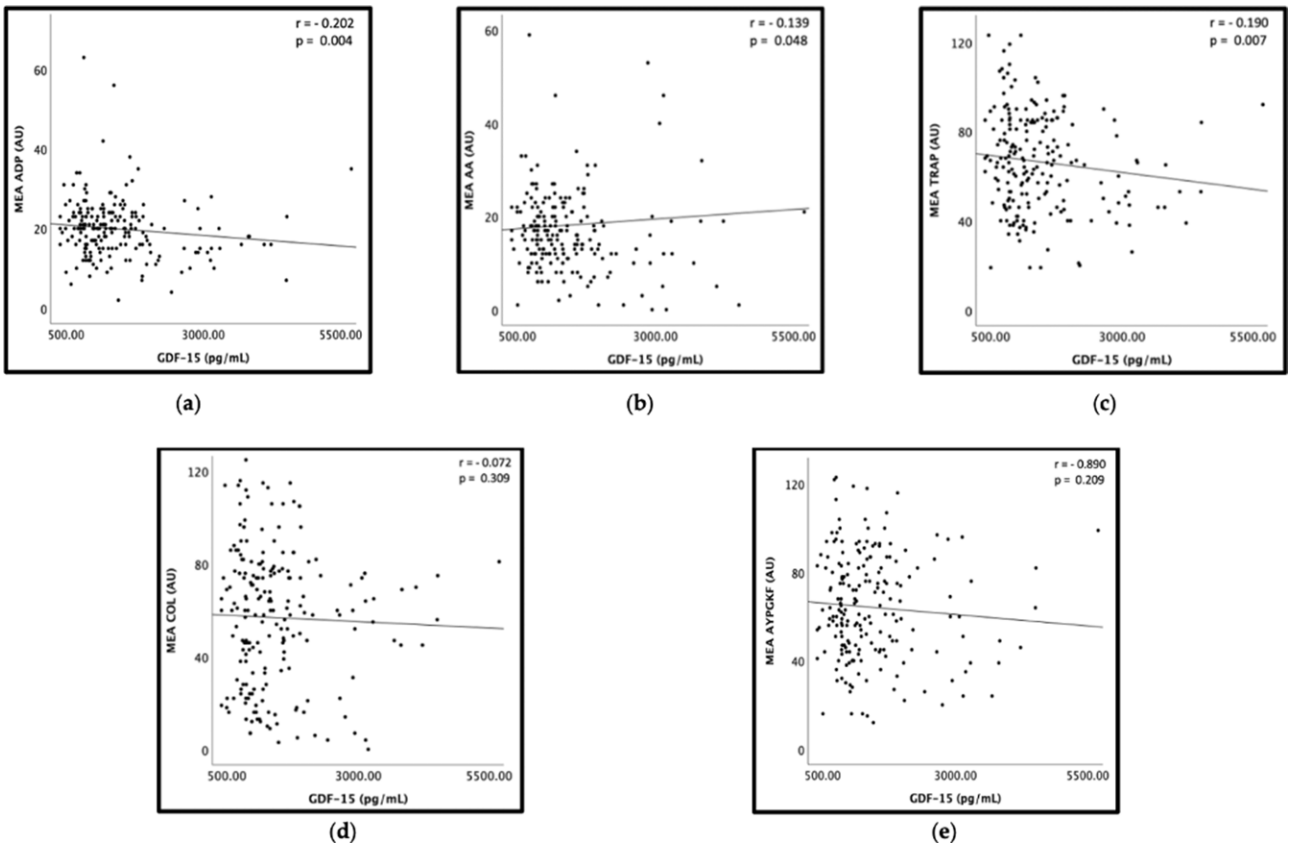

Fig. 1 Correlations of GDF-15 with platelet aggregation by multiple electrode aggregometry (MEA). (a) Scatter plot showing GDF-15 (x-axis) versus adenosine diphosphate (ADP)-inducible platelet ag-gregation by MEA (y-axis). (b) Scatter plot showing GDF-15 (x-axis) versus arachidonic acid (AA)-inducible platelet aggregation by MEA (y-axis). (c) Scatter plot showing GDF-15 (x-axis) versus thrombin receptor-activating peptide (TRAP)-inducible platelet aggregation by MEA (y-axis). (d) Scatter plot showing GDF-15 (x-axis) versus collagen (COL)-inducible platelet ag-gregation by MEA (y-axis). (e) Scatter plot showing GDF-15 (x-axis) versus AYPGKF-inducible platelet aggregation by MEA (y-axis)

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15-2

Elderly patients are hyperresponsive to potent P2Y12 inhibitors

Mutschlechner D.[1,2,3], Tscharre M.[4,2], Wadowski P.[5], Lee S. [5], Pultar J.[6], Weikert C.[5], Panzer S. [5], Gremmel T.[1,3,3]

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Introduction: Aging has recently been associated with increased basal platelet activation and adenosine diphosphate (ADP) hyperreactivity on the one hand, but decreased platelet response to thrombin receptor stimulation on the other hand in individuals without antiplatelet therapy. In the current study, we investigated platelet response to agonist stimulation in elderly patients (70 years or older) on dual antiplatelet therapy with potent P2Y12 inhibitors.

Methods: Platelet aggregation in response to arachidonic acid (AA), ADP, collagen, the protease-activated receptor (PAR)-1 agonist SFLLRN and the PAR-4 agonist AYPGKF was assessed by multiple electrode aggregometry in 79 prasugrel- and 77 ticagrelor-treated patients 3 days after acute percutaneous coronary intervention.

Results: In the overall study population (n = 156), patients aged ≥ 70 years (n = 33) had lower platelet aggregation in response to AA, ADP and SFLLRN than younger patients (all $p < 0.05$). In prasugrel-treated patients (n = 79), those aged ≥ 70 years (n = 13) showed significantly lower platelet aggregation in response to all agonists compared to younger patients (all $p < 0.05$). In contrast, in ticagrelor-treated patients (n = 77), those aged ≥ 70 years (n = 20) only had significantly lower ADP-inducible platelet aggregation than younger patients ($p = 0.03$), whereas platelet aggregation in response to AA, collagen, SFLLRN and AYPGKF was similar between elderly and younger patients on ticagrelor (all $p > 0.05$). Among patients aged ≥ 70 years, prasugrel-treated patients showed significantly lower platelet aggregation in response to AA, collagen and AYPGKF than those receiving ticagrelor (all $p < 0.05$).

Conclusion: Patients aged ≥ 70 years on potent P2Y12 inhibitors exhibit increased inhibition of ADP-inducible platelet aggregation. In addition, elderly patients on prasugrel show

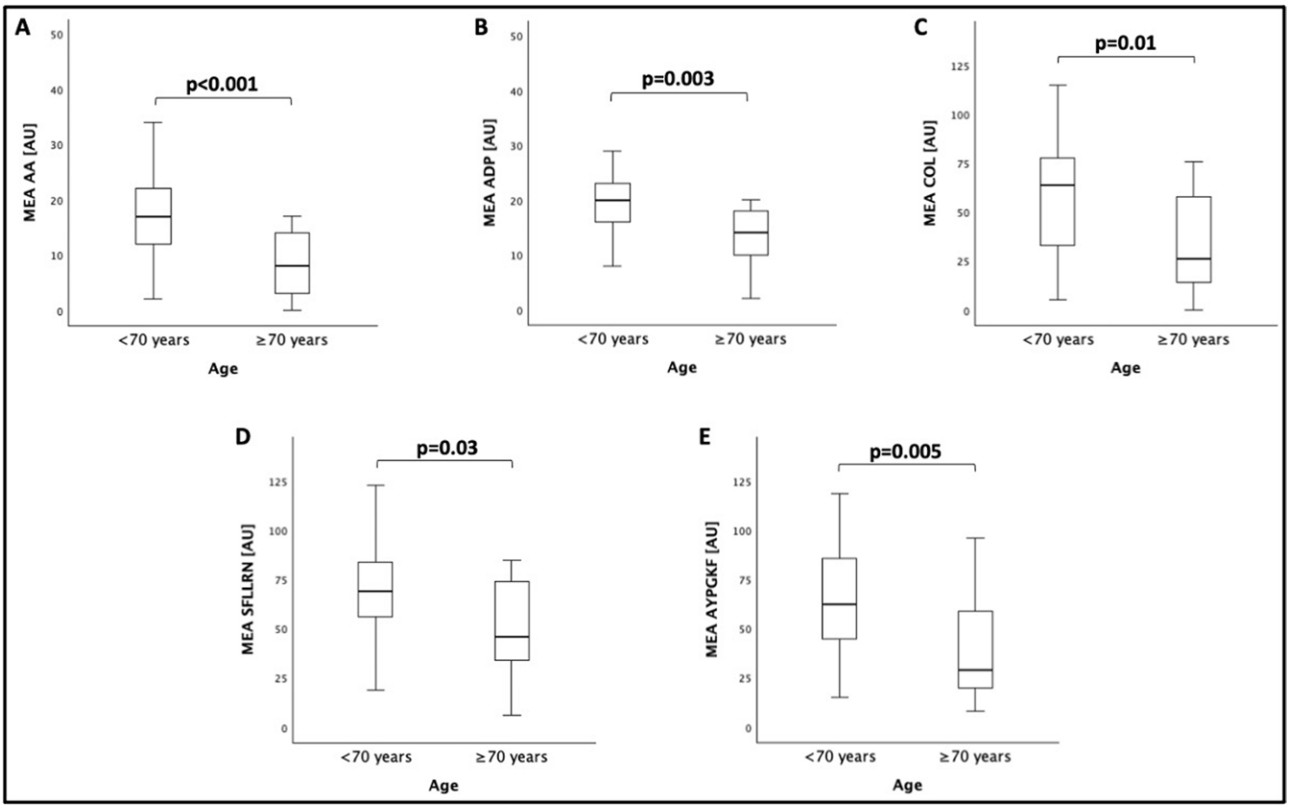

Fig. 1 Platelet aggregation in aggregation units (AU) by multiple electrode aggregometry (MEA) in response to A) arachidonic acid (AA), B) adenosine diphosphate (ADP), C) collagen (COL), D) SFLLRN, E) AYPGKF in prasugrel-treated patients < 70 years versus ≥ 70 years

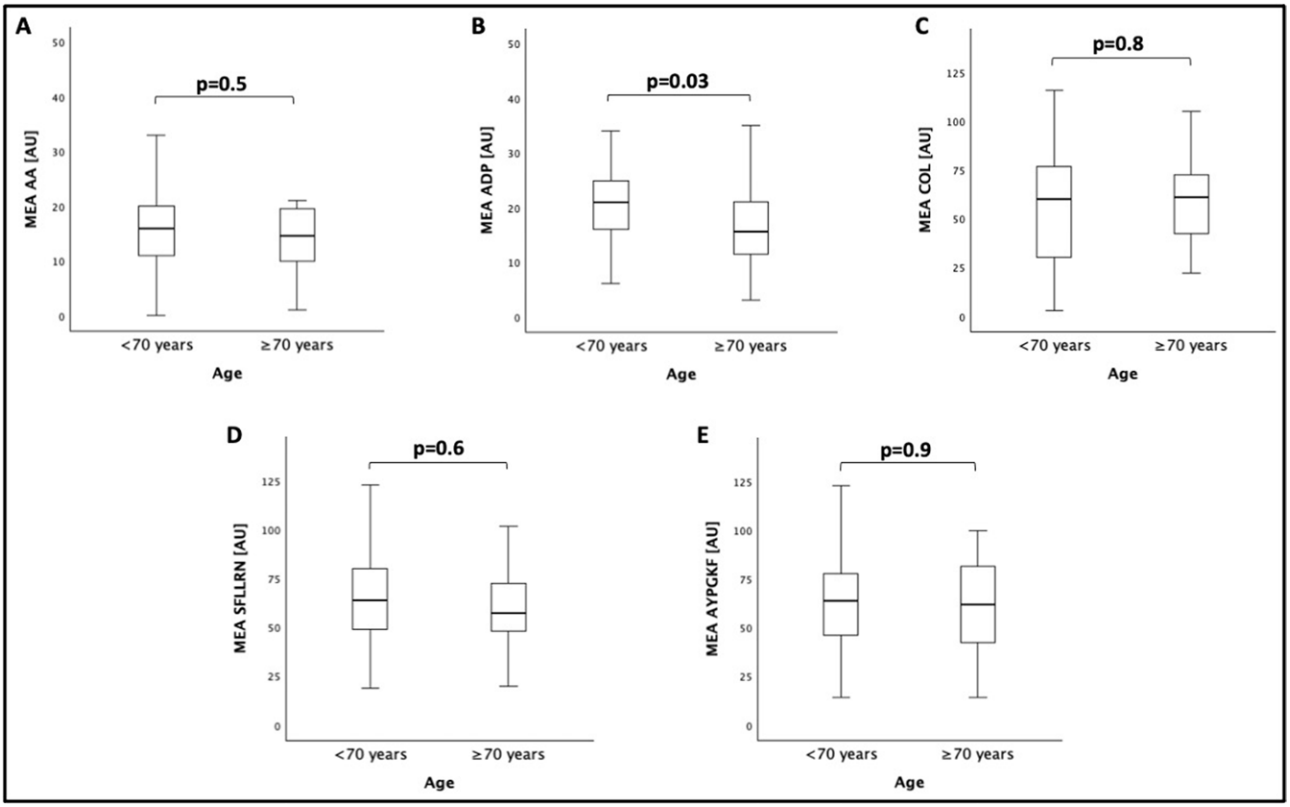

Fig. 2 Platelet aggregation in aggregation units (AU) by multiple electrode aggregometry (MEA) in response to A) arachidonic acid (AA), B) adenosine diphosphate (ADP), C) collagen (COL), D) SFLLRN, E) AYPGKF in ticagrelor-treated patients <70 years versus ≥70 years

a significantly lower response to AA, collagen, SFLLRN and AYPGKF than younger patients.

15-3

Produktprobleme von Labortests zur Diagnostik in der Kardiologie – Analyse der 2014 bis 2023 vom BfArM veröffentlichten Kundeninformationen

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Einleitung: Vermarktung und Marktüberwachung von Medizinprodukten und In-vitro Diagnostika (IVD) sind in Europa durch europäische Direktiven (z. B. Verordnung (EU) 2017/745 über Medizinprodukte, Verordnung (EU) 2017/746 über In-vitro-Diagnostika (IVD)) geregelt. Bei Vorkommnissen und korrektiven Maßnahmen (Field Safety Corrective Action, FSCA) müssen die Hersteller diese den zuständigen nationalen Behörden (Competent Authority (CA); in Deutschland: Bundesinstitut für Arzneimittel und Medizinprodukte (BfArM) für Medizinprodukte und die meisten IVD, in Österreich: BASG) melden und die Kunden über Kundeninformationen (Field Safety Notice, FSN) informieren, die auch den Behörden zur Verfügung gestellt werden. IVD sind von zentraler Bedeutung bei Diagnostik und Monitoring akuter und chronischer kardialer Erkrankungen, z. B. Myokardinfarkt/Myokarditis und Herzinsuffizienz. Ziel der Studie war die Untersuchung von FSN/FSCA von in der kardiologischen Diagnostik eingesetzten IVD in Hinblick auf vorliegende Produktprobleme, damit einhergehende Risiken und Art der FSCA. Eingeschlossen wurden Tests, Kalibratoren und Kontrollmaterialien, nicht jedoch Analyzer und allgemeine Verbrauchsmaterialien.

Methoden: Für die in die Studie eingeschlossenen IVD erfolgte eine Analyse der vom BfArM 2014 bis 2023 auf der Homepage (http://www.bfarm.de/DE/Medizinprodukte/risk-info/kundeninfo/functions/kundeninfo-node.html) publizierten FSCA und FSN.

Resultate: Es fanden sich 72 FSCA im Untersuchungszeitraum, betreffend (mult. Entries) die Parameter TnI: 23, CK-MB: 20, NT-proBNP: 15, Myoglobin: 14, BNP: 7, TnT: 6, HBDH: 2 und proANP: 1. Häufigste Produktprobleme waren (multiple Entries) falsch-hohe/falsch-positive (27), falsch-niedrige/falsch-negative (18) allgemein fehlerhafte (15) und ungültige/fehlende Testergebnisse (6), Interferenzen (12; Sulfasalazin/Sulfapyridin (6), Biotin (4), Lipämie (1), EDTA (1)), Stabilitätsprobleme (13), Kalibrationsfehler/-versagen mit fehlenden/verzögerten Testergebnissen (11) und Änderungen der Zielbereiche von Kontrollmaterialien/Kalibratoren (6), teils mit Hinweisen auf vorangegangene Kundenbeschwerden (5). Typische korrektive Maßnahmen waren produkt- und fehlerabhängig (mult. Entries) Kundeninformationen (72, oft mit ausführlichen Maßnahmenempfehlungen (38) und Aussagen zur Retestung (empfohlen: 8, nicht erforderlich: 11)), Rückruf/Vernichtung der Reagenzien (33; Kundeninformation obligat), Änderung der Gebrauchsanweisung (16), Verkürzung der Produkthaltbarkeit (6), Änderung der Zielwerte von Kalibratoren/Kontrollmate-

rialien (4), Überprüfung und Änderungen der Produktion (4), Änderungen in der Testapplikation auf dem Analyzer (2, ggf. auch Software) und Materialänderungen (1).

Schlussfolgerungen: FSCA zu Labortests der kardiologischen Diagnostik stellen eine wichtige Gruppe aller FSCA zu IVD dar. Betroffen sind IVD zur Diagnostik von akuten Myokardschäden (meist Troponin, CK-MB, Myoglobin) und Herzinsuffizienz (NT-proBNP, BNP). Typische Produktprobleme sind Werteabweichungen und falsch-positive/falsch-negative Werte (z. B. durch Stabilitätsprobleme und Interferenzen) und fehlerhafte Zielwerte von Kalibratoren und Kontrollen. Häufigste korrektive Maßnahmen sind Maßnahmenempfehlungen und Rückruf. FSN leisten bei FSCA einen wichtigen Beitrag zur Verminderung vom Produkt ausgehender Risiken. Das Europäische Marktüberwachungssystem leistet einen wichtigen Beitrag zur Verbesserung der Sicherheit von IVD.

15-4

Relation of plasma neuropeptide-Y with myocardial function and infarct severity in acute ST-elevation myocardial infarction

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Introduction: Acute myocardial infarction is associated with high levels of cardiac sympathetic stimulation, which leads to the release of the co-transmitter neuropeptide-Y (NPY). NPY acts as a potent vasoconstrictor and an association with increased risk for heart failure and microvascular dysfunction after acute ST-elevation myocardial infarction (STEMI) has been suggested. This study comprehensively evaluated the association of plasma NPY with myocardial function and infarct severity, visualized by cardiac magnetic resonance (CMR) imaging, in STEMI patients revascularized by primary percutaneous coronary intervention (PCI).

Methods: In this observational study, we included 260 STEMI patients enrolled in the prospective MARINA-STEMI (Magnetic Resonance Imaging in Acute ST Elevation Myocardial Infarction; NCT04113356) study. Plasma NPY concentrations were measured by an immunoassay 24 h after PCI from peripheral venous blood samples. Left ventricular ejection fraction (LVEF), global longitudinal strain (GLS), infarct size (IS) and microvascular obstruction (MVO) were determined using CMR imaging 4 days and 4 months after PCI.

Results: Median plasma concentrations of NPY were 70 [interquartile range (IQR): 35–115] pg/ml. NPY levels above median were significantly associated with lower LVEF (48% vs. 52%, $p = 0.004$), decreased GLS (−8.8% vs. −12.6%, $p < 0.001$) and larger IS (17% vs. 13%, $p = 0.041$) in the acute phase after infarction as well as in the chronic stage (LVEF: 50% vs. 52%, $p = 0.030$, GLS: −10.5 vs. −12.9, $p < 0.001$, IS: 13% vs. 10%, $p = 0.011$). In addition, NPY levels were significantly related to presence of MVO (58% vs. 52%, $p = 0.041$). Moreover, in multivariable linear regression analysis, NPY remained significantly associated with all investigated CMR parameters (LVEF: $p < 0.001$, GLS: $p < 0.001$, IS: $p = 0.003$, MVO: $p = 0.042$) independent of other established clinical variables including high-sensitivity cardiac troponin T, pre-interventional TIMI flow 0 and left anterior descending artery as culprit lesion location.

Conclusion: High plasma levels of NPY, measured 24 h after STEMI, were independently associated with lower LVEF, decreased GLS, larger IS as well as presence of MVO, indicating plasma NPY as a valuable biomarker for optimized risk stratification.

15-5

Body temperature, systemic inflammation, and risk of adverse events in patients with acute coronary syndromes

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Introduction: Inflammatory processes can trigger acute coronary syndromes (ACS) which may increase core body temperature (BT), a widely available low-cost marker of systemic inflammation. Herein, we aimed to delineate baseline characteristics of STEMI and NSTE-ACS patients stratified by initial BT and to assess its predictive utility toward major adverse cardiovascular events (MACE) across ACS types.

Methods: From 2012 until 2017 a total of 1'044 ACS patients, 517 with STEMI and 527 with NSTE-ACS, were prospectively recruited at the University Hospital Zurich. BT measured by digital tympanic thermometer along with high-sensitivity C-reactive protein (hs-CRP) and cardiac troponin-T (hs-cTnT) were assessed prior to coronary angiography. Patients were stratified according to initial BT, and uni- and multivariable regression models were fit to assess independent associations of initial BT with future MACE risk (i. e., composite of non-fatal stroke, non-fatal myocardial infarction, and death).

Results: At baseline, NSTE-ACS patients had higher hs-CRP compared to those with STEMI (3.2 mg/L vs. 2.2 mg/L, respectively, $p < 0.001$). Among those with STEMI, BT was not predictive of MACE, but a U-shaped relationship between BT and 1-year MACE risk was noted in those with NSTE-ACS ($p = 0.029$), translating into a 2.4-fold (HR, 2.44, 95% CI, 1.16–5.16) increased MACE risk in those with BT > 36.8 °C (reference: 36.6–36.8 °C). Results remained robust in multivariable-adjusted analyses accounting for established risk factors, including sex, age, diabetes, renal function, and hs-cTnT at the time of acute presentation. However, when introducing hs-CRP into the model, the BT-MACE association did not prevail.

Conclusion: In prospectively recruited patients with ACS, initial core BT shows a U-shaped relationship with 1-year MACE risk among those with NSTE-ACS, but not in those with STEMI. Initial BT is a broadly available low-cost marker to identify ACS patients with high inflammatory burden, at high risk for recurrent ischaemic events and thus potentially suitable for an anti-inflammatory intervention.

15-6

Ein Fallbericht von Allergischem Akuten Koronarsyndrom (Kounis Syndrom)

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Einleitung: Ein akutes Koronarsyndrom ausgelöst durch eine allergische Reaktion bzw. anaphylaktischen Schock wird Kounis-Syndrom genannt. Die Krankheit existiert erst seit dem Jahr 1991 als allergische Angina Pectoris in der Literatur. Obwohl es als seltene Erkrankung beschrieben wird, muss man davon ausgehen, dass das Kounis-Syndrom signifikant unterdiagnostiziert ist und die tatsächliche Prävalenz deutlich höher liegt. Zentraler Pathomechanismus des Kounis-Syndroms ist die Freisetzung von Mediatoren durch aktivierte Mastzellen. Die Entzündungsmediatoren induzieren Vasokonstriktion, Vasospasmen, aktivieren Thrombozyten und stoßen die Ausschüttung von Tissue Factor an. Sie können ebenfalls die vorbestehenden Plaques instabil machen. Wir berichten von einem Fall im Rahmen eines anaphylaktischen Schocks auf Pantoprazol.

Methoden: Seit 3 Monaten war der Patient wiederholt in der Notfallambulanz wegen allergischer Reaktionen vorstellig, sodass er 4 Wochen ein Antihistaminikum, ein Cortison und Pantoprazol eingenommen hat. 2 Monate zuvor nahm er Amlodipin und Pantoprazol zu Hause ein und hat mit einem Erythem und Hypotonie reagiert. Er wurde damals mit einem Antihistaminikum und Cortison behandelt. Wegen epigastrischen Schmerzen und einer positiven Familienanamnese wurde ein Myokardinfarkt in Frage gestellt, aber es wurde kein Hinweis gefunden. In Vor-EKGs ist intermittierend ein kompletter Rechtsschenkelblock vorhanden. Angina pectoris und Atemnot wurden negiert. In der Notfallambulanz dieses Mal wurde Pantoprazol i. v. verabreicht. Anschließend klagte er über ein Taubheitsgefühl an den Lippen und Zunge, sodass ein Antihistaminikum und Cortison verabreicht wurden. Der Blutdruck fiel daraufhin ab (70/30 mmHg) und die ICU wurde verständigt. Im EKG fand sich eine Sinustachykardie, ST-Hebungen in II, III, aVF und ein kompletter Rechtsschenkelblock. Inzwischen wurde der Patient mit Flüssigkeit und Vasopressoren behandelt. Nach 15 Minuten kam es zur Stabilisierung der hämodynamischen Situation und der Patient war allseits beschwerdefrei. Die ST-Hebungen und der Rechtsschenkelblock waren rückläufig. In der Echokardiographie fand sich eine diskrete Hypokinesie der Hinterwand, sodass eine Koronarangiographie durchgeführt wurde.

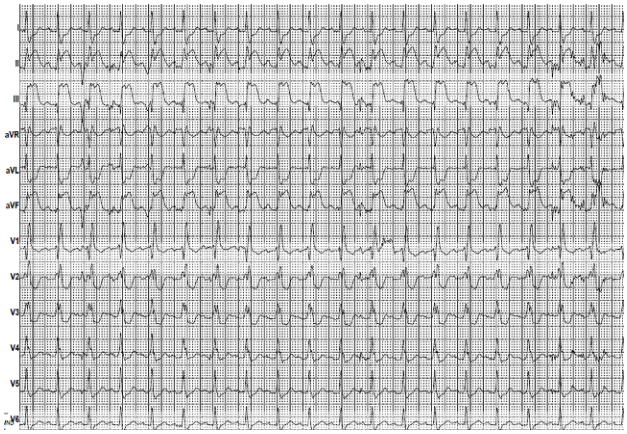

Fig. 1 Anfalls-EKG

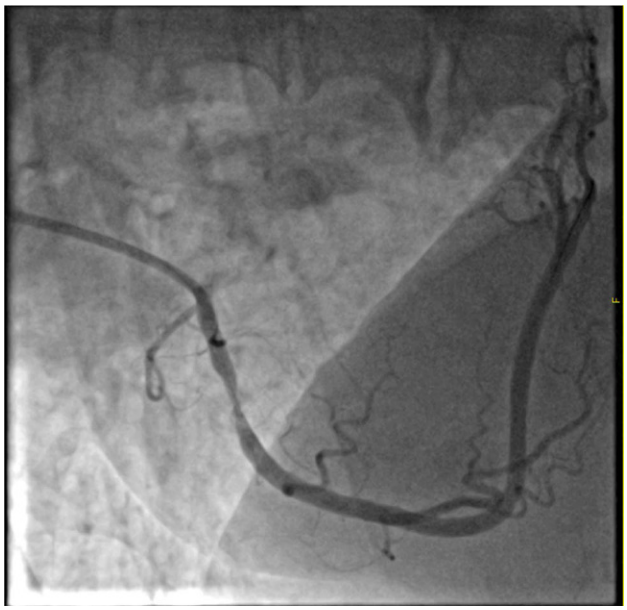

Fig. 2 Koronarangiographie RCA-subtotaler Verschluss

Resultate: Es zeigte sich ein subtotaler Verschluss des proximalen Anteils der rechten Koronararterie, welche wiedereröffnet und mit einem Drug-Eluting-Stent versorgt wurde. Im Verlauf kam es zu einem minimalen Anstieg der Herzenzyme. Das Troponin T war mit maximal 196 ng/L ausgelenkt und die CK war stets im Normbereich.

Schlussfolgerungen: Das Kounis Syndrom wird in 3 verschiedene Typen unterteilt. Beim Typ 1 spielt der Koronarspasmus eine zentrale Rolle und die Koronararterien stellen sich unauffällig dar. Der Typ 2 kommt bei Patienten mit zumindest atherosklerotischen Wandveränderungen vor. Die Ausschüttung vasoaktiver und plättchenaktivierender Botenstoffe führt zu Koronarspasmen, die eventuell eine Plaqueruptur oder Thrombusbildung an der Gefäßwand verursachen. Bei dem Typ 3 handelt sich um allergisch getriggerte Reaktionen gegen die medikamentenfreisetzenden Stents oder Nickelallergie mit konsekutiver Stentthrombose. In unserem Fall gehen wir von dem Typ 2 aus, da der Patient einige Risikofaktoren und in der Koronarangiographie eine subtotale Stenose nachgewiesen bekommen hat. Ob die subtotale Stenose bereits vor dem anaphylaktischen Schock bestanden hat und durch den Blutdruck-Abfall im EKG nun demaskiert wurde oder die Stenose erst durch den anaphylaktischen Schock verursacht wurde ist nicht mit Sicherheit differenzierbar. Was gegen die vorbestehende Stenose spricht ist, dass in einer ähnlichen Situation vor 2 Monaten keine ST-Hebung im EKG nachgewiesen werden konnte. Bei diesem Ereignis erlitt der Patient epigastrische Schmerzen bereits 16 Stunden vor dem Schock und das erste Troponin T war im Normbereich. Diese Befunde deuten darauf hin, dass seine Schmerzen nicht durch eine Koronarstenose verursacht wurden und die Stenose erst durch die allergische Reaktion bzw. den Koronarspasmus entstanden ist.

Referenzen

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POSTERSITZUNG 16 – BASIC SCIENCE 1

16-1

Nicotinamide Mononucleotide Supplementation Attenuates Atherosclerosis in Western Diet-Fed Ldlr-/- Mice

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Introduction: Depletion of tissue NAD+ levels is frequently observed in the metabolic syndrome and may contribute to worse inflammation. NAD+ supplementation with the NAD+ precursor, nicotinamide mononucleotide (NMN), has shown beneficial cardiovascular effects. Moreover, NMN is shown to activate the NAD+-dependent mitochondrial deacetylase, sirtuin 3 (SIRT3), and blunt activation of its downstream target, the NOD-like receptor protein 3 (NLRP3) inflammasome, thereby reducing inflammation. However, the therapeutic effect of NAD+ repletion with NMN in atherosclerosis remains incompletely investigated.

Methods: Here we fed Ldlr-/- mice chow or western diet (WD) for 16 weeks and administered either the NAD+ precursor, nicotinamide mononucleotide (NMN), or vehicle starting at week 9 of WD feeding. We monitored body weight, performed glucose tolerance tests and measured plasma lipid levels. The aortic root was stained with Oil Red O for quantification of lipid deposition. In leukocytes isolated from bone marrow (BM) and spleen, we performed NAD+ quantification and measured expression of NAD+ metabolic enzymes by RT-qPCR and immunoblotting.

Results: Increased body weight, elevated free fatty acid, cholesterol and glucose levels, and impaired glucose tolerance in WD mice were unaffected by NMN supplementation. However, NMN treatment attenuated plaque growth in the aortic root of WD-fed mice. Interestingly, NAD+ levels were significantly reduced in BM-derived leukocytes and expression of key NAD+-producing (Nampt, Nmnat) and consuming (Parp1, Cd38, Sirt3) enzymes were significantly upregulated in spleen-derived leukocytes following WD feeding. Moreover, acetylation of the SIRT3 target, mitochondrial superoxide dismutase (MnSOD), and expression of markers of the NLRP3 inflammasome (Nlrp3, Il1b, Tnfa) were significantly increased in spleen-derived leukocytes from WD-fed mice. Following NMN treatment, SIRT3 protein expression tended to increase and upregulated expression of NAD+ metabolic enzymes and Nlrp3 were blunted.

Conclusion: Thus, NMN supplementation attenuated plaque progression in a model of WD-induced atherosclerosis, potentially involving modulation of leukocyte NAD+ metabolism and activation of the SIRT3-NLRP3 inflammasome axis.

16-2

Association of ABO blood group with long-term outcome in patients with carotid stenosis

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Introduction: ABO antigens contribute to haemostasis and are associated with cardiovascular disease and acute coronary syndromes. Individuals with non-O blood group have demonstrated a higher risk of arterial thrombosis, which could be partly attributed to a decreased proteolysis of von Willebrand factor (VWF) and, consequently, an increased activity of factor VIII.

Methods: We included 296 patients with symptomatic (n = 102, 34.5%) or high grade asymptomatic (n = 194, 65.5%) carotid artery stenosis, who underwent carotid endarterectomy. Patients were stratified into O (n = 94, 31.8%) and non-O (n = 202, 68.2%) group based on their ABO blood group type. The proteomics data of extracellular matrix (ECM) from plaque core and periphery was assessed in symptomatic O (n = 15) and non-O (n = 25) individuals.

Results: After median follow-up time of 5.2 years (IQR 2.3–6.9), 81 (27.4%) non-O patients reached MACE in contrast to 25 (8.5%) patients in O group. Survival probability of patients with O blood group was significantly higher compared to non-O group ($p = 0.02$). In a multivariable Cox proportional hazard regression model, non-O blood group independently predicted the MACE after adjustment for age, sex, coronary artery disease and obesity (HR 1.8, 95% CI 1.1–2.9, $p = 0.02$). Analysis of plaque proteomics revealed no significant difference in the levels of VWF within the ECM of symptomatic plaques between the O and non-O groups.

Conclusion: ABO blood group antigens are associated with clinical presentation as well as long-term outcome of patients with high-grade carotid artery stenosis.

16-3

Right ventricular regeneration after myocardial infarction

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Introduction: Background: In a murine model of right ventricular (RV) myocardial infarction, reverse remodeling with recovery of the ventricular function and degradation of the fibrotic scar was observed. During RV regeneration, expression of an undescribed gene was observed. Aim of this study was to elucidate the function of this gene and investigate a possible anti-fibrotic role.

Methods: Methods: Cardiac fibroblasts were isolated from mice lacking the identified anti-fibrotic gene. Functional in-vitro assays, BrdU and scratch assay, were performed to analyze proliferation and migration. RNA sequencing and histological analysis of the RV of wild type and knock out mice were performed to investigate the role within the RV. RV myocardial infarction was induced via ligation of the right coronary artery in wild type and knock out mice. Scar formation was analyzed in histological sections and ventricular function via transthoracic echocardiography.

Results: Results: Fibroblasts lacking the identified anti-fibrotic gene showed increased proliferation and increased migration (both $p < 0.001$) in-vitro. Histological analysis of knock out mice showed a dilated RV with a thinned ventricular wall. Within sections of the liver, a congestive hepatopathy was observed in the knock-out but not wild-type mice. In parallel, RNA seq. of the RV of knock out mice showed downregulation of pathways associated with muscle differentiation and heart development. Mice lacking the novel gene showed impaired RV function ($p = 0.001$) and increased scar formation ($p = 0.048$) compared to wild type mice after myocardial infarction.

Conclusion: Conclusion: The novel discovered gene demonstrates a potent anti-fibrotic role during development and regeneration of the RV and could therefore represent a novel therapeutic strategy to treat myocardial fibrosis.

16-4

CaMKII-mediated hypertrophic and inflammatory signaling in hypertensive heart disease

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Introduction: Ca2+/calmodulin-dependent protein kinase II (CaMKII) plays a dual role in driving both adaptive and maladaptive remodeling in the myocardium by selectively phosphorylating Ca2+ cycling proteins and regulating transcriptional signaling. Evidence suggests that the decisive factor influencing the direction of downstream effects lies in the subcellular spatio-temporal activation pattern of CaMKII, yet the precise tipping point from adaptation to dysfunction remains elusive. Thus, we aim to characterize localized CaMKII activity in a clinically relevant animal model of hypertensive heart disease at early and late stages of remodeling and determine the influence of persistent low-grade inflammation.

Methods: Dahl salt-sensitive rats were fed a high-salt diet (8% NaCl) for 5 or 10 weeks to model early and late hypertensive effects, respectively. Age-matched low-salt-diet-fed (0.3% NaCl) rats served as normotensive controls.

Results: Spleens, kidneys and hearts from hypertensive rats showed significant hypertrophy ($p < 0.0001$). Immunocytochemistry revealed marked shifts in the localization of CaMKII activation between hypertensive and control groups at both time-points. Immune-inflammatory signaling was evident through transcriptional upregulation of interleukin-6 ($p = 0.019$) and its receptor ($p = 0.0095$), as well as follicular structures in mediastinal lymph nodes indicating B cell maturation. Immunoblotting and a caspase-1-activity assay further suggested the activation of the NLRP3 inflammasome.

Conclusion: Our findings support the existence of a putative link between subcellular CaMKII activation and inflammatory signaling in cardiomyocytes. Understanding the molecular mechanisms by which CaMKII intersects with inflammatory pathways may pave the way for innovative therapeutic strategies aimed at attenuating cardiac inflammation, preventing adverse remodeling, and ultimately improving outcomes for individuals afflicted by hypertensive heart disease.

16-5

Effect of E-Cigarette vape and Cigarette smoke on Human Vascular Tissue and Cells

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Introduction: Cigarette smoking remains to be one of the main preventable cardiovascular risk factors. Alternatively, e-cigarettes have become popular recently as a promoted "healthier" way of smoking, Therefore the aim of the study was to analyse the effect of e-cigarette vape extract on human vessels and smooth muscle cells.

Methods: Human saphenous veins were collected from 54 patients (n = 54) as well as cells from human saphenous veins (n = 18) undergoing coronary artery bypass grafting surgery. Samples were randomized into three treatment groups (consisting of a control and four interventional group per treatment group): a) n = 18 were treated with tobacco cigarettes (Marlboro Red™), groups b) and c) (n = 18 per group) were treated with two different e-cigarette (JUUL™ and nikoBlue™) devices using a specially designed smoking machine. After treatment, the cellular and structural integrity of the cultured vessels were investigated. Likewise, isolated venous smooth muscle cells were treated with smoke- and vape- extract and subjected to cell viability analyses.

Results: Regardless of the tested nicotine-delivery device, all treated veins exhibited unchanged tissue integrity and number of cell nuclei. Marlboro Red™ treated veins showed a significant reduction in smooth muscle cell actin content with a significant increase in the amount of oxidized proteins. No such chances were detectable in e-cigarette vape extract treated veins. Incubation of isolated smooth muscle cells with Marlboro Red™ and nikoBlue™ smoke- and vape-extract respectively, resulted in a significantly impaired metabolic activity of the cells. Such a change in metabolic activity was not present in cells after treatment with JUUL™ vape extract. Marlboro Red™ treated cells showed a significant increase in apoptosis after 48 h incubation, JUUL™ treatment after 96 h incubation, and nikoBlue™ treatment showed no apoptosis at all. None of the devices examined showed a significant and apoptosis typical depolarisation of the mitochondrial membrane potential compared to control. Plasma membrane integrity, as an indication of necrotic cell death, was significantly impaired in Marlboro Red™ treated cells, but not in JUUL™ or nikoBlue™ treated cells. Moreover, DNA damage in smooth muscle cells was induced by conventional cigarettes as well as e-cigarette vape.

Conclusion: Although the effect of e-cigarette vapour extract appears to be less severe in terms of cell death compared to conventional cigarettes, data on induced DNA damage by e-cigarettes show a hazard even at low concentrations. The exact effects of e-cigarette vaping on smooth muscle cells need to be further investigated.

16-6

Head-to-Head Comparison of two 50 Watt High Power Short Duration Approaches for Pulmonary Vein Isolation

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Introduction: Sufficient lesion creation is mandatory for successful radiofrequency ablation. Contact force (CF) and impedance drop are markers of lesion quality. Up to now little data exist comparing the two biggest companies in the field (Biosense Webster and Abbott) using their latest technology in the setting of high-power short-duration (HPSD) ablation for atrial fibrillation regarding those parameters. The aim of this study is to evaluate whether the two mapping systems, Biosense Webster and Abbott, are comparable in terms of their periprocedural measurements by using 50 Watt HPSD ablation protocols in combination with the CLOSE-protocol using either the Ablation Index (AI) or the Lesion Size Index (LSI) – arbitrary units composed of power, contact force and ablation time depending on differences in the markers of lesion quality.

Methods: We retrospectively analysed procedural data from 150 patients that were scheduled for first-do-symptomatic PVI using either the Carto 3 System (Biosense Webster, Inc., CA, USA) and the QDOT MicroTM catheter or the EnSiteX System (Abbott, Inc., IL, USA) and the TactiCath Contact Force Ablation Catheter, Sensor Enabled. HPSD ablation protocols (Biosense Webster: 50 Watts; AI 550 at the anterior LA wall; AI 400 at the posterior LA wall, the roof and the lower edge of the inferior veins; Abbott: 50 Watts; LSI 5.5 at the anterior LA wall; LSI 4.5 at the posterior LA wall, the roof and the lower edge of the inferior veins) were compared regarding differences within their markers of lesion quality. The following data were collected for evaluation and individual comparison: the number of radiofrequency ablations performed, the net ablation duration, the procedure duration, the fluoroscopy time, the average contact force, the left atrial dwell time, and the impedance drop. Additionally, first-pass isolation is considered as a quality criterion for successfully performed pulmonary vein isolation and will be determined and compared for the two study groups in the context of the master's thesis.

Results: Although observing higher contact force values in the Biosense Webster cohort (18.3 +/− 2.7 vs. 15.7 +/− 2.6, $p < 0.001$) we found lower Impedance drop percentages in this group (8.7 +/− 1.0 vs. 13.7 +/− 1.5, $p < 0.0001$) with a slightly lower first-pass isolation rate (Biosense Webster = 73.7% vs. Abbott = 76.8%, p. 0.706). A lower left atrial dwell time in the Biosense Webster cohort (84 +/−26 vs. 95 +/−23, p. 0.005) and a higher fluoroscopy time in the Biosense Webster cohort (11 +/−8,6 vs. 6.8 +/− 4.6, $p < 0.0001$) was found.

Conclusion: In conclusion differences in the procedural data emerged when comparing the 50 Watts HPSD protocols of the patient population. Therefore, the need for additional research in this field arises.

POSTERSITZUNG 17 – BEST CLINICAL CASES 2

17-1

Erste praxisnahe Einblicke über die Wirkung von Mavacamten anhand von Fallberichten

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Einleitung: Die hypertrophe Kardiomyopathie ist eine idiopathische Herzmuskelerkrankungen, die mit einer meist asymmetrischen, vorwiegend den linken Ventrikel betreffenden Herzmuskelverdickung einhergeht. Die Patienten zeigen klinisch ein breites Spektrum an Symptomen, von vollständiger Beschwerdefreiheit bis zu Dyspnoe, Präsynkopen, Synkopen, therapieresistenter Herzinsuffizienz und plötzlichem Herztod. (1) Die bisherige Therapie bestand aus Betablocker, Non-Dihydropyridin Calcium Kanal Blockern und Disopyramid. Bei anhaltenden Beschwerden gab es als einzige alternative Therapie eine transkoronare Septumablation oder die chirurgische Myektomie. (3) Mit Mavacamten gibt es mit Erstzulassung im Juni 2023 eine erstmals zielgerichtete und spezifische medikamentöse Therapie für die symptomatische (NYHA II-IV) obstruktive hypertrophe Kardiomyopathie. Der Myosininhibitor bindet direkt an das Myosin und verringert somit die Bildung von Myosin-Aktin-Querbrücken. Dies führt zu einer Reduktion der Kontraktilität, verbesserten Relaxation des linken Ventrikels und somit Reduktion der linksventrikulären Auflusstraktobstruktion. (4) Die Zulassung stützt sich auf die Resultate der EXPLORER-HCM und VALOR-HCM-Studien. Voraussetzung für die Therapie ist eine linksventrikuläre Pumpfunktion >= 55 %. Da Mavacamten über Cytochrom P450 metabolisiert wird, muss vor Therapiebeginn der CYP2C19-Status erhoben werden.

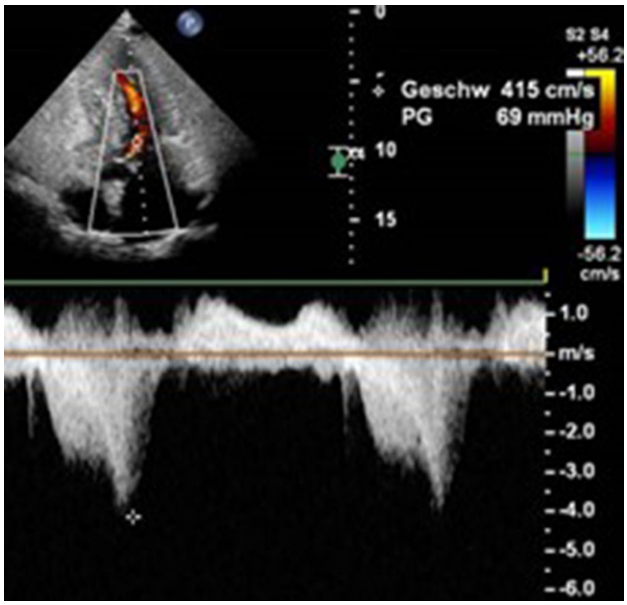

Fig. 1 Druckgradient im LVOT in Ruhe vor Therapie. jpg: Patientin 1, max. Druckgradient im LVOT in Ruhe vor Therapie

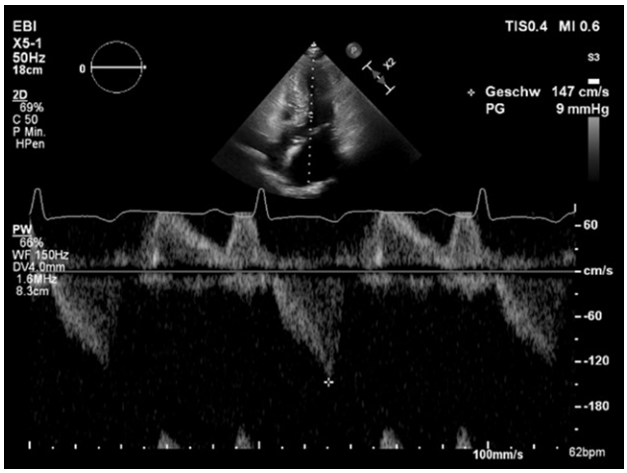

Fig. 2 Patientin 1, max. Druckgradient im LVOT in Ruhe nach 4 Wochen Therapie

Methoden: Bei langsamen CYP2C19-MetabolisiererInnen muss mit einer Tagesdosis von 2,5 mg begonnen werden, bei allen anderen kann mit 5 mg 1 × tägl. gestartet werden. Im Anschluss müssen regelmäßige echokardiographisch Kontrollen erfolgen. Bei einer LVEF unter 50 % muss die Behandlung pausiert werden. Als Nebenwirkungen können Schwindel, und Atemnot sowie Synkopen und eine Einschränkung der linksventrikulären Pumpfunktion auftreten. (6) In den aktuellen ESC-Guidelines für Kardiomyopathien wird Mavacamten als eine Klasse IIA-Indikation bei symptomatischen Patienten trotz Betablockertherapie oder Therapie mit Non-Dihydropyridin Kalzium Kanal Blockern als zusätzliche Therapie empfohlen. (3) Fallpräsentation Wir möchten ihnen zwei Patienten mit einer symptomatischen hypertrophen obstruktiven Kardiomyopathie und Einleitung einer Mavacamtentherapie vorstellen. Im ersten Fall handelt es sich um eine 68-jährige weibliche Patientin (Patientin 1), bei der im Jahr 2017 erstmals eine HOCM diagnostiziert wurde. Die Patientin befindet sich im Oktober 2023 in einem NYHA-Stadium II bis III. Echokardiographisch zeigt sich eine ausgeprägte Septumhypertrophie mit einem maximalen Ruhegradienten von 69 mmHg über dem linksventrikulären Ausflusstrakt. Die LVEF ist im hochnormalen Bereich (nach Simpson biplan 69 %). Weiters findet sich eine diastolische Dysfunktion Grad III. Der NT-pro-BNP-Wert liegt bei 4236 pg/ml bei grenzwertig normaler Nierenfunktion.

Resultate: Eine Betablockertherapie mit Metohexal wird seit Jahren eingenommen. Unter dieser besteht bereits eine Sinusbradykardie. Bei einer normalen Metabolisierung von CYP2C19 wurde mit einer Mavacamtentherapie 5 mg 1 × tägl. Anfang Oktober gestartet. Bereits nach vier Wochen berichtet die Patientin über eine Besserung der klinischen Symptomatik (NYHA-Stadium II). Echokardiographisch zeigt sich eine deutliche Reduktion des maximalen linksventrikuläre Ausflusstraktgradienten in Ruhe, dieser bei 9 mmHg liegend. Auch nach einem adäquaten Valsalva-Manöver kann lediglich ein maximaler Gradient von 10 mmHg gemessen werden. Die LVEF hat sich nur minimal von 69 % auf 60 % reduziert. Der NT-pro-BNP-Wert hat sich mit 1029 pg/ml trotz gering steigender Nierenfunktionsparameter deutlich reduziert. Im zweiten Fall möchten wir einen 77-jährigen männlichen Patienten präsentieren. Eine HOCM ist bereits seit 2015 bekannt. In einer Kontrolle im Oktober 2023 gibt der Patient eine Belastungsdyspnoe im NYHA-Stadium II an. Echokardiographisch zeigt sich ein maximaler Ruhegradient über den linksventrikulären Ausflusstrakt von 31 mmHg, bei einem Valsalva-Manöver steigt der maximale Gradient auf 56 mmHg. Weiters kann eine diastolische Dysfunktion Grad II

diagnostiziert werden. Die LVEF ist im hoch normalen Bereich. Der NT-pro-BNP-Wert liegt bei 1317 pg/ml bei normaler Nierenfunktion. Eine Betablockertherapie wird seit Diagnosestellung eingenommen.

Schlussfolgerungen: Eine TASH-Prozedur oder operative Sanierung mittels Myektomie wurde vom Patienten von Anfang an abgelehnt. Bei einer normalen Metabolisierung von CYP2C19 wurde Anfang Oktober mit einer Mavacamtentherapie mit 5 mg tägl. gestartet. Bereits nach 4 Wochen berichtet der Patient über eine gebesserte klinische Symptomatik im NYHA Stadium I. Echokardiographisch zeigt sich eine deutliche Besserung, in Ruhe lässt sich lediglich ein maximaler Ausflusstraktgradient von 9 mmHg messen und auch nach Valsalva-Manöver kommt es zu keinem Anstieg des maximalen Druckgradienten. Die LVEF zeigte sich unverändert bei 58 % nach Simpson biplan. Der NT-pro-BNP-Wert zeigte sich bei gleichbleibender Nierenfunkton initial geringgradig reduziert auf 1164 pg/ml, in weiteren Kontrollen sinkend. Zusammenfassung Mit diesen zwei Patienten möchten wir über unsere ersten Erfahrungen mit Mavacamten berichten. Bei beiden Patienten kam es innerhalb von 4 Wochen zu einer deutlichen Reduktion des maximalen linksventrikulären Auflusstraktgradienten mit einer Besserung der klinischen Symptomatik. Unverändert blieben die Septumdicke, die diastolische Dysfunktion und die EKG-Veränderungen. Die LVEF hat sich im ersten Fall nur minimal reduziert, im zweiten Fall blieb sie stationär. Nebenwirkungen wurden bisher von keinem der beiden Patienten berichtet. Derzeit haben wir zwei weiteren Patienten Mavacamten verordnet, die Ergebnisse folgen.-

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17-2

Substrate modification via Epicardial Ablation in a patient with long QT syndrome type II

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Introduction: The treatment of patients with congenital long QT syndrome (LQTS) is based on several therapeutic pillars. Conservative measures, medical therapy are powerful to avoid malignant ventricular arrhythmias (VA). Furthermore, ICD implantation can prevent sudden cardiac death in high risk LQTS patients. Bailout strategies include left cardiac sympathetic denervation (LCSD) and recently epicardial catheter ablation of pathological signals has been suggested. We report a case report of a patient with LQTS undergoing epicardial ablation after multiple ICD shocks for malignant VA.

Methods: We report a case of a 27-year-old female patient with diagnosed LQTS type II. She was diagnosed with LQTS II (KCNH2 mutation) at the age of eight. Due to recurrent syncope and documented VA, she was provided with an ICD in 2011 at the age of 15. After the course of several years and after experiencing several appropriate ICD shocks, bailout strategies were offered and discussed as all established therapies like trigger avoidance and betablockers did not prove to reduce her arrhythmia burden. More established bailout strategies like

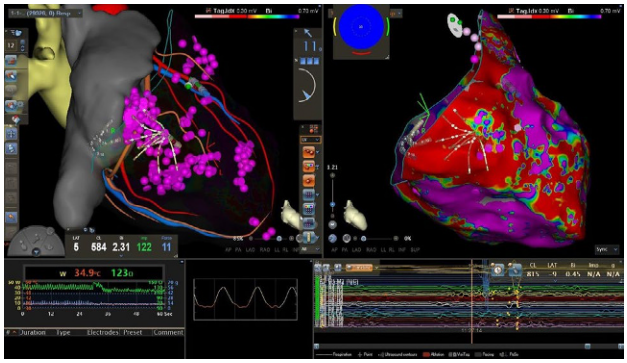

Fig. 1 The epicardial 3D electro-anatomical map showed extensive low-voltage areas at the apical as well as the infero-basal aspect reaching into the outflow tract of the right ventricle (pink is normal voltage, red is low voltage, pink location points indicate for fractionated low potentials as seen in the right picture)

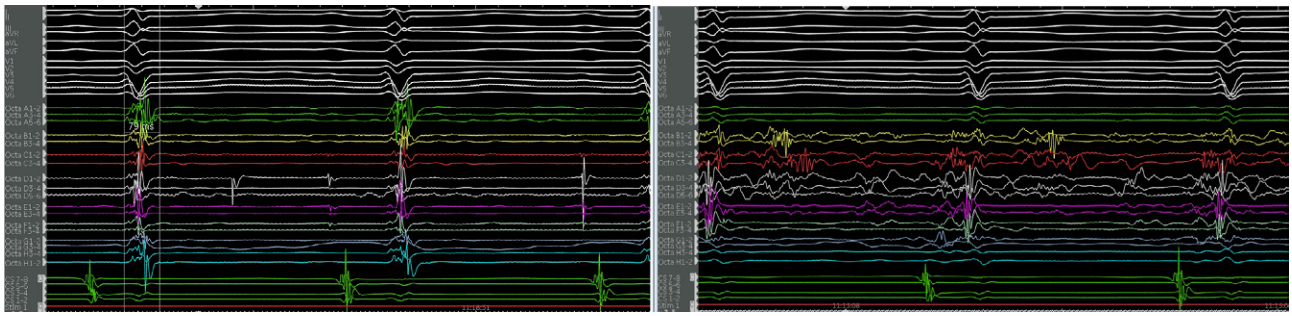

Fig. 2 Low-voltage QRS fragmentation without provocation (left side) and under provocation of isoprenaline (right side); 12-lead surface ECG – white signals, a multipolar mapping catheter – OctaA1-2 until Octa H1-2 and a coronary sinus catheter – CS7,8–1,2 in bright green; recorded at a speed of 200 ms/sec

LCSD were clearly declined by the patient. An upgrade to a two-chamber device was not considered useful as episodes were not associated with bradycardia or pause-dependent. Furthermore, she expressed that she plans to have kids in the near future. As LQTS type II is reported to have an increased arrhythmia burden in the per- and post-partum period, epicardial ablation was offered before a potentially planned pregnancy. After an extensive and long discussion about all options, her planned pregnancy, and potential bail-out-strategies, she decided to undergo epicardial ablation fully aware that the data on this option are scarce.

Results: The electrophysiological study was performed under general anaesthesia and showed low voltage areas at the inferobasal aspect of the right ventricle (RV) extending to the right ventricular outflow tract and a small area at the apex of the RV. Few late potentials and several fragmented potentials were identified in the above-mentioned low-voltage areas. During isoproterenol provocation, a massive QRS fragmentation of the epicardial ventricular signals was seen in the priorly identified low voltage areas. The most conspicuous signals were correlated with the above-mentioned areas of low voltage. Epicardial ablation of areas of pathological signals was performed and the patient remained free of symptoms since ablation noted at the 3-months follow-up.

Conclusion: This case report represents a recently suggested bail-out strategy in patients with high arrhythmia burden in LQTS. Furthermore, the findings in this case suggest that LQTS may not only be a primary electrical disease as thought so far. This bailout strategy will be reserved to highly symptomatic patients in expert centers until further data will be available and more patients have to be treated to understand the underlying mechanisms, to determine ablations strategies and to see a long-term effect and long-term follow-ups.

17-3

Spontane Heilung einer Koronarobstruktion – ist das möglich?

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Einleitung: Die spontane Koronardissektion ist eine seltene Ursache des akuten Koronarsyndrom, welche vor allem prämenopasuale Frauen betrifft. Typisch ist die LAD betroffen und nach der Diagnose mittels Korona-rangiografie tritt eine spontane Heilung in über 80 % der Fälle ein. Eine PCI ist nur selten notwendig.

Methoden: -

Resultate: Es stellt sich eine 50-jährige Dame mit plötzlich einsetzenden Thoraxschmerzen in unserer ZNA vor. Bei unauffälligem EKG aber Dynamik der kardialen Biomarker wurde die Arbeitsdiagnose ACS-NSTEMI ge-stellt. Mittels Akutkoronarangiographie konnten wir eine Dissektion der LAD mit zusätzlichem Wand-hämatom feststellen. Aufgrund der unauffälligen Echokardiographie sowie der Beschwerdefreiheit der Patientin, entschloss man sich für eine rein konservatives Procedere. ASS, Concor und ein Statin wurden etabliert. Hinweise auf eine Fibromuskuläre Dysplasie gab es nicht. In einer Kontrollangiographie zeigte sich 3 Monate später eine vollständige Heilung mit unauffälligen Koronargefäßen.

Schlussfolgerungen: Selten aber doch begegnet uns eine Spontandissektion der Koronargefäße. In einer Vielzahl der Fälle reicht die medikamentöse Therapie aus und eine Heilung tritt auch spontan ein. Nicht jede Obstruktion der Herzkrankgefäße bedarf einer Revaskularisierung.

17-4

Mitral transcatheter edge-to-edge repair in a patient with end-stage hypertrophic non-obstructive cardiomyopathy

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Introduction: Patient presentation: A 76-year-old patient presented with acute heart failure and incipient cardiogenic shock, exertional dyspnoea New York Heart Association (NYHA) III, and severe functional mitral regurgitation (MR). He had a known non-obstructive hypertrophic cardiomyopathy (HNOCM) with a class 5 disease-causing mutation in the MYBPC3 gene. Cardiovascular risk factors included arterial hypertension, type 2 diabetes mellitus, and persistent atrial fibrillation. Other medical history comprised chronic kidney disease G4, polyneuropathy warranting a walking aid, and a clinical frailty score of 5 (Canadian Study of Health and Aging Score). The pharmacological heart failure therapy included Bisoprolol 1.25 mg, Lisinopril 5 mg, Eplerenone 50 mg, Dapagliflozin 10 mg, and Furosemide 40 mg. A primary prophylactic implantable cardioverter-defibrillator (ICD) was implanted five years ago. Over the past years disease progression led to recurrent worsening heart failure hospitalizations. Therefore, a CardioMEMS heart failure system (Abbott Laboratories, Abbot Park, IL, USA) was implanted two years ago. At this point mild-to-moderate (grade II) MR was present. Despite optimal medical heart failure therapy, the patient was hospitalized 7 times due to decompensated heart failure over the course of the next 2 years, mostly referred to peripheral centres.

Methods: Initial work up: On physical examination, the patient's blood pressure was 90/60 mmHg and he had a precordial pansystolic murmur in auscultation. NT-proBNP was 27,803 pg/ml and eGFR was 21 ml/min/1.73 m2. CardioMEMS showed stable elevated pulmonary pressure throughout the last year, with a rapid increase within a week prior to hospitalization from a mean pulmonary artery pressure (mPAP) of 38 mmHg to 62 mmHg. Transthoracic echocardiography (TTE) revealed left ventricular hypertrophy (septal diameter 15 mm), mildly reduced left ventricular ejection fraction (LVEF) (42%), left ventricular dilation (end-diastolic diameter 57 mm), and left atrial enlargement (72 ml/m2). No left ventricular outflow tract obstruction was present. The MR worsened compared to previous findings, now showing grade IV, with a vena contracta of 10 mm, an effective regurgitant orifice area (EROA) of 72 mm^2, and a regurgitation volume of 30 ml (image 1). The mitral annulus had a medial-lateral dimension of 43 mm, and an anterior-posterior dimension of 43 mm. Tricuspid regurgitation was moderate with a tricuspid regurgitant velocity (TRV) of 3.8 m/s. Transesophageal echocardiography (TEE) confirmed severe functional MR. The mitral leaflets showed no calcification, but a functional restriction due to tethering of both leaflets resulting in a significant central coaptation defect according to Carpentier IIIb. Coronary angiography showed only a mild coronary artery disease with no need for intervention.

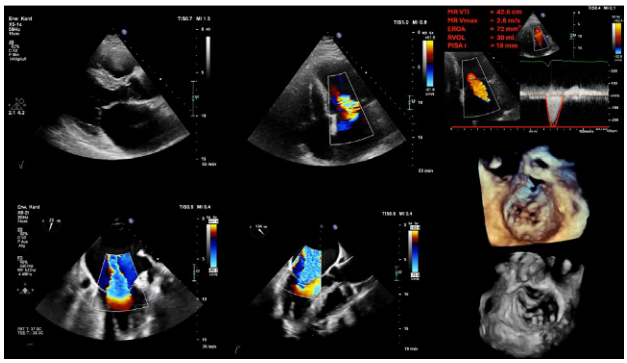

Fig. 1 pre-intervention

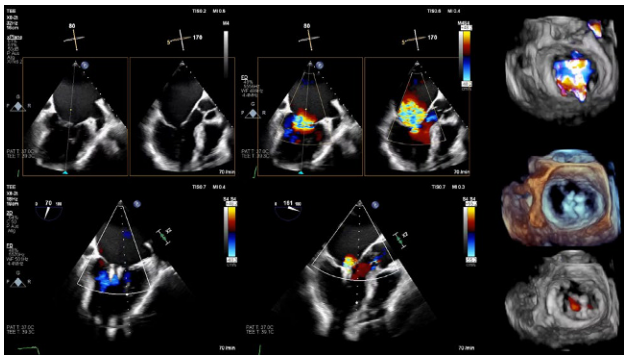

Fig. 2 intervention

Results: Diagnosis and management: The patient was diagnosed with end-stage HNOCM and severe functional MR. Given high perioperative risk and urgent need of mitral repair, our interdisciplinary heart team decided in favour of transcatheter edge-to-edge repair (TEER) for MR. Transcatheter MV repair with the MitraClip (Abbott Laboratories, Abbot Park, IL, USA) was performed with two XTW G4 clips placed in the A2-P2 scallops (image 2). MR severity was reduced from severe (grade IV) to mild (grade I), the final transvalvular mean gradient was 2 mmHg. Comparing the measured sPAP values derived from periprocedural TEE directly before and after the intervention, an acute reduction of 10 mmHg sPAP could be achieved. In parallel, systolic blood pressure increased by 40 mmHg. No complications occurred during the further hospitalization period. Follow-up: During a follow-up of 5 weeks after the procedure, the patient showed a significant improvement in symptoms, with stable NYHA II, and a blood pressure of 126/79 mmHg. CardioMEMS readout showed an mPAP of 43 mmHg. TTE showed no significant change in LVEF (41%), elevated TRV (3.0 m/s), and a mild (grade 0-I) residual MR without mitral stenosis. NT-proBNP was 6,174 pg/ml and eGFR was 37 ml/min/1.73 m2.

Conclusion: Conclusion: 3–12% of all patients with hypertrophic cardiomyopathy (HCM) develop end-stage HCM, defined as left ventricular dysfunction with LVEF < 50% and left ventricular dilation.[1, 2] In these patients, severe MR may contribute to heart failure symptoms and frequent worsening heart failure hospitalizations. According to the guidelines of the European Society of Cardiology regarding the treatment of valve disease [3], especially in patients with heart failure, mitral repair with TEER is recommended in patients with secondary MR not eligible for surgery and fulfilling criteria that suggest increased chance of therapy-response.[4] However, the underlying randomized controlled trial excluded patients with cardiomyopathies, such as HCM, and overall experience regarding safety and efficacy of TEER procedures in HNOCM, especially in an end-stage, are rare. Here, we report the case of a patient with end-stage HNOCM with recurrent worsening heart failure episodes and severe functional MR with a mechanism of tethering due to left ventricular dilation. After careful evaluation, this patient received TEER of the mitral valve and benefitted significantly. This case report illustrates that in carefully selected patients with end-stage HNOCM and severe functional MR, TEER procedure is technically feasible and safe, and shows significant efficacy during short-term follow-up.

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17-5

A Biatral Tachycardia Refractory to Radiofrequency Ablation is Successfully Treated by Pulsed Field Ablation

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Introduction: Sometimes the ablation therapy of atrial fibrillation and its accompanying atrial tachyarrhythmias, especially if several ablation procedures have been performed in the same patient and medical antiarrhythmic therapy is ineffective, is demanding. The pathomechanisms of the underlying arrhythmias in these cases is often complex and effective lesion formation to suppress these arrhythmias may be challenging. We present a 77 year old man with repeated symptomatic atrial tachycardias (AT) starting after the most recent ablation in June 2022, the cycle length was 203 ms, they were refractory to antiarrhythmic drugs (flecainide, sotalol) and transthoracic cardioversions. The patient has a long history of arrhythmias and multiple antiarrhythmic therapies. He underwent several pulmonary vein (PV) isolations and additional ablations in both atria 2007, 2016, 2017 and 2018 in another institution. Additionally, an ablation of premature ventricular beats in the right ventricular outflow tract was performed 2013: it resulted in a suppression of the premature ventricular beats and a complete AV-block; a biventricular pacemaker was implanted. A complete reisolation of the PVs was performed in 2020. The described box lesion in the posterior wall of the left atrium (LA), known from the reports of earlier ablations, could not be completed in 2020 and in a further procedure 2021. This posterior box could finally be completed in June 2022, when the V. cava sup. was additionally isolated.

Methods: In October 2023 the patient underwent an invasive electrophysiological study of the clinical atrial tachyarrhythmia with the cycle length (CL) of 203 ms, performed with ultra high density mapping (UHDM, Rhythmia).

Results: A perimitral tachycardia was found and terminated with the introduction of an anteroseptal mitral line by radiofrequency (RF) ablation. It resulted in another AT with a cycle length of 218 ms. In the UHDM a biatrial tachycardia was found

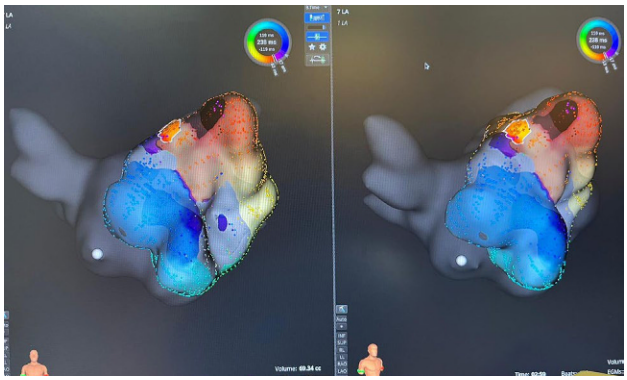

Fig. 1 Bachmann bundle LA

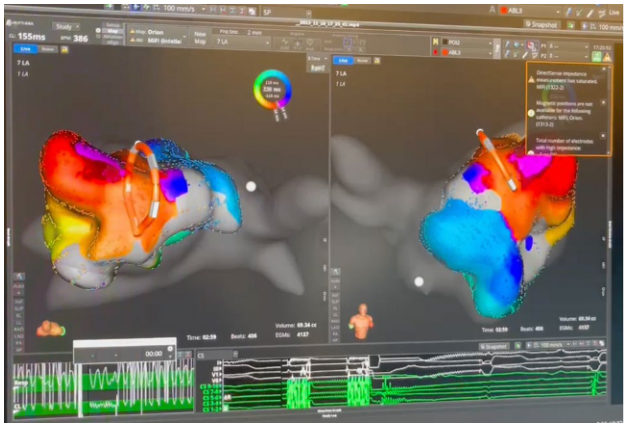

Fig. 2 Termination of Biatrial Tachykardia

as the underlying pathomechanism (Fig1): the AT entered the LA roof from the Bachman bundle (BB), was blocked on the mitral isthmus line (MIL), descended via the LA wall to the coronary sinus; further conducted to the right atrium (RA) and back up to the BB to close the biatrial circle. Multiple RF ablations were performed on the left insertion of the BB and finally also on the RA side of the BB, with energy settings of up to 40 W over 120 sec. No change in CL was achieved. Our conclusion: RF couldn't reach deep enough for this location. Electroporation (pulsed field ablation (PFA)) is suspected to achieve deeper and more reliable lesions than RF ablation. Therefore, the ablation mode was changed to PFA. With the Farapulse system the basket catheter was placed with some of the electrodes to the roof of the LA, where the entrance of the BB is suspected. In this case slightly lateral to the anteroseptal MIL. With one application of PFA-energy the AT terminated (Fig2). After reinduction with burst pacing one more application was necessary. It couldn't be reinduced by burst pacing. In the final UHDM a conduction via the BB to the left side of the LA was documented. The patient had no further atrial tachyarrhythmias until a recent control.

Conclusion: Previous ablation therapies often make cases like this more complex, mostly on the basis of incomplete, nontransmural and sometimes unnecessary scars. With UHDM some of these old and incomplete scars, mainly if they are endocardial, can be found. The exact pathomechanism of complex atrial tachyarrhythmias, especially in the setting of several preceding interventions, is more easily examined by the very tiny electrodes of UHDM systems. If the crux of identifying the origin of the rhythm disorder is solved, sometimes the problem of transmural energy delivery occurs. Radiofrequency energy is a potent ablation power: but if the energy delivery is too high, the risk of steam pops evolves, with potentially deleterious effects. Therefore, as shown in the presented challenging electrophysiological intervention, the interaction of UHDM and the new power source of PFA can form a strong unit that is able to treat an atrial tachycardia via the thicker part of the roof of the left atrial, where RF-energy failed to have any effect.

17-6

A rare case of endomyocardial fibrosis mimicking apical hypertrophic cardiomyopathy

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Introduction: Endomyocardial fibrosis (EMF) is accountable for a vast proportion of restrictive cardiomyopathies in tropical and subtropical developing countries. Cases in European Caucasians are very rare. EMF is characterized by fibrotic remodeling of the left and right ventricular endocardium, usually with concomitant apical thrombus. Little is known about pathogenesis and possible genetic predisposition, but eosinophilia is considered to be the most common singular cause. Therapy remains symptom-oriented and typically includes anticoagulation, diuretics and treatment of the underlying cause, if identified.

Methods: retrospective analysis of patient data

Results: A 33-year-old Caucasian male patient presented with chest pain and an abnormal ECG with ST-depressions from V4 to V6 and deep negative T-waves from V3 to V6 in 2022. Troponine-T concentrations were moderately elevated. He got hospitalized with the suspected diagnosis of myocarditis. Performed echocardiography showed apical hypertrophy with an ace-of-spades sign in the contrast study. Cardiac magnetic resonance imaging (CMR) was reported by radiology to confirm the diagnosis of apical hypertrophy, additionally myocardial edema and beginning myocardial fibrosis of the left ventricle. The follow-up CMR showed an apical thrombus. The reading cardiologist emphasized that unifying diagnosis of the case is more likely EMF than HCM and after discussing the case with a large British CMR center, the diagnosis of EMF was considered definite. In consequence an off-label anticoagulation was started in August 2023. Genetic testing resulted in a likely pathogenic Plakophilin-2 (PKP2) mutation (c.155dup p. (Ser53GlufsTer33)), usually known in arrhythmogenic right ventricular cardiomyopathy. The remaining blood tests showed normal results, the suspected hypereosinophilia was missing. Two years after the initial diagnosis the patient is symptomless and in good clinical condition. Anticoagulation was continued as long-term therapy but switched from a direct Xa anticoagulant to a vitamin K antagonist due to incomplete thrombus resolution.

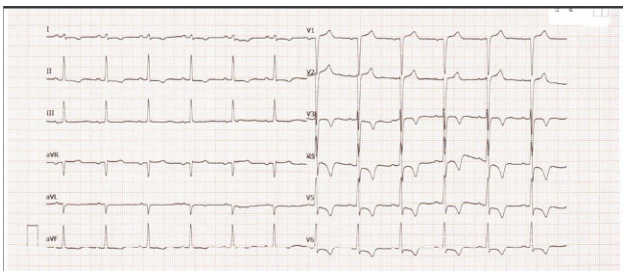

Fig. 1

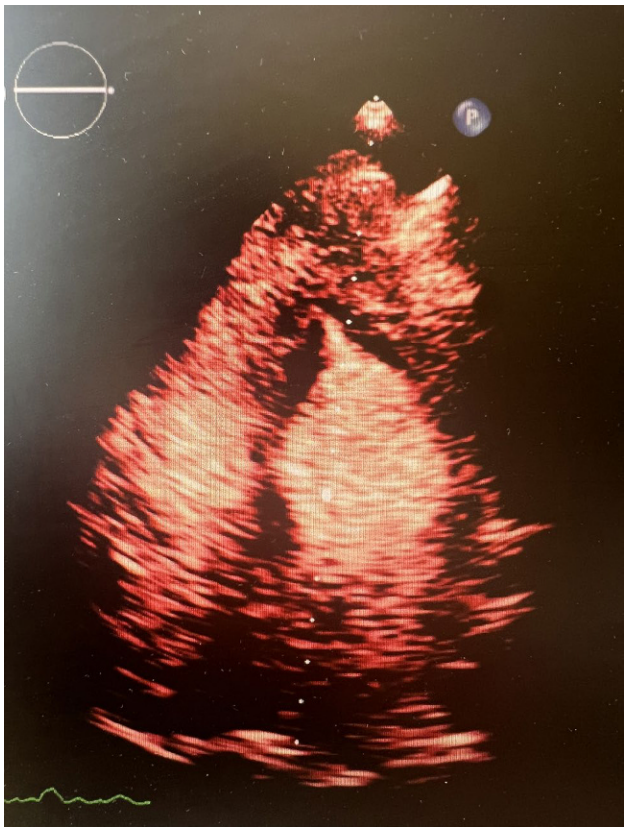

Fig. 2

Conclusion: This case underlines the importance of combining different imaging techniques. Moreover, it draws attention to the rare diagnosis of EMF, which usually has poor prognosis. The status of the PKP2 mutation remains unclear, but increased understanding of the genetic and environmental factors may help understanding the unusual phenotypical presentation in the future.

POSTERSITZUNG 18 – CHIRURGIE 5

18-1

HYBRID at its best: Simultaneous TAVR, OPCAB and EVAR

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Introduction: Aortic valve stenosis and coronary artery disease are often concomitant findings in elderly patients in the developed world. In patients with a higher perioperative risk interventional treatment is typically favoured. Nevertheless, not all patients can be treated this way due to additional findings. Especially anatomical and vascular limitations may jeopardize interventional treatment options. In the current patient a giant aortic aneurysm and severe generalized atherosclerosis was present.

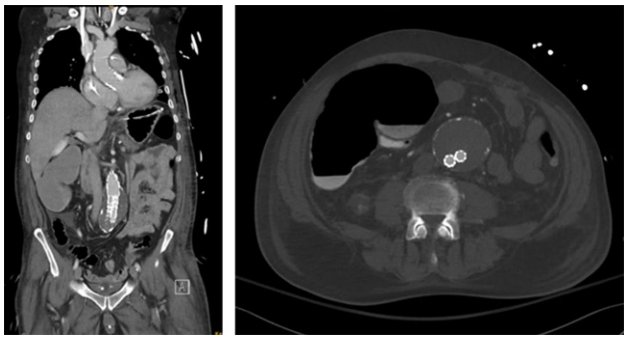

Fig. 1 Post surgery CT Scan

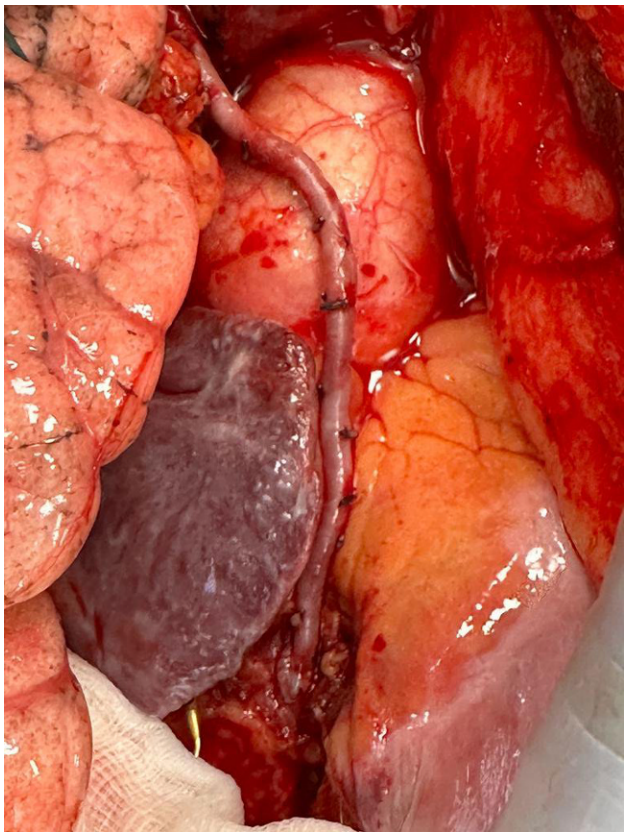

Fig. 2 RIMA-RCA Bypass in situ

Methods: A 72 year old male patient was admitted with aortic stenosis from a referring hospital. Due to comorbidities and age the patient underwent a standardised protocol for transcatheter aortic valve replacement (TAVR). On coronary angiography a significant stenosis of the right coronary artery was found. On CT-scan the aortic arch was highly calcified. All aortic vessels showed multiple stenosis. Additionally, a huge abdominal aortic aneurysm was found that also required urgent treatment. The patient was discussed in the local heart team and vascular board. Due to the described findings a transvascular TAVR was not possible. The right coronary artery was not suitable for percutaneous intervention. The abdominal aortic aneurysm was judged as interventionally treatable. In conclusion the patient was scheduled for an endovascular aortic repair (EVAR), a transapical (TA)-TAVR and an off pump single bypass

(OPCAB). For anaesthesiologic reasons the decision was made to go for 1.TAVR 2.EVAR 3.OPCAB.

Results: After preoperative measurement of the aortic valve Edwards Sapien S 3 29 mm balloon-expandible valve (Edwards Lifesciences, Irvine, Ca, USA) was selected and implanted via an apical access. Subsequently, the EVAR procedure was performed. To deliver the EVAR main body to the infrarenal aorta, the stenosed common iliac arteries first had to be treated with balloon-expandable stents, Omnilink Elite 10×29 mm, (Abbott Cardiovascular, Plymouth, MN, USA). Then, the EVAR main body Incraft AB26 (Cordis, Miami Lakes, FL, USA) was delivered via the right common femoral access and completed with an iliac leg from the left common femoral access. The left internal iliac artery was first coiled with three detchable coils (Interlock, Boston Scientific, Marlborough, MA, USA) and then covered with an iliac leg to prevent the formation of a type II and type Ib endoleak. As a last step the OPCAB procedure was performed in a standard fashion via median sternotomy. The right internal mammary artery was prepared and a direct anastomosis to the right coronary artery was done. The patient could be extubated without neurological deficit on the day of surgery but had to be reintubated on the second postoperative day (POD). Weaning from invasive ventilation was possible on the 4 POD. Acute kidney failure required haemodialysis from the 3 to 11 POD. On the 12 POD the patient could be transferred to the normal ward in his home hospital. The patient could be discharged without need for permanent dialys

Conclusion: In complex high risk patients an interdisciplinary approach is essential. In this case the most threatening diagnosis was the covered ruptured aortic aneurysm. A long EVAR implantation procedure was expected. So the mayor goal in this case was to treat the aortic stenosis first to provide stable hemodynamic parameters for a safe anaesthesia. Nevertheless, a prolonged intensive care unit stay could be expected. In summary, complex treatment of a high risk patient could be performed after careful interdisciplinary planning with good outcome and quality of life for the patient.

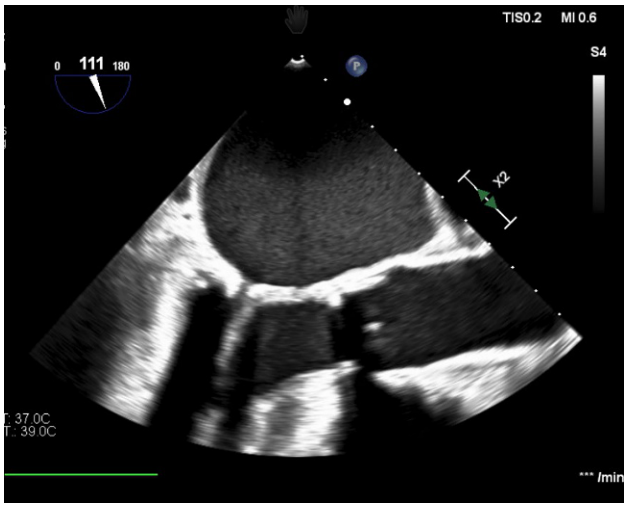

Fig. 1 Relation between aortic and mitral valve

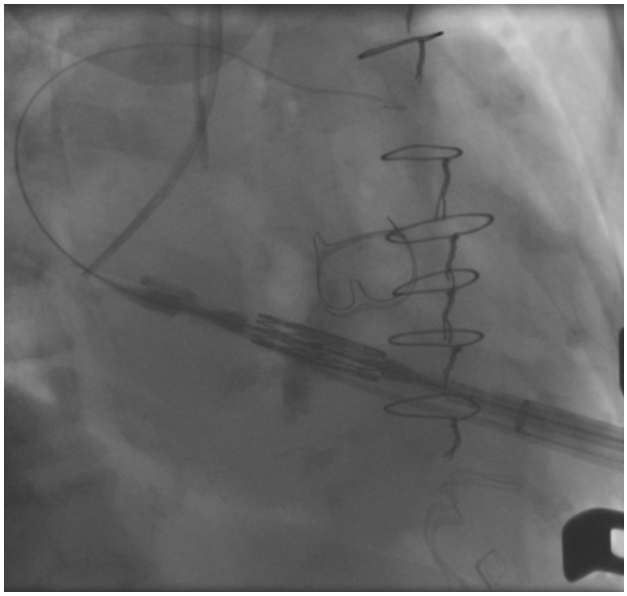

Fig. 2 Fluroscopy during implantation

18-2

Transapical mitral valve replacement in a non-circumferential mitral anulus calcification after Bio-Bentall procedure

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Introduction: Mitral valve stenosis in patients after previous aortic valve replacement can be a challenging condition. The gold standard remains the open surgical re-operation. In elderly high risk patients alternative approaches may be warranted. Although there are several options for transcatheter mitral valve replacement only few are suitable for mitral stenosis. One of the devices which could be used is the Edwards Sapien S3-Ultra and Sapien S3 balloon-expandable valve (Edwards Lifesciences, Irvine, Ca, USA). A circumferential Massive Anular Calcification (MAC) is typically required in a native mitral annulus.

Methods: A 81 year old female patient with previous Bio-Bentall procedure now suffered from severe mitral valve stenosis. Due to severe comorbidities the patient was not suitable for redo open heart surgery. After extensive discussion in the heart team it seemed like that the implanted aortic root prosthesis, Edwards magna ease aortic 25 mm (Edwards Lifesciences, Irvine, Ca, USA) and Albograft Polyester Vascular Graft 30 (LeMaitre Vascular, Burlington, MA, USA) could be used as abutment to anchor the Sapien S3 properly in the partially calcified mitral anulus. We decided to go for a transapical access. This supports a better control during positioning of the valve.

Results: After exact planning an Edwards 29 mm S3 Ultra balloon-expandible valve (Edwards Lifesciences, Irvine, Ca, USA) was selected. The aim was to get the perfect hight in the non-calcified anulus. Post deployment no paravalvular leakage was detected. The patient went to the normal ward on the first post operativ day. The patient could be discharged from the hospital in a good condition after an uneventful clinical course on postoperative day 8.

Conclusion: In patients after surgical aortic root replacement this approach could be used as a good alternative to open heart surgery. This case shows that a high risk patient can be treated with an acceptable perioperative risk and good outcome. For better control of the implanted device in such cases we recommend the apical access route.

18-3

Langzeitergebnisse der Schrittmachertherapie bei extrakardialen Fontan Patienten

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Einleitung: Patienten mit Zustand nach Fontan Operation bei Single Ventrikel Physiologie können eine Sinusknotendysfunktion oder einen höhergradigen AV-Block entwickeln. Schrittmacherimplantationen (PSM) können aufgrund des Operationssitus mit extrakardialer Fontanprothese nur epikardial und üblicherweise per Rezidivsternotomie erfolgen. PSM-Abhängigkeit kann in diesem Patientenkollektiv mit erhöhter Langzeitkomplikationsrate von Fontan assoziierten Erkrankungen und herabgesetzter Lebenserwartung vergesellschaftet sein. Diese Studie untersucht Notwendigkeit, Komplikationsrate und Langzeit Outcome in der zentrumseigenen Kohorte von Fontan-Patienten.

Methoden: In dieser retrospektiven Single-Center Studie wurden alle Patienten nach Fontan Operation in unserem Zentrum mit Geburtsdatum zwischen Januar 1994 und August 2013 inkludiert und Patienten nach Schrittmacherimplantation speziell evaluiert. Die Daten stammen aus der Aufarbeitung von medizinischen Patientenakten, EKG's und Kontrollbesuchen im Zeitraum bis August 2023. Das primäre Studienziel war die Evaluierung von HTX-freiem Überleben zum Zeitpunkt des letzten Kontrolltermins bei Fontan Patienten nach PSM Implantation. Durch eine univariate binäre logistische Regressionsanalyse wurde ausgewertet, ob die Schrittmacherimplantation einen Risikofaktor für das Versterben oder Herztransplantation im Langzeitverlauf darstellt.

Resultate: Von unseren 321 Fontan Patienten im beschriebenen Zeitintervall (medianes follow up Alter 13.9 Jahre) benötigten nur 18 (5.6 %) Patienten eine Schrittmacherimplantation. Vier von 18 (22.2 %) Patienten erhielten den Schrittmacher vor der Fontan Operation und 14 von 18 Patienten (77.8 %) benötigten eine Schrittmachertherapie im Median nach 2.8 [IQR: 5.1 a] Jahren nach der Fontan Operation. Aus diesem Kollektiv entwickelten drei (16.7 %) Patienten im weiteren Verlauf ein intestinales Eiweißverlustsyndrom und ein Patient (5.6 %) eine Plastic Bronchitis. Im Vergleich dazu entwickelten Patienten ohne PSM in 8 Fällen (2.6 %) eine Plastic Bronchitis, in 17 Fällen (5.6 %) ein intestinales Eiweißverlustsyndrom und in einem Fall (0.3 %) Beides. Das transplantationsfreie Überleben nach Fontan Operation betrug bei Patienten mit PSM nur 72.2 % (medianes FU 9.2 a) im Vergleich zu 94.7 % (medianes FU 8.9 a) bei Patienten ohne Schrittmachertherapie (OR: 6.9; 95 % CI: 2.2–21.7; $p < 0.001$). Gründe für Herztransplantation oder Versterben waren Ventrikelversagen in vier Patienten und Failing Fontan-Physiologie aufgrund von Plastic Bronchitis bei einem Patient nach im Median 8.4 Jahren nach Schrittmacherimplantation. Eine Patientin zeigte eine schwere, glücklicherweise reversible PSM-assoziierte Kardiomyopathie.

Schlussfolgerungen: Die Notwendigkeit von Schrittmacherimplantationen nach der extrakardialen Fontan Operation ist mit 5,6 % niedrig. Leider zeigen die betroffenen Patienten jedoch ein erhöhtes Risiko für Versagen des Single Ventrikels und Entwicklung von Fontan assoziierten Eiweißverlust Erkrankungen. Dieses Patientenkollektiv bedarf daher eines intensiven Monitorings, um diese lebensbedrohlichen Krankheiten frühzeitig erkennen und behandeln zu können.

18-4

Monitoring of mitochondrial function in donation after circulatory death – a porcine ex-situ heart perfusion model

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Introduction: Due to the high ATP demand of myocardium, cardiac function is highly dependent on an efficient mitochondrial oxidative phosphorylation. Ischemia and reperfusion injury (I/R) has severe impact on the function of the mitochondrial respiratory system. In donation after circulatory death (DCD), extent of I/R damage is decisive for posttransplant graft function. We aimed to investigate the mitochondrial respiration using high-resolution respirometry (HRR) in a porcine ex-situ heart perfusion (ESHP) model.

Methods: 12 German domestic pigs (65–75 kg) were used to simulate two different organ donation protocols: "donation after brain death" (DBD) ($n = 6$) and DCD ($n = 6$). ESHP was performed for 6 hours. Mitochondrial function in tissue homogenates of porcine myocardium was assessed by HRR. Samples were obtained at baseline (b), and after 1, 3, and 6 hours of ESHP. Data were expressed as mean and standard deviation. Comparison of repeated measurements were performed with two-way ANOVA followed by Sidak's post hoc test.

Results: The oxidative phosphorylation capacity after addition of NADH-generating substrates, fatty acids and succinate decreased slightly in the DCD group. A significant difference after 6 hours of perfusion was found (DBD 200.5 ± 27.9 vs DCD 143.4 ± 22.7 pmol $-1 \cdot s -1 \cdot mL -1$, $p = 0.038$). The flux control ratio of the NADH-linked (Complex I) respiration declined in the DCD group (6 h: DBD 0.16 vs DCD 0.05, $p = 0.007$). The mitochondrial outer membrane damage, assessed by cytochrome c addition was significantly lower after 6 hours of ESHP ($p < 0.001$) without a difference between the groups.

Conclusion: We performed the first in-depth analysis of mitochondrial respiratory function during ex-situ heart perfusion in a DCD model. Interestingly, mitochondrial respiration is preserved over 3 hours in DCD hearts with a decline in function after 6 hours. Importantly, the initial mitochondrial outer membrane damage recovered over time in both groups. Next, the predictive value of HRR might be evaluated in clinical practice to promote organ acceptance in the future.

18-5

Frozen Elephant Trunk procedure in acute aortic arch Intramural Hematoma

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Introduction: Although, the Frozen Elephant Trunk (FET) procedure is a potential treatment option for patients with severe acute aortic arch intramural hematoma, the impact of native tissue preservation during aortic arch reconstruction is currently unknown. This study reports on outcomes of FET procedure with aortic arch island reconstruction in the given patient collective.

Methods: Eleven patients underwent FET procedure for acute Type A (n = 9; [81.8%]) and acute Non-A Non-B (n = 2; [18.2%]) intramural hematoma (male: 5 [45.5%]; age: 66 [IQR 53–73]), of which 2 (18.2%) had undergone prior failed thoracic endovascular aortic repairs (TEVAR). Aortic arch reconstruction was conducted by repair of supra-aortic vessels as island style during total aortic arch repair (n = 8; [72.7%]) or peninsula style during subtotal arch reconstruction (n = 3; [27.3%]).

Results: Eight (72.7%) patients received FET in landing zone 3, with Ascendo-Subclavian bypass or Subclavian-Carotid bypass being conducted in one (9.1%) and four (36.4%) patients, respectively. Postoperative stroke occurred in three (27.3%) and spinal cord ischemia in no patient. One (9.1%) patient required surgical revision due to hemothorax. Three patients (27.3%) required secondary TEVAR due to progression of the aortic pathology after initial FET during the follow up. Mortality was documented in one (9.1%) patient due to age related fatigue shortly after hospital discharge.

Conclusion: The FET procedure is a feasible treatment option for patients with severe acute intramural hematoma of the aortic arch. Concomitant aortic arch island reconstruction is safe with no increased risk for periprocedural complications in experienced centers.

18-6

Extended thoracoabdominal aortic repair after Frozen Elephant Trunk procedure in the era of endovascular aortic repair: the two and three staged approach

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Introduction: As downstream endovascular aortic repair enables hybrid aortic repair for mega aortic syndrome (MAS) by initial Frozen Elephant Trunk (FET) to be a versatile treatment protocol by promoting feasibility of the final abdominal aortic repair, the impact of its role in procedural staging is currently unknown. This study analyses outcomes between the two and three staged aortic repair and its clinical implications.

Methods: Between 5/2005–1/2024 twenty-seven patients underwent treatment of MAS (male: 14 [51.9%]; age: 64 [IQR 52–68] years; aortic dissection: 18 [66.7%]) by initial FET. Subsequent thoracic endovascular aortic repair (TEVAR) was conducted concomitantly in four (14.8%) of eleven (40.7%) two staged repairs, while final open thoracoabdominal (OPEN) or fenestrated endovascular aortic repair (FEVAR) in three (11.1%) and in thirteen (48.1%) of overall sixteen (59.3%) three staged repairs, respectively.

Results: The median time for complete MAS repair was 34.7 (IQR 13–38) months. False lumen depressurization with endovascular aortic septotomy with electrocautery was applied in six patients (22.2%). For secondary TEVAR, landing zone 4 was primarily targeted (n = 26; [96.3%]), with the distal stent graft extension covering up to thoracic vertebrae TH12 in twenty (74.1%) patients. Between patients undergoing two or three staged repair, neither rates of spinal cord ischemia (n = 0 vs. n = 2 [12.5%]; p = 0.499), nor stroke (n = 1 [9.1%] vs. n = 3 [18.8%]; p = 0.624) did significantly differ between both groups, with only one (9.1%) patient undergoing early surgical hemothorax revision. Noteworthy, over a median follow-up of 2 (IQR 0–6) years, two (7.4%) patients died, one (12.5%) patient after third-stage OPEN procedure due to multiorgan failure on postoperative mechanical circulatory support and one (12.5%) patient after concomitant endovascular repair during attempted surgical endoleak management within the follow-up time.

Conclusion: Variation in staging during hybrid aortic repair with initial FET, subsequent TEVAR and final endovascular or open repair for treatment of MAS is feasible and safe, providing a versatile treatment protocol in a complex patient collective.

18-7

Relationship Between Clinical, Psychological, Physiological, and Technical Parameters during Digital-Health -assisted Cardiac Rehabilitation Including Home Training

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Introduction: Home and telehealth-based interventions are increasingly used in cardiac rehabilitation (CR), a multidisciplinary model of health care. Digital tools such as wearables or digital training diaries are expected to support patients to adhere to recommended lifestyle changes, including physical exercise programmes. As previously published, the EPICURE study analysed the effects of digital tools, i. e., a digital training diary, adherence monitoring, and wearables, on exercise capacity during outpatient CR phase III (OUT-III) which includes an approximately 12-week home training phase [1]. The study encompassed 149 Austrian patients, of which 50 utilized digital tools. The present paper takes a deeper look into the EPICURE data to better understand a) the relation between the use of digital tools and various psychological, clinical, and physiological parameters, and b) the relation between these parameters and the improvement of exercise capacity during cardiac rehabilitation.

Methods: For this work, we analysed questionnaires concerning the patients' CR and data acquired by digital tools during CR. On all these parameters we performed two analyses: 1) Comparison of the two groups with and without digital tools and 2) correlation with the change in the maximum workload as achieved during the exercise stress test. If data pre and post OUT-III were available, the change in the respective parameter during OUT-III was determined and group analyses and correlation were applied on a) data pre OUT-III, b) data post OUT-III, and c) the change during OUT-III.

Results: We found significant improvements in quality of life in both groups with a p-value P = .012 for patients with and P = .004 for patients without digital tools. However, no significant differences between the improvements of patients with or without digital tools was identified (P = .53). Patients with digital tools perceived significantly higher competence during CR (P = .049), and they anticipated higher cardiac risks if non-adherent to physical activity (P = .028). Although, the overall subjectively reported adherence was not significantly different in the two groups, specific items differed: Patients with digital tools were significantly less likely not to do their exercises when they were tired and to forget their exercises with P = .003 for both items. Concerning reasons for (non-) adherence, patients with digital tools reported significantly more often to do their exercises because they enjoyed them (P = .012), whereas they were significantly less likely a) to stop exercising when muscular pain was worse (P = .012) and b) to continue doing their exercises when muscular pain improved (P = .024). Finally, patients who reported a high level of concrete planning achieved significantly higher improvements in exercise capacity (P = .039).

Conclusion: We conclude that digital tools can support adherence to exercise training recommendations during facility- as well as home-based out-patient CR. This comprehensive analysis provides valuable insights into the multifaceted impact of digital tools on outpatient cardiac rehabilitation including home training, shedding light on factors influencing patient outcomes and adherence in the evolving landscape of digital health interventions.

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18-8

TEVAR as well as Dacron grafts are no physiological tools for therapy in aortic arch pathologies

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Introduction: Surgeries to treat pathologies of the aortic arch are among the most demanding cardiovascular interventions with a considerable risk of death and stroke [1]. Conventional aortic arch repair is a particularly invasive procedure. With the aging of the population in developed countries, the number of elderly patients with aortic arch pathology who are physiologically unsuitable for such invasive repair is increasing. The emergence of thoracic endovascular aortic repair (TEVAR) has led to the development of minimally invasive aortic repair techniques [2]. The aim of this study is to examine how aortic arch intervention affects the elastomechanical properties of the aorta.

Methods: Eleven non-diseased thoracic aortas from human cadavers (4 female, 7 male; mean age 67.7 ± 13.5 years) were perfused in a custom-built mock circulation loop [3], with a blood analog solution of glycerin–dH2O (50.6% v/v, pH 7.4).

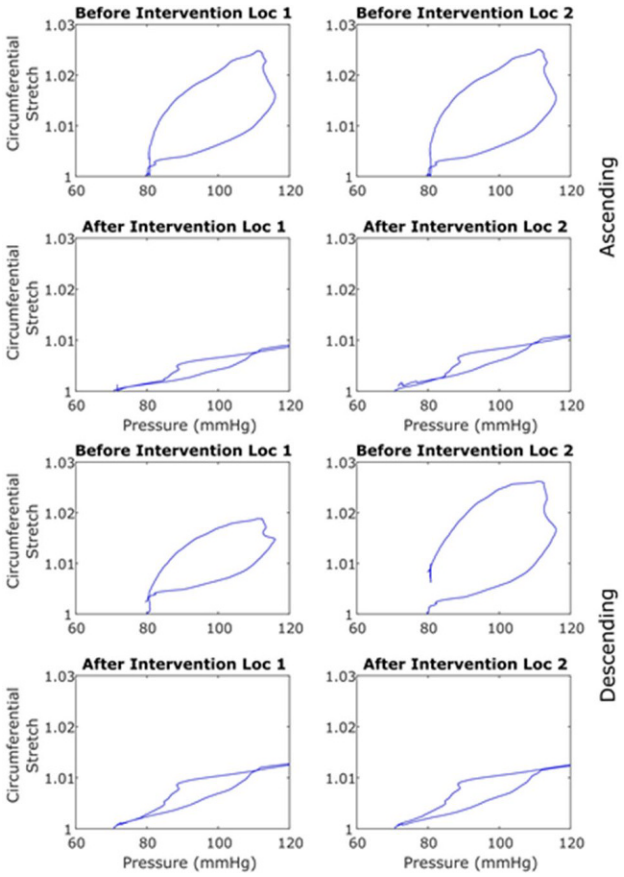

Fig. 1

A healthy hemodynamic profile was employed in this study. The focus area of the intervention was the aortic arch, where either a stent graft (oversize 10–20%) or a Dacron graft (length 10–17 cm) was implanted. To assess the outcome of the two types of interventions, pre- and post-intervention measurements were performed. Two pressure sensors were used to record pressure values at the inlet and outlet of the aorta. Additionally, the outer diameter was measured at various locations along the aorta using a video extensometer. The selection of measurement locations was deliberate and based on Saint-Venant's principle, with them positioned away from both the inlet and intervention region. We calculated the circumferential stretch by considering the diastolic diameter as the reference configuration.

Results: Fig. 1 illustrates the pressure measured by sensors and the circumferential stretch calculated from the video extensometer recordings for the ascending and descending aorta at two different locations (Loc 1, Loc 2) on each. The specified hysteresis loops provide insight into the intervention results and enable comparative analyses between pre- and post-intervention during the cardiac cycle in ascending and descending regions of the aorta. The Bramwell-Hill equation was then used to calculate the pulse wave velocity (PWV) from the pressure-diameter data, allowing comparison of PWV before and after intervention. The time decay method was used to quantify the effect of the intervention on total arterial resistance and compliance. Time-domain and frequency-domain analyses of pressure and input volume were also used for pre- and post-intervention comparison.

Conclusion: This in vitro study examines the effects of aortic arch interventions using two different grafts, namely stent graft and Dacron graft. The study presents valuable elastomechanical data of the regions not directly affected by the intervention using ex vivo measurements.

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18-9

Tricuspid valve replacement utilising intraoperatively hand-crafted ProxiCor ECM valve

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Introduction: Primary tricuspid regurgitation due to infective endocarditis in young patients with a history of intravenous substance abuse presents a dilemma in choosing the best possible valve replacement. Permanent anticoagulation with Vitamin-K-Antagonists (VKA) and therefore a mechanical valve may not be an option in cases with limited adherence to therapeutic protocols. Biological valve replacement may require repeat valvular surgery due to valve deterioration.

Methods: n/a

Results: We report a case of infective endocarditis in a 53-year old patient with a history of intravenous substance abuse requiring tricuspid valve replacement. We present a novel approach to tricuspid valvular replacement in adults utilising a hand-crafted valve using the Proxicor/CorMatrix extracellular matrix (ECM). By taking exact intraoperative TOE measurements and following standardized instructions it is possible to craft a personalized, fully competent valve with this patient-centred approach. Early postoperative TOE and TTE show great results with no significant regurgitation, stenosis or paravalvular leak.

Conclusion: n/a

POSTERSITZUNG 19 – KARDIOLOGISCHE PFLEGE UND MEDIZINISCH-TECHNISCHE DIENSTE

19-1

"HerzMobil" – ein Telemonitoring Programm für Menschen mit Herzinsuffizienz – Auswertung der Patient*innenbefragung 2023

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Einleitung: Aufgrund der ausgeprägten Symptomatik bei Herzinsuffizienz (HI) kommt es bei den Betroffenen zu einer deutlichen Verminderung der Lebensqualität und eingeschränkter Leistungsfähigkeit. Akute Dekompensationen führen häufig zu wiederholten Krankenhausaufnahmen. Studien belegen, dass ein patient*innenzentrierter, multidisziplinärer Betreuungsansatz, mittels Telemonitoring eine wirksame Methode ist, um die

Lebensqualität zu verbessern und das Risiko für Hospitalisierungen zu senken. Dazu wird das HerzMobil Programm angeboten. Teilnehmer*innen erhalten eine Beratung zur Pathologie der Herzinsuffizienz, sowie zu empfohlenen Lebensstilmaßnahmen und Medikamenten, durch eine HerzMobil Nurse und werden dann für drei Monate kontinuierlich betreut. Mittels bereitgestellter Messgeräte und einem Handy, werden jeden Tag Blutdruck-, Puls- und Gewichtswerte auf das HerzMobil Webportal übertragen. Auch die Medikamentencompliance und das Befinden werden dort dokumentiert. Pflegepersonen können dadurch Zustandsveränderungen frühzeitig erkennen, Therapieanpassungen mit den Netzwerkärzt*innen durchführen und Patient*innen gezielt auf Verhaltensregeln schulen. Das Programm soll neben den Symptomen auch das Selbstmanagement im Umgang mit der Erkrankung verbessern. Durch einen Fragebogen wird dahingehend das subjektive Befinden der Patient*innen gemessen, um die Wirksamkeit des Programms zu beurteilen.

Methoden: Zur Beurteilung der Effektivität und Abläufe des Versorgungsprogramms werden, nach schriftlicher Zustimmung zur Teilnahme am Programm, der Kansas City Cardiomyopathy Questionnaire (KCCQ), die European Heart Failure Self-Care Behaviour Scale (EHFScB-9) und das Information System Success Modell Instrument an die Patient*innen ausgeteilt. Um die Ergebnisse vergleichen zu können, wird ein zweiter Erhebungsbogen nach Beendigung des Programms ausgefüllt. Der Bogen ist in verschiedene Abschnitte gegliedert. Zuerst wird nach körperlichen Einschränkungen in Aktivitäten des täglichen Lebens gefragt, wie zum Beispiel sich anziehen, duschen/baden, 100 m gehen, oder Garten-/Hausarbeit erledigen. Danach können Symptome wie Ödeme, Müdigkeit oder Dyspnoe beurteilt werden. Außerdem werden Fragen zum Thema Selbstwirksamkeit und Lebensqualität gestellt. Soziale Einschränkungen werden mit Fragen zu Hobbys, Arbeit, Besuche und intimen Beziehungen beurteilt. Im Abschlussfragebogen sind Fragen zur Qualität der Umsetzung des Programms enthalten, zusätzlich wird gebeten den Nutzen des Programms zu bewerten. Die Beantwortung der Fragen erfolgt mittels Selbsteinschätzung, durch die Teilnehmer*innen selbst. Die Antwortmöglichkeiten sind anhand der Likert-Skala in die Items 1 „überhaupt nicht/trifft zu“ bis 5 „sehr/trifft nicht zu“ gegliedert.

Resultate: Insgesamt konnten im Jahr 2023 48 Fragebögen der Kohorte zu Beginn des Programms, 50 am Ende des Programms ausgewertet werden. Die Fragen, in welchem Ausmaß die Erkrankung Aktivitäten des täglichen Lebens beeinträchtigen, wurden zu Beginn von durchschnittlich 34 % der Teilnehmer*innen mit „überhaupt nicht“ beurteilt, am Ende stimmten diesem Item 51,8 % zu. 25 % gaben nach dem Programm sogar an, keine Beschwerden mehr zu verspüren (zuvor 4,3 %). 19,6 % gaben zu Beginn an, „jeden Morgen“ geschwollene Knöchel zu haben, am Ende nur mehr 2 %, 60 % „nie“. 17,4 % gaben zu Beginn an, dass ihre Müdigkeit ihnen „sehr“ zu schaffen macht, am Ende 6 %. Ebenfalls 17,4 % fühlten sich zu Beginn durch ihre Dyspnoe „ständig“ beeinträchtigt, 0 % am Ende. Bei den Fragen zur Lebensqualität bewerteten die Patient*innen in welchem Ausmaß die Herzinsuffizienz ihre Fähigkeit das Leben zu genießen beeinträchtigt mit einem Mittelwert von 3,4 auf der Likert-Skala, am Ende lag dieser Wert bei 2,3. Der Mittelwert, wie zufrieden sie mit den derzeitigen Einschränkungen für den Rest des Lebens wären, lag zu Beginn bei 3,6 und am Ende bei 2,7. Soziale Kontakte bewerteten zu Beginn 34,9 % mit „sehr“ eingeschränkt, am Ende wurde die Frage vom Großteil (36,6 %) mit „überhaupt nicht“ beurteilt. Die Informationsqualität wurde von 82,4 % mit dem besten Item bewertet, ebenso die Systemqualität (87,5 %), 63,8 % stuften den Nutzen des Programms mit dem besten Item ein.

Schlussfolgerungen: Nach Beendigung des dreimonatigen, multidisziplinären Betreuungsprogramms wurde die körperliche Belastbarkeit von den Patient*innen als verbessert eingeschätzt. Diese Ergebnisse sind unter anderem durch eine optimierte medikamentöse Therapie und Adaption des Lebensstils zu erklären. 42 % der Patient*innen gaben nach der Betreuung an, sich „vollkommen sicher“ zu sein, was sie bei Verschlechterung der Herzbeschwerden tun können, am Beginn war der Wert von 19,1 % deutlich geringer, daher hat das Programm auch die Selbstwirksamkeit der Teilnehmer*innen gefördert. Durch eine verminderte körperliche Einschränkung wurden auch die Lebensqualität verbessert und die sozialen Kontakte gefördert. Bei den Fragen zum Nutzen gaben die Patient*innen an, dass sie durch das Programm besser über ihren Gesundheitszustand informiert waren. Ebenfalls konnten ärztliche und pflegerische Empfehlungen bezüglich des Lebensstils leichter umgesetzt werden. Auch nach Beendigung des Programms wollen die Betroffenen weiter auf ihre Gesundheit achten und schätzen ein, dass sie durch die vorangegangene Beratung und Betreuung jetzt auch selbstständig in der Lage dazu sind. Anhand dieser Ergebnisse empfiehlt es sich, im Sinne der Transformation von einer Akutversorgung zu einer Langzeitversorgung von chronisch kranken Menschen, das Programm HerzMobil auch noch weiter auszubreiten und für herzinsuffiziente Österreicher*innen flächendeckend zugänglich zu machen.

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19-2

Die Rolle der Pflege im Projekt – Optimierung vor Herzoperation

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Einleitung: Die Zahl von Patient:innen mit einer Herzinsuffizienz steigt weltweit an. Nicht selten kommt es aufgrund von nicht hinreichendem Selbstmanagement und fehlender Information zu Re-hospitalisierungen. Telemonitoring-basierte Disease-Management-Programme (DMP) können dem entge-

genwirken [1]. Im Rahmen des DMP HerzMobil Tirol konnte bereits bewiesen werden, dass durch das telemonitoring-unterstützte Versorgungsprogramm die Gesamtsterblichkeit sowie die Wiederaufnahmen von Patient:innen reduziert und die Lebensqualität und Sicherheit im Umgang mit der Erkrankung gesteigert werden [2]. In einem neuem multidisziplinären telemonitoring-unterstützten Projekt sollen nun Patient:innen mit einem erhöhtem Risiko vor einem elektiven herzchirurgischen Eingriff (Herzklappen und/oder Bypassoperation) präoperativ optimiert werden, um eine Verbesserung des Verlaufes nach der Operation zu erzielen. Auch in diesem Projekt soll die Pflege eine wesentliche Rolle einnehmen. In der Literatur erfolgt jedoch nur selten eine genaue Aufgaben- bzw. Tätigkeitsbeschreibung im Rahmen von DMPs [3]. Daher stellt sich die Frage: Welche Aufgaben übernimmt der gehobene Dienst für Gesundheits- und Krankenpflege im multidisziplinären telemonitoring-unterstützten Projekt „Optimierung vor Herzoperation"?

Methoden: Für die Entwicklung des Projektes wurden in einem multidisziplinären Team, bestehend aus Pflegepersonen, Ärzten:innen, Sportwissenschaftler:innen sowie IT- und Daten-Spezialisten, regelmäßige Besprechungen abgehalten. Im Rahmen dessen wurde ein Behandlungsprozess erstellt, welcher u. a. die Aufgaben der verschiedenen Rollen definiert. Aufgrund der bereits vorhandenen Erfahrungen und Strukturen im Rahmen des DMP's, erfolgte für die Pflege lediglich eine separierte Einschulung durch die Kardiolog:innen der Herzinsuffizienzambulanz in der Durchführung des klinischen Assessments.

Resultate: Die Hauptaufgaben der Pflege im Projekt – Optimierung vor Herzoperation umfassen neben dem pflegediagnostischen Prozess die Koordination sowie das Einbringen der pflegerischen Expertise im multidisziplinären Team, die Durchführung des klinischen Assessments bei der Erst-, Zwischen- und Abschlussuntersuchung, die Patientenedukation (Geräteschulung, Krankheits- und Lifestyle-Schulung, präoperative Vorbereitung), die telemedizinische Betreuung (Telemonitoring, Telekonsultationen) sowie die Durchführung und Mitwirkung bei wissenschaftlichen Erhebungen und Evaluierungen im Rahmen des Projektes.

Schlussfolgerungen: Die Aufgaben des gehobenen Dienstes für Gesundheits- und Krankenpflege sind in einem DMP sehr weitläufig und tragen wesentlich zum Erfolg von multidisziplinären Disease Management Projekten und Programmen bei. Besonders zur Geltung kommen dabei die Kompetenzen im multiprofessionellen Versorgungsteam, welche eine Schlüsselrolle für die Erfolge solcher Projekte und Programme darstellen können. Das Projekt sowie das bereits bestehende Versorgungsprogramm zeigen zudem auf, dass die Profession Pflege mit ihrem Kompetenzbereich auch im telemedizinischen Bereich einen wesentlichen Stellenwert einnehmen kann.

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19-3

Die Arbeit im Herzkatheterlabor: "Null-acht-fünfzehn" oder doch nicht so einfach?

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Einleitung: Hochzuverlässigkeitssysteme zeichnen sich dadurch aus, bei hohen Risiken fast fehlerfreie Leistungen zu erbringen. Um dies zu erzielen, werden verschiedene Praktiken regelhaft angewendet. Eine Praktik bildet vereinfachte Sichtweisen zu vermeiden, um mitunter unerwartete Situationen frühzeitig zu erkennen und darauf zu reagieren [1].

Methoden: Im Rahmen einer Forschung wurden in österreichischen Herzkatheterlaboren teilnehmende Beobachtungen bei Koronarangiographien und interprofessionelle Interviews mit der ärztlichen, pflegerischen und technischen Berufsgruppe durchgeführt. Ausgehend von der wissenschaftstheoretischen Position des Symbolischen Interaktionismus, orientierte sich die gegenstandsbezogene Theoriebildung an Strauss und Corbin [2]. Die qualitativen Daten wurden mittels MAXQDA aufbereitet.

Resultate: Aus den Interviews geht hervor, dass die Arbeit im Herzkatheterlabor aus der Beobachtungsperspektive einfacher aussieht, als sich diese in der direkten Umsetzung erweist. Grundlegend bedarf es einer Lernkurve, um eine Routine zu erlangen. Die hierbei generierte Sichtweise wirkt sich weiterführend auf das Arbeitshandeln aus. Als problematisch wird gesehen, wenn sicherheitsrelevante Hinweise von Mitarbeiter:innen, wie zu Geräten, ignoriert werden. Allgemein wird mit zunehmender Routine berufsgruppenunabhängig häufiger angenommen, eine einfache Intervention würde vorliegen. Dies kann sich als Trugschluss erweisen, womit eine komplexe Intervention mit erhöhtem Zeitaufwand notwendig wird. Die Mitarbeiter:innen sind jedoch auf unerwartete Situationen vorbereitet, wie auch beispielsweise bei distaler Knotenbildung am Katheter. Bei auftretenden Komplikationen unterscheidet sich die nachgeschaltete Sicht auf das Geschehene: Die eine Seite bildet die abweisende Haltung, die andere Seite hinterfragt selbstkritisch ihr Handeln, um etwaige Chancen für eine verbesserte Arbeitsweise zu nutzen. Zusätzlich stellt sich die Übernahme einer Leitungsfunktion als nicht einfach heraus, um anfallende Belange (auf übergeordneter Instanz) durchzusetzen. Ist keine unterstützende Leitung im Herzkatheterlabor vorhanden, erweist es sich als schwieriger auf Situationen einzuwirken, da Probleme nicht zwingend als solche wahrgenommen und angegangen werden.

Schlussfolgerungen: Für die Praxis im Herzkatheterlabor ist es bedeutend ein Bewusstsein für vereinfachte und differenzierte Betrachtungsweisen zu schaffen. Dies liegt daran, weil sich das jeweilige Denken auf das Handeln auswirkt. Dort wo sich die Sichtweisen konträr gegenüberstehen, liegt oftmals ein unterschiedliches Ausmaß an Hintergrundwissen vor und birgt Konfliktpotential. Ein starkes hierarchisches Gefälle erweist sich als kontraproduktiv, da eine beruflich höher gestellte Position (Systemführung) nicht per se mit einer Expertise (Fachführung)

gleichzusetzen ist [3]. Vor allem die Fachrichtung der interventionellen Kardiologie bewegt sich auf einem schmalen Grat, weil die Tätigkeit ein Selbstbewusstsein aber auch eine Selbstkritik erfordert. Zu empfehlen ist, dass die Mitarbeiter:innen der unterschiedlichen Berufsgruppen ihr spezifisches Wissen einbringen, sich aufmerksam zuhören und gemeinsam sichere Versorgungsprozesse etablieren.

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19-4

Bluthochdruck: Die Entwicklung eines multidisziplinären telemonitorisch-unterstützten Versorgungsprogrammes

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Einleitung: Bluthochdruck (BHD) ist eine weltweit und über alle Bevölkerungsschichten verteilt vorkommende, sehr häufige Erkrankung des Gefäßsystems. Die Prävalenz in der Altersklasse von 30–79 Jahren liegt in Österreich bei 34 % [1]. Die Dunkelziffer dürfte jedoch viel höher liegen und stellt eine oft unbemerkte und auch unterschätzte Gefahr dar. Weltweit sind 14 % aller Todesfälle auf Bluthochdruck zurückzuführen [2]. Auch in Österreich stellt Bluthochdruck den wichtigsten Risikofaktor für frühzeitige Sterblichkeit sowie Behinderung dar und ist damit die Hauptursache für kardiovaskuläre Erkrankungen. Die Behandlung ist jedoch eine große Herausforderung. Strukturelle und multidisziplinäre Schulungsprogramme stellen einen zukunftsweisenden Weg zur bedarfsgerechten Versorgung dar. Diese werden bei der Therapieeinleitung, Adaptierung und Kontrolle durch Devices mit Telemonitoring unterstützt [2]. Ziel der Versicherungsanstalt [xxx] und [xxx] und [xxx Institution xxx] war es, ein multidisziplinäres telemonitorisches Versorgungsprogramm für Patient:innen mit Bluthochdruck in Tirol zu entwickeln, um eine Optimierung der medikamentösen Therapie, eine Verbesserung des Lebensstils und die Vermeidung von Folgeerkrankungen zu erzielen.

Methoden: In der Vorbereitung auf ein entsprechendes Versorgungsprogramm wurde ein Konzeptpapier von einem multidisziplinären Team aus Ärzten und Ärztinnen, Pflegepersonen, Sozialversicherungsvertreter:innen und IT-Spezialisten entwickelt. Daraus entstand 2020 eine erste Projektphase. Aus der abschließenden Prozess- sowie Ergebnisevaluierung und nachfolgenden Weiterentwicklung des Projektes wurde 2022 der Sozialversicherungspartner [xxx] in die anschließende Projektphase II aufgenommen.

Resultate: Der Behandlungsprozess für die Versorgung von Patient:innen mit Bluthochdruck in Tirol gliederte sich in drei Pfade: (1) Zuweisungspfad, (2) Behandlungspfad und (3) Evaluierungspfad. Eingeschlossen wurden Patient:innen, die die Einschlusskriterien erfüllten und deren erhöhter Blutdruck, bestimmt mittels einer ambulanten 24 h Blutdruckmessung (ABDM), nicht gemäß ESC/ESH Leitlinien eingestellt war. Die telemonitorische Behandlung/Betreuung mit folgenden Elementen erstreckte sich über drei Monate: (1) zwei Untersuchungstermine beim Netzwerkarzt/bei der Netzwerkärztin, (2) medikamentöse Therapieoptimierung, (3) gerätespezifische Einschulung, (4) Schulung mit individuell abgestimmten Inhalten zu den persönlichen kardiovaskulären Risikofaktoren durch eine spezialisierte Netzwerkpflegeperson, (5) telemonitorische Betreuung und (6) Lebensstilschulung inkl. BHD-Podcast mit Quiz. Zum Abschluss erfolgte eine vergleichende 24 h ABDM. Bei Bedarf konnte eine Verlängerung um weitere drei Monate erfolgen. Zwischenergebnisse zeigen, dass durch die Teilnahme im Projekt der Bluthochdruck signifikant reduziert und die Lebensqualität gesteigert werden kann, jedoch liegen derzeit noch keine Endergebnisse vor.

Schlussfolgerungen: Durch das multidisziplinäre Netzwerk und die telemonitorische Betreuung des Projektes Bluthochdruck ist es möglich Patient:innen mit einem Bluthochdruck im multidisziplinären Team individuell zu versorgen. Die ersten Erfahrungen aus den Projektphasen zeigen, dass der Betreuungsbedarf von Bluthochdruckpatient:innen in Tirol gegeben ist und eine Verbesserung des Blutdruckes als auch der Lebensqualität erzielt werden kann. Für eine tirol-weite Ausrollung müssen die Endergebnisse ausgewertet und evaluiert werden, um eine mögliche flächendeckende Versorgung anbieten zu können.

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19-5

To tell or not to tell

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Introduction: This is a case of non dislosure to a pateint after a complication that caused no injury to the patient. Highlightening some ethical principles of responsiblity of staff in disclosure to the patient. All risks and complications along with benefits of a procedure should be disclosed and discussed during the consenting process. Part of patient centered care is allowing the patient a part in the deiciosn to proceed with a proceure or not. In this case the patient was not asked his opinion of following through with a risky left main PCI using shockwave therapy in a small hospital with no surgical back up.Health care providers have legal and ethical obligation to report risks, benefits, and alternative treatments. Just because an error did not result in a serious event does not negate the fact that it was and still is an error. Your behaviour and response to an error affects the perception of what happened.Patients are normally frightened, angry, and distrustful if harmed by a medical error.The complication "ruptured balloon" was written in the discharge letter but had not been discussed with the patient. Therefore causing the patient distress and anxiety as he was discharged from hospital still feeling unwell.

Methods: Patient history 83 year old Man Hx CABG (Internal mammary IM -Left anterior descending LAD) & (SVG-Obtuse Marginal) Insulin dependent diabetic Atrial fibrillation Multiple falls (low blood sugar), Hypertension Echo 45–50% EF, no regional wall motion abnormality, mild LV hypertrophy Admitted to hospital with: Suspicion of sepsis • Ketoacidosis (glucose 946 mg/dl) • Vomiting and feeling nauseous • Started on insulin drip • No chest pain • Cardiac markers noted to be elevated (Trop I 4.140 ng/ml) • ECG slight elevation in ST • WBC (12,79 K/uL) ANGIOGRAM • Left M heavily calcified • 90% eccentric stenosis • Competitive flow into Left Anterior Descending via arterial conduit • Ramus/high diagonal 80–90% ostial stenosis the remainder of vessel patent (not grafted) • Circumflex

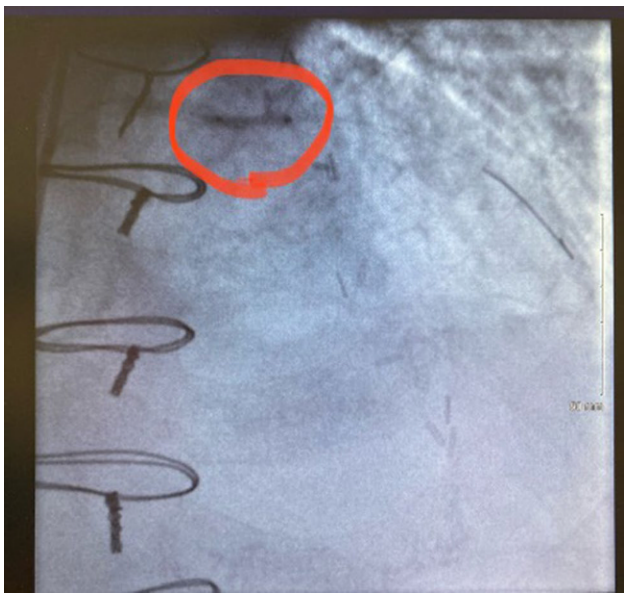

Fig. 1

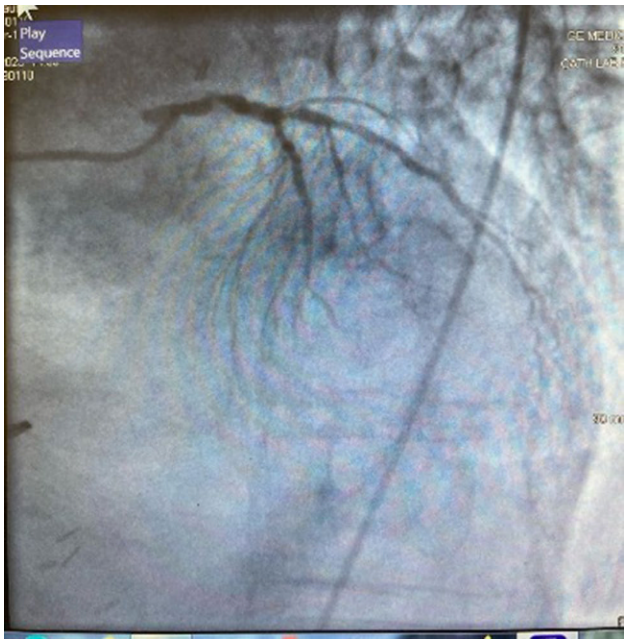

Fig. 2

occluded • Right Coronary Artery no limiting lesions • Internal Mammary-Left Anterior Descending all patent, no retrograde filling of diagonal branch • SVG-Obtuse Marginal graft & runoff vessels patent PCI Diagonal ramus Ostial lesion predilated 2.5 mm balloon as well as LM 3.0×8 mm DES delivered with excellent results Left Main IVL 4.0 shockwave balloon 4 cycles delivered followed by balloon rupture 4.0×12 mm DES Mid stent post dilation non-compliant balloon 24 atm Excellent result 20% residual stenosis

Results: Ethical questions Consent Medical standpoint angiography & potential PCR recommended > no oppurtunity for questions form patient Shared decsion Was not informed of benefits/risks Disclosure The patient was not told of balloon rupture during procedure Therefore patient still questions his health problems related to this PCI procedure and ruptured balloon.

Conclusion: Patients want disclosure of all harmful errors and seek information about what happened, why the error happened, how the error's consequences will be mitigated, and how recurrences will be prevented. The initial disclosure conversation should be held as soon as possible. Harmful errors should be disclosed and most helath care workers "choose words carefully" when telling patients about errors. with a clinical perspective using OCT or IVUS when dealing with difficult calcified lesions should be in the toolbox

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19-6

Der Einfluss von Prehabilitation bei koronar-arterieller Bypassoperation

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Introduction: Cardiovascular diseases are the number one cause of death worldwide. Coronary artery bypass surgery is performed in patients to ensure sufficient oxygen supply to the heart. Prehabilitation includes individually tailored exercise and sports therapies prior to surgery to establish physical and mental conditions for a complication-free recovery and rapid recuperation.

Methods: To develop this paper, the EMED format was employed, encompassing the sections of Introduction, Methodology, Results and Discussion. The literature search was conducted between December 2022 and May 2023 using the nursing databases CINHAL Complete via EBSCO, Medline Complete via EBSCO and Medline via PubMed. The selection of studies was based on a critical evaluation according to Panfil, resulting in the inclusion of seven studies.

Results: A total of 1464 patients participated in the studies, of which 417 received preoperative training. No negative effects were observed during the prehabilitation phase. Significant differences were found in terms of hospital stay duration, complications and postoperative physical fitness.

Conclusion: This literature search has revealed that prehabilitation has a positive effect. The investigated intervention-methods differed and therefore further research is needed to confirm their effectiveness.

POSTERSITZUNG 20 – RHYTHMOLOGIE 2

20-1

Entwicklung von prozeduralen Parametern bei Pulmonalvenenisolationen – eine Single Center Analyse

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Einleitung: Die Pulmonalvenenisolation (PVI) spielt eine Schlüsselrolle in der Behandlung von Vorhofflimmern und ist als wichtige Säule der Rhythmuskontrolle etabliert. Die Einführung der modernen Mapping-Systeme und deren kontinuierliche technische Optimierung sowie die Verbesserung der Kathetertechnologie haben Auswirkungen auf die Durchleuchtungszeit (DZ), Prozedurdauer (PD) sowie die Ablationszeit (AZ). Neben diesen Faktoren sorgt die zunehmende Erkenntnis über potentielle strahlenassoziierten Langzeitfolgen im Bereich der interventionellen Kardiologie für einen bedachten Einsatz der Fluoroskopie. Das ALARA-Prinzip („as low as reasonably achievable“) gilt dabei als wichtigste Maßgabe. Die Möglichkeit der Durchführung von Zero-Fluoroscopy (ZF) Prozeduren bei elektrophysiologischen Untersuchungen mit Indikation abseits der Pulmonalvenenisolation schafft zudem ein Bewusstsein für einen durchleuchtungssparenden intraprozeduralen Umgang mit ionisierender Strahlung.

Methoden: Wir analysierten die Daten aller Pulmonalvenenisolationen, welche als Ersteingriffe an unserem Zentrum durchgeführt wurden. Von 1959 PVIs von 2006–2023 wurden MESH-Katheter Eingriffe (44), Mehrfacheingriffe (457) und ein frühzeitiger Abbruch (1) ausgeschlossen. Von den verbliebenen PVI-Ersteingriffen (n = 1457) wurden 787 (54 %) mit Kryoballon (Kryo) und 670 (46 %) als Radiofrequenz (RF)-Ablation durchgeführt. 3 RF-Eingriffe wurden als ZF-PVIs durchgeführt. Die Eingriffe wurden hinsichtlich Durchleuchtungszeit, Prozedurdauer und Ablationszeit untersucht und getrennt für Kryo-PVIs und RF-Ablation ausgewertet. Die Analyse erfolgte mittels linearer Regression und deskriptiv mit Box-Plots aufgeschlüsselt nach Eingriffsjahr. Zusätzlich wurde die oben genannten prozeduralen Parameter in den fünf Jahren vor und nach der Einführung der Zero-Fluoroscopy Strategie bei elektrophysiologischen Untersuchungen an unserem Zentrum im August 2018 verglichen (Zeitraum 2014-07/2018 vs. 08/2018–2023). Die Mittelwerte wurden mittels Student’s t-Test verglichen. Die Auswertung wurde mit SPSS durchgeführt.

Resultate: Die DZ bei RF-PVIs verringerte sich im Beobachtungszeitraum von median 61 min (IQR 56–76) auf 4 min (IQR 2,8–6,6) (−2,2 min/Jahr, $p < 0{,}001$). Die PD bei RF-PVIs verringerte sich von 420 min (IQR 390–465) auf 105 min (IQR 70–130) (−11,8 min/Jahr, $p < 0{,}001$). Die AZ bei RF-PVIs halbierte sich seit unseren ersten Aufzeichnungen 2014 von 44 min (IQR 14,8–54) auf 21,2 min (IQR 13,8–28) (−2,6 min/Jahr, $p < 0{,}001$). Die DZ bei Kryo-PVIs verringerte sich seit Beginn der Durchführung 2009 von 44,5 min (IQR 36,5–60,5) auf 14,2 min (IQR 9,65–23,7) (− 1,3 min/Jahr, $p < 0{,}001$). Die PD bei Kryo-PVIs verringerte sich von 185 min (IQR 166,3–223,8) auf 60 min (IQR 50–85) (−7,2 min/Jahr, $p < 0{,}001$). Die AZ bei Kryo-PVIs verringerte sich seit unseren ersten Aufzeichnungen 2014 von 20 min (IQR 16–26) auf 15 min (IQR 13,3–17,8) (−0,6 min/Jahr, $p < 0{,}001$) Im Vergleich der prozeduralen Parameter in den 5 Jahren vor und nach der Einführung der ZF-Strategie fanden sich folgende Ergebnisse bei RF-PVIs (prä-ZF n = 110, post-ZF n = 360) und Kryo-PVIs (prä-ZF n = 333, post-ZF n = 209): Die DZ bei RF-PVIs nahm im Mittel um 11,8 min (19,2 vs 7,4, $p < 0{,}001$) ab, während sie bei Kryo-PVIs im Wesentlichen unverändert blieb (17,9 vs 17,5, $p = 0{,}56$). Die PD bei RF-PVIs nahm im Mittel um 31,4 min ab (150,8 vs 119,4, $p < 0{,}001$), während sie bei Kryo-PVIs im Wesentlichen unverändert blieb (81,3 vs 76,8, $p = 0{,}05$). Die AZ bei RF-PVIs nahm im Mittel um 9,9 min (38,9 vs 29, $p < 0{,}001$) und bei Kryo-PVIs um 2,6 min (20,9 vs 18,3, $p < 0{,}001$) ab.

Schlussfolgerungen: Seit der Einführung der PVI an unserem Zentrum kam sowohl bei Prozeduren mit RF- als auch mit Kryo-Energie zu einem kontinuierlichen Rückgang der Durchleuchtungszeit, Prozedurdauer und Ablationszeit. Bei PVIs mit dem Kryoballon waren diese Effekte nur in den Anfangsjahren zu beobachten und erreichten nach der initialen Lernphase in den letzten 10 Jahren annähernd ein Plateau. Eine gewisse Schwankungsbreite der Tendenzen der Verläufe der prozeduralen Parameter über die Jahre ist auf die Einschulung neuer Untersucher mit naturgemäß initial verlängerter PD, DZ und AZ zurückzuführen Der Effekt der Einführung einer ZF- Strategie in unserem EP-Labor im August 2018 stellt sich im Bereich der RF-PVIs durch eine signifikante Reduktion der DZ in den Folgejahren dar. Dieser Abwärtstrend ist weiter anhaltend. Im Gegensatz dazu führte dies zu keiner signifikanten Veränderung der DZ bei Kryo-Prozeduren im selben Zeitraum. Wir führen das auf die Tatsache zurück, dass die Kryo-PVI primär ein durch-

leuchtungsgeguidetes und streng standardisiertes Verfahren ohne 3D-Mapping ist. Die Verkürzung der PD und AZ ist auf eine Weiterentwicklung der Mapping-Systeme und der Katheter-technologien sowie auch auf ein zunehmendes manuelles Training des EP-Teams zurückzuführen. Für die Verkürzung der DZ sind neben den genannten Faktoren auch ein vermehrtes Bewusstsein für die Einsparung von Strahlung durch die Zero-Fluoro-Strategie an unserer Abteilung mit verantwortlich.

20-2

Vorhofflimmern bei systemischer Sklerose: Macht das Geschlecht den Unterschied?

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Einleitung: Es wird angenommen, dass das entzündliche Milieu der systemischen Sklerose (SSc) atriales Remodeling fördert und die Vulnerabilität für Vorhofflimmern (AF) erhöht [1, 2]. Häufig ist das weibliche Geschlecht von der SSc betroffen, was eine unterschiedliche Autoimmunität zwischen Frauen und Männern verdeutlicht [2]. Bisher ist wenig bekannt, ob diese Prädisposition das Auftreten von AF beeinflusst. Das Ziel dieser unizentrischen Studie war es, die Zeit bis zum Auftreten von AF bei Frauen sowie Männern mit SSc im ambulanten und stationären Setting unter Standardtherapie zu erfassen.

Methoden: In einer longitudinalen retrospektiven Datenanalyse wurden SSc-Personen im Alter von 18 bis 85 Jahren mit einem ACR/EULAR-Score ≥ 9 auf das Vorliegen von AF untersucht. AF und antiarrhythmische Therapie vor SSc-Diagnose galten als Ausschlusskriterium. Um den Einfluss der SSc auf AF zu explorieren, wurden Kaplan-Meier-plots und Regressionsmodelle erstellt, wobei die Zeit von SSc-Diagnose bis zum erstdetektierten AF den Hauptzielparameter darstellte. Mithilfe des Geschlechts (♀/♂) fand eine Subgruppenanalyse statt. Als Quelle dienten 12-Kanal-EKGs, Herz-Echos und Gesundheitsakten.

Resultate: Es wurden 114 Personen eingeschlossen, darunter 96 (84.2 %) Frauen und 18 (15.8 %) Männer. Der Hauptzielparameter AF lag nach 10 Jahren SSc bei 12.0 % (95 % CI 4.5–18.8). Das Alter bei SSc-Diagnose trug zum Auftreten von AF bei (HR 1.154; 95 % CI 1.079–1.233; $p < 0.001$), während das Geschlecht neben dem Body-Mass-Index (BMI), dem links- (LAVI) und rechtsatrialen Volumenindex (RAVI), der pulmonal arteriellen Hypertonie (PAH) und der arteriellen Hypertonie (aHT) die stärkste Variabilität verzeichnete (HR 2.359; 95 % CI 0.466–11.943; $p < 0.300$). Obwohl 11.2 % (95 % CI 3.4–18.4) der Frauen nach 10 Jahren SSc und 14.4 % (95 % CI 0.0–31.4) der Männer nach 5 Jahren SSc an AF erkrankten, war der Log-Rank-Test für die Zeit bis zum Auftreten von AF zwischen den Geschlechtern nicht signifikant. In der Subgruppenanalyse unterschieden sich die Frauen von den Männern im Median durch eine längere Beobachtungsdauer (9.40/4.71 Jahre; $p = 0.008$), PAH-Exposition (3.83/1.10 Jahre; $p = 0.038$) und ein längeres krankheitsfreies Intervall bei aHT (8.33/4.34 Jahre; $p = 0.049$) und PAH (8.67/3.82 Jahre; $p = 0.019$). In Bezug auf AF-Prävalenz, Alter bei SSc-Diagnose, BMI, LAVI, RAVI, aHT-Exposition und ENA-Antikörper wiesen beide Subgruppen ähnliche Merkmale auf.

Schlussfolgerungen: AF tritt bei Frauen mit SSc später auf als bei Männern, wenngleich keine statistische Signifikanz erzielt wurde, da Männer in der Studie unterrepräsentiert waren, was die Fehlerwahrscheinlichkeit vom Typ II erhöht. Gleichzeitig waren Frauen kränker als Männer und verblieben länger im Protokoll, womit aktuelle Theorien über den ungünstigen SSc-Verlauf bzw. nachteilige kardiale Adaptionsmechanismen bei Männern bekräftigt werden. Um die geschlechtsspezifischen Unterschiede von AF bei SSc abschließend zu präzisieren, sind weitere Studien notwendig.

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20-3

Same-day discharge following catheter ablation: a single-centre experience

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Introduction: Same-day discharge (SDD) after catheter ablation of various arrhythmias is an emerging practice in many countries. These concepts were initiated due to the increasing number of electrophysiological procedures, procedural safety, and limited hospital capacities. As the Austrian healthcare system is facing similar challenges, we initiated an SDD program at our centre.

Methods: We conducted a pilot project on SDD from January 8th to January 26th at the University Hospital of Graz. Patients < 75 years of age, living within 50 km of the hospital, without serious comorbidities, and a maximum body mass index of ≤ 35 kg/m2 were offered the SDD concept. Additionally, post-interventional lay person assistance at home was confirmed. Patients were scheduled for pulmonary vein isolation [PVI; either pulsed field (PFA) or radiofrequency ablation(RF)], catheter ablation of supraventricular tachycardia (SVT) or right-ventricular premature ventricular contractions (PVC). PVI was conducted under deep sedation, while all other procedures were performed under conscious sedation. The groin puncture was closed using the Prostyle® closure system and a Cathofix® compression bandage for 4 hours. Oral anticoagulation was administered before discharge. If single anti-platelet-therapy (SAPT) was prescribed, patients received 1 mg/kg of low-molecular-weight heparin subcutaneously and were instructed to start with SAPT the following day. Patients were monitored for at least 4 hours and were mobilised before discharge. Prior to discharge, an ECG and a transthoracic echocardiography

were performed and the puncture site was examined. A structured discharge interview was conducted, and the patient was given a patient information sheet on behaviour after day-care procedures. 14 days after discharge, patients were contacted by phone to assess satisfaction and possible complications.

Results: We performed catheter ablation in 32 patients. Median age was 62 years, median body mass index (BMI) 27 and median CHADS-VASc 1. Median left ventricular ejection fraction (LVEF) was 62% and median left atrial diameter was 45 mm. We performed catheter ablation for typical/atypical AVNRT in 34%, typical right atrial flutter in 16%, atrial tachycardia in 15% (right atrial: 9%, left-atrial: 6%), PVC and WPW in 3%, and PVI in 34% (PFA: 31%, RF 3%). All patients were discharged on the same day, except for one patient who required prolonged monitoring after deep sedation due to obstructive sleep apnea. 81% of patients felt very confident, 69% of carers felt very confident and 13% felt moderately confident about the SDD. All patients said that the information provided was sufficient. 19% reported adverse symptoms after the procedure (1 headache, 2 patients with palpitations, 1 patient with dysesthesia right lower limb, 2 patients with minor bleeding at the puncture site), 13% (n = 4) reached out for medical advice. In none of them any intervention was necessary. One patient contacted us by phone, the other three patients presented at the local A&E department. 94% said they would have a SDD procedure again.

Conclusion: SDD is safe and will be a future concept to facilitate elective invasive catheter ablation procedures.

20-4

Electrophysiological findings, incidence, and predictors for AF recurrence after pulsed field versus radiofrequency pulmonary vein isolation. A retrospective analysis

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Introduction: Pulsed field ablation (PFA) is an emerging method for catheter ablation of atrial fibrillation (AF). Data comparing efficacy and safety of PFA compared to thermal ablation is still scarce. In this study, we compared a cohort of patients who underwent PFA with those who received very high power short duration (vHPSD) radiofrequency catheter ablation at the University Hospital Graz.

Methods: We analysed data from both cohorts (PFA: n = 231; RF: n = 243). Both procedures were performed under deep sedation (propofol and fentanyl). The PFA procedure involved 2 × 2 × 2 pulses, with additional pulses as required. RF procedures were performed using the QDOT Micro catheter to deliver 90 watts of energy over 4 seconds.

Results: Baseline characteristics are shown in Table 1. First pass isolation was achieved more frequently in the PFA group (85% vs. 57%; p < 0.001). Median procedure duration (RF:PFA 110 min:60 min; p < 0.001), fluoroscopy time (RF:PFA 13 min:18 min; p < 0.001) and fluoroscopy dose (RF:PFA 8Gycm2:11Gycm2, p = 0.026) showed significant differences, with procedure time being shorter in the PFA group. However, a significantly higher number of patients with additional flutter were ablated in the RF group [RF-group 38% vs. 6% in the PFA group (p < 0,001)]. Recurrence rates did not differ significantly between the vHPSD and PFA groups (RF: 55/243 (23%), PFA: 38/231 (17%); p = 0.65). As the difference within the recurrence rates between RF ad PFA were not significantly, we searched for possible predictors

Tab. 1 I) Patient related differences

	PFA	vHPSD	P-value
Patients enrolled	N = 231	N = 243	
Recurrences	17% (n = 38)	23% (n = 55)	0.09
Time to recurrence	153 (109–217)	90 (90–111)	<0.001
Age (median + IQR 25.–75. Perzentile)	63y (56–70)	63y (55–70)	0.763 0.809
Gender	38% ♀	37% ♀	0.812
BMI	27 (24–31)	27 (25–30)	0.330 0.483
CHADS-VASc	2 (1–3)	2 (1–3)	0.830 0.700
Cardiac Imaging			
LA enlargement	61%	56%	0.329
LVEF (normal)	84%	71%	0.003
AF type – Paroxysmal – Persistent – Long std. pers.	61% (n = 141) 36% (n = 83) 3% (n = 7)	65% (n = 156) 34% (n = 81) 2% (n = 5)	0.651
Comorbidities			
Hypertension	60%	59%	0.843
Diabetes	8%	9%	0.736
Stroke	6%	7%	0.815
Blood samples			
Kreatinin	0.98 (0.88–1.12)	1.02 (0.89–1.16)	0.156
NT-pro BNP	224 (104–515)	239 (101–627)	0.456

Tab. 2 II) Procedure related differences

	PFA	vHPSD	P-value
Patients enrolled	N = 231	N = 243	
First pass isolation	85%	57%	<0.001
CTI line	6%	38%	<0.001
Cardioversion	22%	17%	0.170
Median Procedure duration (min)	60 (50–79)	110 (85–148)	<0.001
Median Fluoroscopy time (min)	18 (14–25)	13 (9–19)	<0.001
Median X-Ray dose (Gycm2)	11 (6–19)	8 (5–19)	0.026

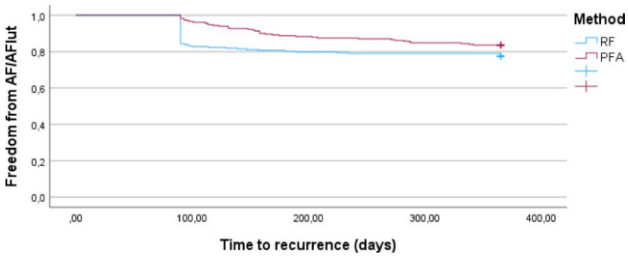

Fig. 1

for AF recurrence in the overall cohort. We found cardioversion at the end of the procedure (p = 0.037), procedure duration (p = 0.020), and additional ablation of CTI (p = 0.009) to be associated with AF recurrence.

Conclusion: Based on our results, recurrence rates between PFA and vHPSD in a miced AF ablation cohort do not differ significantly, although the first pass isolation rate is significantly higher in the PFA group. Procedure time is shorter, but fluoroscopy time and x-ray dose are significantly lower in the RF group. However, randomized trials are needed to further compare thermal methods to pulsed electric field.

20-5

Transseptal Puncture Guided by Three-Dimensional Electroanatomical Mapping: Early Experience Using a Simplified Approach in Adults with Congenital Heart Disease

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Introduction: The widespread use of three-dimensional (3D) mapping systems and echocardiogra- phy in the field of cardiac electrophysiology has made it possible to perform transseptal punctures (TSP) with low or no fluoroscopy. However, such attempts in adults with congenital heart disease (ACHD) who have previously undergone surgical or interventional treatment are limited. Therefore, we sought to explore the feasibility and safety of an approach to perform zero- or low-fluoroscopy TSP in ACHD patients undergoing left atrial cardiac ablation procedures.

Methods: This study included 45 ACHD patients who underwent TSP for ablation of left-sided tachycardias (left atrium or pulmonary venous atrium). Arrhythmias included left-sided atrial tachycardias and atrial flutters, atrioventricular (AV) reentry tachycardias due to accessory pathways, and atrial fibrillation. Patients with preexisting interatrial connections, such as persistent patent foramen ovale (PFO) or baffle leak, were excluded. Computed tomography (CT) of the heart was performed in all patients prior to ablation. 3D mapping of the right-sided heart chambers before TSP was used to superimpose the registered anatomy, which was subsequently used for the mapping-guided TSP technique.

Results: TSP was performed with zero-fluoroscopy in 27 patients, and the remaining 18 patients had a mean fluoroscopy exposure of 315.88 ± 598.43 µGy.m2 and a mean fluoroscopy duration of 1.9 ± 5.4 min. No patient in this cohort experienced TSP-related complications.

Conclusion: Our study describes a fluoroscopy-free or low-dose fluoroscopy approach for TSP in ACHD patients un- dergoing catheter ablation of left-sided tachyarrhythmias who had been previously treated surgically or interventionally due to congenital heart defects. By superimposing 3D electroanatomic mapping with cardiac CT anatomy, this protocol proved to be highly effective, feasible and safe.

20-6

Soluble ST2 is associated with postoperative atrial fibrillation after cardiac surgery in postmenopausal women

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Introduction: Background: Postoperative atrial fibrillation (POAF) represents the most common complication following cardiac surgery. Approximately one-third of patients experiencing POAF transition to atrial fibrillation (AF) within a year, challenging the notion of POAF as merely a transient event. Soluble ST2 is an established biomarker regarding fibrosis and myocardial stretch, however, its role in predicting the onset of POAF remains unclear.

Methods: Methods: In this prospective observational study, preoperative soluble ST2 levels have been assessed in 496 individuals with no prior history of AF who underwent elective cardiac surgery, including valve, coronary artery bypass graft surgery, or a combined procedure.

Results: Results: The average age was 67 years, and 29.4% were female. Overall, 42,3% of the participants developed POAF. Soluble ST2 levels were found to be significantly higher in patients with POAF. Interestingly, ST2 was only predictive of POAF in females with an adjusted OR of 2.04 (95%CI 1.210–3.451; p = 0.008) and not male patients (adj. OR 1.062; 95%-CI 0.825–1.367; p = 0.642). Furthermore, within a linear regression model it was observed that for every 1 ng/mL increase in

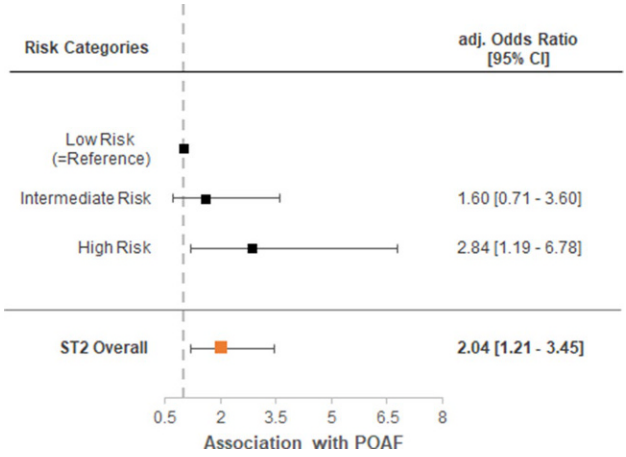

Fig. 1 Adjusted effects of ST2 levels on the onset of POAF in females

soluble ST2 levels, the average POAF duration extended by 39.5 minutes (95%CI: 15.8–63.4 minutes; p = 0.001).

Conclusion: Conclusion: Soluble ST2 predicts the onset of POAF in women but not men undergoing cardiac surgery. Furthermore, soluble ST2 levels were associated with the subsequent burden of POAF. Thus, assessment of soluble ST2 in addition to clinical risk factors could improve risk stratification for development of POAF following elective cardiac surgery.

20-7

Kardiale Resynchronisation bei Herzinsuffizienz und Rechtsschenkelblock

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Einleitung: Patienten mit Herzinsuffizienz (HI), LVEF≤35 %, Sinusrhythmus und typischem Linksschenkelblock (LSB) mit QRS-Breite > 150 ms profitieren von einer kardialen Resynchronisationstherapie (CRT; Klasse IA Indikation in den ESC-Guidelines 2021[1]). Pat. mit „non-LBBB" haben hingegen nur eine Klasse IIaB Indikation. Laut einem Review von M. Henin[2] wurden 2002 bis 2010 Pat. ungeachtet der Art der Leitungsverzögerung untersucht, lediglich in der ENHANCE CRT study[3] waren nur Pat. mit „non-LBBB" eingeschlossen. Ältere Studien (MIRACLE-ICD, COMPANION, MADIT-CRT) haben diese Pat. nur in Subgruppenanalysen ausgewertet. Beim „non-LSB" können 4 Gruppen unterschieden werden: atypischer LBBB, typischer RBBB, interventrikuläres Conduction Delay (IVCD), atypischer RBBB mit maskiertem LBBB[2]. Pat. mit RBBB profitieren von einer CRT bei zusätzlichem LV-Delay (atyp. RBBB)[4]. Über eine isolierte RV-Stimulation bei RBBB gibt es nur Fallberichte, wo es bei erhaltener AV-Überleitung durch Fusion einer septalen RV-Stimulation mit der intrinsischen Überleitung (zum linksventrikulären Reizleitungssystem) zu einer Resynchronisation kommt[5,6] sowie tierexperimentelle Untersuchungen mit RV-Stimulation bei pulmonaler arterieller Hypertonie, die zu einer Verbesserung der RV-Funktion geführt hat[7].

Methoden: Wir berichten über einen 80-jährigen Mann mit ischämischer Kardiomyopathie (3-Gefäßerkrankung, ACBG 2012), mittelgradig red. LVEF 45 %, paroxysmalem Vorhofflimmern nach Pulmonalvenenisolation 2014, COPD GOLD IV mit erhöhtem sPAP, art. Hypertonie und typ. RBBB (QRS 0,15 sec). Wegen tachykarder Vorhofflimmerrezidive wurden diverse Antiarrhythmika (Dronedaron, Sotalol und Amiodaron) eingesetzt, aber nur Amiodaron war effektiv. Eine Dauertherapie war wegen eines auftretenden Tremors nicht möglich. Im Jänner 2024 wurde daher ein CRT-D System vor einer geplanten AV-Knotenablation implantiert. Bei der CRT-D Implantation war nur eine inferiore LV-Sonden Position möglich, bei RBBB fand sich kein elektromechanisches Delay (RV-LV-sense 0 ms; Abb. a). Die biventrikuläre Stimulation musste wegen schmerzhafter Phrenicusstimulation beendet werden und ein Conduction System Pacing (CSP) wird geplant. In der Wartezeit darauf versuchten wir, die für den Pat. beste Übergangslösung zu finden. Die med. Therapie umfasste Apixapan, Valsartan, Sotalol, Bisoprolol und Furosemid, für die COPD erhielt er Tiotropium und Olodaterol, Fluticasonpropionat, Ipratropiumbromid b. Bed. Ausgangs-Echokardiographie: Rechter Ventrikel (RV) gering vergrößert (41 mm), rechtsventrik. Funktion grenzwertig, geringe TRINS (TV Vmax 3 m/s), sPAP 41 mm, LVF mittelgr. reduziert. Das NT-pro-BNP-Wert betrug 954 ng/L.

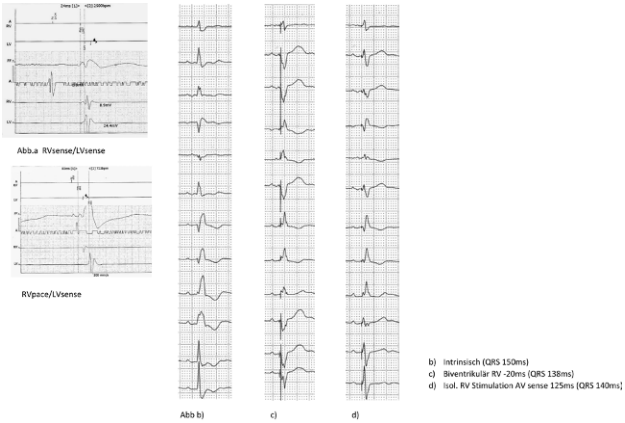

Fig. 1

Resultate: Das intrinsische EKG (Abb. b) zeigt einen typischen RBBB. In Abb. c sieht man den QRS-Komplex bei biventrikulärer Stimulation mit einem VV-intervall 20 ms RV vor LV (QRS-Breite 138 ms). Bei isolierter RV-Stimulation wird der schmalste QRS-Komplex bei einer gesensten AV-Zeit von 125 ms erreicht, er ist mit 140 ms (Abb. d) beinahe so schmal wie bei CRT mit 20 ms RV vor LV. Der Grund für die Wahl der AV-Zeit von 125 ms war die Tatsache, dass bei einer kürzeren AV-Zeit ein ausgeprägterer linksanteriorer Hemiblock entstand. Weil der Pat. nach 17 Tagen über Belastungsdyspnoe klagte und das NT-Pro BNP auf 1081 ng/L anstieg, wurde die Diuretikadosis erhöht. Neun Tage später klagte der Pat. weiter über Atemnot bei Belastung. Korrelierend fand sich bei der Echokardiographie eine Zunahme der RV-Größe (48 mm), Anstieg der TRINS (TV Vmax 3,4 m/s) und eine reduzierte rechtsventrikuläre Funktion (RV-Strain –14 %). Das NT-Pro BNP war nochmals deutlich angestiegen (1339 ng/L) und es wurde die isolierte RV-Stimulation beendet.

Schlussfolgerungen: Obwohl bei unserem Patienten der QRS-Komplex durch eine isolierte RV-Stimulation verschmälert werden konnte, mussten wir aufgrund der Verschlechterung der Symptomatik und der objektiven Parameter diese Stimulation wieder verlassen. Möglicherweise kommt es bei Patienten mit COPD durch eine RV-Stimulation zu einem Anstieg des pulmonal arteriellen Druckes (PAP) und/oder des pulmonal arteriellen Widerstandes (PVR) und damit zu einer Zunahme der TRINS[8]. Aufgrund unserer Beobachtung sollten Patienten mit implantiertem Schrittmacher und Auftreten einer Herzinsuffizienz bei Vorliegen eines typischen RBBB systematisch untersucht werden, ob nicht durch eine einfache Umprogrammierung der AV-Zeit eine Verschmälerung des QRS-Komplexes und damit eine klinische Besserung zu erreichen ist und so ein Aufrüsten auf eine CRT oder auf ein Conduction System Pacing evt. vermieden werden kann. Wenn bereits ein CRT implantiert wurde kann die Optimierung des VV-Intervalls (RV vor LV) oder eine isolierte RV-Stimulation dann erwogen werden, wenn die intrinsische Leitung zum linksventrikulären Reizleitungssystem normal ist. Patienten mit RBBB und höhergradiger COPD profitieren von dieser VV-Optimierung (RV vor LV) oder einer isolierten RV-Stimulation offenbar nicht.

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20-8

Comparison of single-shot ablation methods for pulmonary vein isolation: PFA vs. Cryo

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Introduction: Pulmonary vein isolation (PVI) is the cornerstone of modern non-pharmacological treatment of atrial fibrillation (AF). The Cryoballoon (CB) technology in one of the most commonly used single-shot methods in many centres. Pulsed Field Ablation (PFA) is a new, non-thermal, tissue selective approach which has recently been introduced and used to achieve PVI. We sought to compare procedural and acute safety data of both techniques in our centre.

Methods: In this retrospective analysis we included all PVI procedures using CB or PFA in our centre from April 2022 until December 2023. A total of 192 patients (92 CB and 100 PFA, 128 males and 64 females) with paroxysmal (70,8%) and persistent (29,2%) AF were analysed and compared regarding procedural data and safety.

Results: Our analysis revealed a shorter overall procedure duration in the PFA group (CB: 69,3 ± 3,6 min vs. PFA: 61,6 ± 3,1 min; p-value = 0,001). Fluoroscopy time was significally shorter for the CB group (CB: 13,3 ± 1,4 min, PFA: 15,7 ± 1,1 min, p-value = 0,009), whereas a significantly lower dose of radiation was used in the PFA group (CB: 2677 ± 490,3 µGym2, PFA: 1780 ± 289,6 µGym2, p-value = 0,002). These results could be explained mainly by the fact that during CB are commonly used more cine loops in compare to PFA procedures. The overall complication rate was 21. One major complication (1%), a cardiac tamponade was reported in the PFA group. Minor vessel complications (hematoma, (pseudo)aneurysm, AV fistula) occurred in the 5 patients (5,4%) in the CB group and in 3 patients (3%) in the PFA group (p-value = 0,39). Thrombin was injected under ultrasound guidance into the femoral pseudoaneurysm in 2 (2,2%) patients in the CB group and in 2 (2%) patients in the PFA group. In addition, in the CB group a reversible -during the procedure- phrenic nerve palsy was described in 11 patients 12%. The reversible phrenic nerve palsy occurred in 4 patients (4,4%) during right inferior pulmonary vein (RIPV

Tab. 1 Baseline charecteristics

	CB (n = 92)	PFA (n = 100)
Age, years	65,5 (63,6–67,4)	62,2 (60,3–64,0)
Women, n (%)	36 (39,1)	28 (28)
Paroxysmal AF, n (%)	71 (77,2)	65 (65)
Hypertension, n (%)	45 (48,9)	54 (54)
Coronary Artery Disease, n (%)	4 (4,3)	14 (14)
Diabetes Mellitus II, n (%)	7 (7,6)	8 (8)
Hyperlipidemia, n (%)	36 (39,1)	46 (46)

Tab. 2 Comparison of procedure duration, fluoroscopy dose and time

	CB (n = 92)	PFA (n = 100)	p-value
Procedure duration (min)	69,3 ± 3,6	61,6 ± 3,1	0,001
Fluoroscopy dose (µGym²)	2677 ± 490,3	1780 ± 289,6	0,002
Fluoroscopy time (min)	13,3 ± 1,4	15,7 ± 1,1	0,009

Conclusion: The new technology of PFA seems to be faster and spares radiation dose as compared to CB technology. Complication rates were similar regarding vascular problems but completely eliminating phrenic nerve palsy with the use of PFA. Thus, PFA seems to be a promising energy source for PVI in future.

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20-9

Anticoagulation in Atrial Fibrillation and End Stage Kidney Disease on Hemodialysis: A Meta-analysis of Randomized Trials Comparing Direct Oral Anticoagulants with Vitamin K Antagonists

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Introduction: Only small randomized trials have investigated the efficacy and safety of direct oral anticoagulants (DOACs) compared to Vitamin K antagonists (VKAs) in patients with non-valvular atrial fibrillation (NVAF) and end-stage kidney disease. We therefore aimed to perform a systematic review and meta-analysis comparing anticoagulation with DOACs to VKAs in NVAF patients undergoing chronic hemodialysis.

Methods: A systematic search using Medline, Web of Science, and Embase was performed. All randomized trials comparing DOACs with VKAs in patients with NVAF on chronic hemodialysis were included. As primary endpoint we analysed all-cause mortality. As secondary endpoints, we investigated total bleeding events, life-threatening or major bleeding events and thromboembolic events or stroke. We used the odds ratio as outcome measure and fitted a random-effects model due to the expected heterogeneity.

Results: Three studies fulfilled the inclusion criteria comprising 383 patients (218 on apixaban or rivaroxaban, 165 on VKA). No significant difference between DOACs and VKAs regarding death (OR 0.94 [95%CI 0.55–1.63], p = 0.84; Fig. 1), total bleedings (OR 0.99 [95%CI 0.63–1.54], p = 0.96) and life-threatening or major bleeding (OR 0.65 [95%CI 0.32–1.33], p = 0.24) was detected. There was a trend towards a reduction of thromboembolic events or stroke in patients receiving DOACs (OR 0.39 [95%CI 0.14–1.05], p = 0.06; Fig. 2).

Conclusion: Oral factor Xa inhibitors carried a similar risk of bleeding and death compared to VKAs in NVAF patients on chronic hemodialysis. Moreover, there was a trend towards a reduction of thromboembolic events or stroke in patients receiving DOACs.

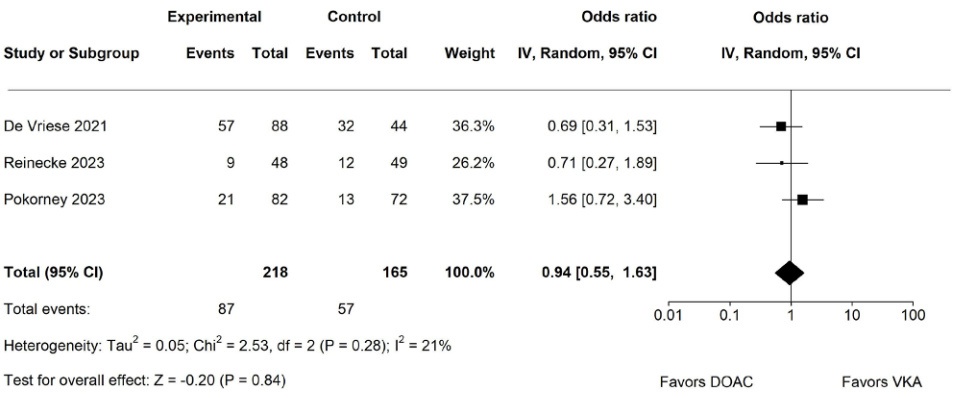

Fig. 1 Forest plot for all-cause death

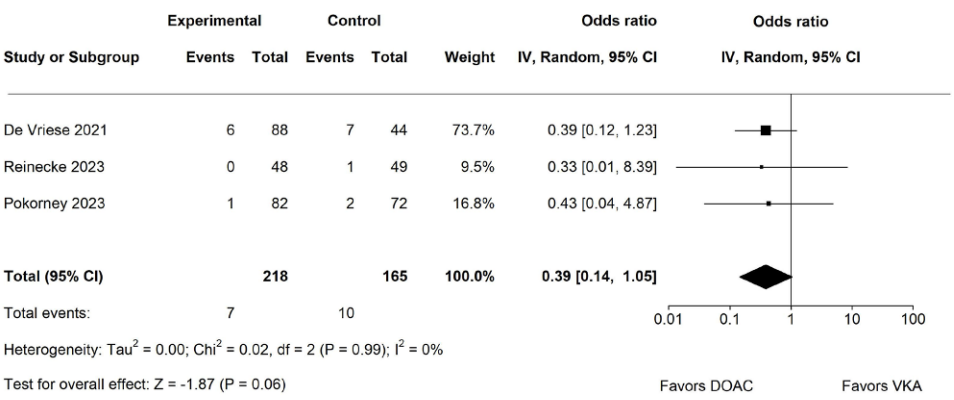

Fig. 2 Forest plot for thromboembolic events or stroke

POSTERSITZUNG 21 – VITIEN

21-1

Beyond the Valve: Incidence, Outcomes, and Modifiable Factors of Acute Kidney Injury in Patients with Endocarditis Undergoing Valve Surgery – A Retrospective, Single-Center Study

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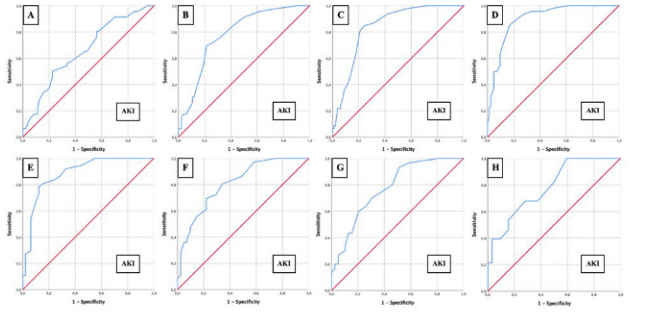
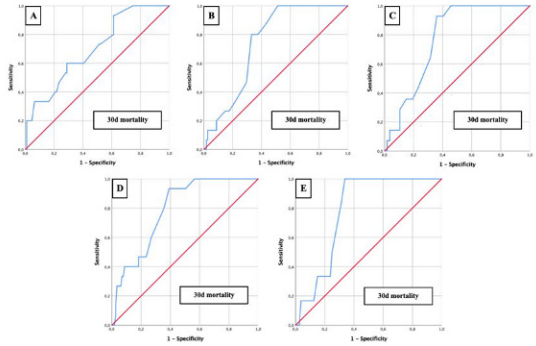
Introduction: Endocarditis, a challenging and potentially life-threatening infectious condition affecting the heart valves, frequently necessitates surgical intervention to optimize outcomes. While valvular surgery is a crucial aspect of management, postoperative acute kidney injury (AKI) remains a significant concern. This retrospective study aimed to investigate the incidence of AKI, assess its impact on short-term mortality, and identify potentially modifiable factors in patients with proven endocarditis scheduled for valve surgery.

Methods: A single-center retrospective study was conducted between 2013 and 2021, enrolling 130 consecutive patients with confirmed endocarditis slated for valve surgery. Creatinine levels were closely monitored pre- and postoperatively, and AKI was defined according to the Kidney Disease: Improving Global Outcomes (KDIGO) criteria. Patient demographics, comorbidities, procedural details, and postoperative complications were meticulously recorded. The primary outcomes were the incidence of AKI, the evaluation of the relevance of creatinine levels for AKI detection and the association of AKI in predicting 30-, 60-, 120-day and 180-day mortality. Secondary outcomes included the exploration of modifiable factors contributing to AKI.

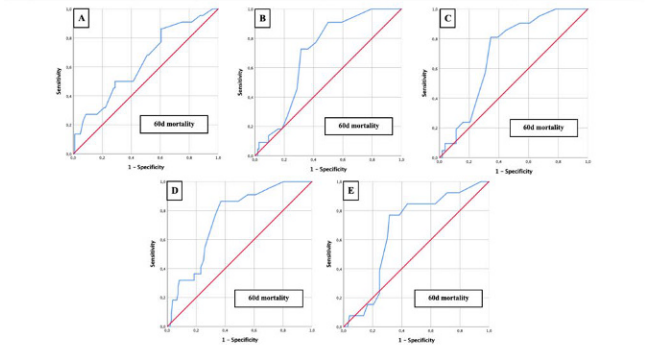
Results: Postoperatively, 35.4% of patients developed AKI. Over the span of creatinine measurements from the preoperative period to 7 days postoperatively, patients who developed acute kidney injury and those who did not, exhibited the highest elevation in creatinine levels on the 2nd postoperative day (2.2 ± 1.0 mg/dl vs. 1.3 ± 0.7 mg/dl; $p < 0.001$). In the AUROC analyses regarding the occurrence of AKI, the best predictive value of creatinine level was determined on the 2nd postoperative day with 1.35 mg/dl (AUC: 0.901; sensitivity: 0.89, specificity: 0.79; Youden Index: 0.68; $p < 0.001$). Regarding short-term survival, the calculated Kaplan-Meier curves demonstrated



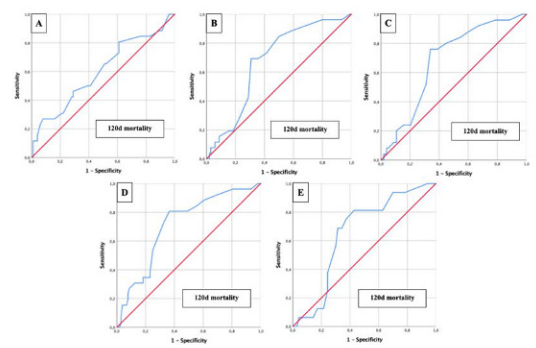
	Value	Prediction	AUC	95%CI	P-value	Cut-off	Sensitivity	Specificity	Youden Index
A	Creatinine D-1 (mg/dl)	AKI	0.659	0.561 — 0.756	0.003	1.11	0.50	0.78	0.27
B	Creatinine D0 (mg/dl)	AKI	0.781	0.701 — 0.860	< 0.001	1.35	0.70	0.79	0.48
C	Creatinine D1 (mg/dl)	AKI	0.838	0.770 — 0.906	< 0.001	1.35	0.80	0.79	0.60
D	Creatinine D2 (mg/dl)	AKI	0.901	0.849 — 0.953	< 0.001	1.35	0.89	0.79	0.68
E	Creatinine D3 (mg/dl)	AKI	0.886	0.817 — 0.956	< 0.001	1.35	0.78	0.88	0.66
F	Creatinine D4 (mg/dl)	AKI	0.810	0.715 — 0.904	< 0.001	1.25	0.69	0.78	0.47
G	Creatinine D5 (mg/dl)	AKI	0.776	0.669 — 0.884	< 0.001	1.25	0.60	0.80	0.40
H	Creatinine D6 (mg/dl)	AKI	0.783	0.670 — 0.896	< 0.001	1.15	0.68	0.72	0.40



	Value	Prediction	AUC	95%CI	P-value	Cut-off	Sensitivity	Specificity	Youden Index
A	Creatinine D-1 (mg/dl)	30d mortality	0.701	0.569 — 0.833	0.012	1.11	0.60	0.71	0.31
B	Creatinine D0 (mg/dl)	30d mortality	0.743	0.648 — 0.837	0.002	1.05	1.00	0.49	0.49
C	Creatinine D1 (mg/dl)	30d mortality	0.772	0.682 — 0.861	0.001	1.35	0.93	0.64	0.57
D	Creatinine D2 (mg/dl)	30d mortality	0.789	0.694 — 0.884	< 0.001	1.35	0.93	0.61	0.54
E	Creatinine D3 (mg/dl)	30d mortality	0.783	0.672 — 0.895	0.021	1.45	1.00	0.66	0.66

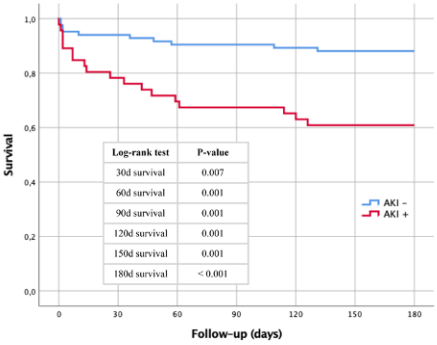


	Value	Prediction	AUC	95%CI	P-value	Cut-off	Sensitivity	Specificity	Youden Index
A	Creatinine D-1 (mg/dl)	60d mortality	0.632	0.506 — 0.758	0.052	0.82	0.86	0.39	0.26
B	Creatinine D0 (mg/dl)	60d mortality	0.698	0.600 — 0.795	0.004	1.35	0.73	0.69	0.41
C	Creatinine D1 (mg/dl)	60d mortality	0.708	0.610 — 0.806	0.003	1.35	0.81	0.65	0.46
D	Creatinine D2 (mg/dl)	60d mortality	0.744	0.646 — 0.843	< 0.001	1.35	0.86	0.63	0.49
E	Creatinine D3 (mg/dl)	60d mortality	0.670	0.530 — 0.809	0.052	1.45	0.77	0.69	0.45



	Value	Prediction	AUC	95%CI	P-value	Cut-off	Sensitivity	Specificity	Youden Index
A	Creatinine D-1 (mg/dl)	120d mortality	0.602	0.474 — 0.730	0.110	0.82	0.81	0.39	0.20
B	Creatinine D0 (mg/dl)	120d mortality	0.674	0.570 — 0.778	0.006	1.35	0.69	0.69	0.38
C	Creatinine D1 (mg/dl)	120d mortality	0.680	0.575 — 0.785	0.005	1.35	0.76	0.66	0.42
D	Creatinine D2 (mg/dl)	120d mortality	0.714	0.608 — 0.819	0.001	1.35	0.81	0.64	0.44
E	Creatinine D3 (mg/dl)	120d mortality	0.655	0.525 — 0.786	0.053	1.25	0.81	0.57	0.38

Fig. 1 AUROC curves regarding prediction of AKI and prediction of short-term mortality



Number at Risk	0 months	1 months	2 months	3 months	4 months	5 months	6 months
AKI -	84	79	78	76	76	74	74
AKI +	46	36	33	31	31	28	28
Overall	130	115	111	107	107	102	102

Fig. 2 Kaplan-Meier curve with corresponding log-rank tests regarding short-term mortality and the postoperative development of AKI

consistently significant associations between the presence of AKI and higher mortalities at 30 to 180 days postoperatively. Again, elevated creatinine levels with 1.35 mg/dl on the 2nd postoperative day emerged as a robust predictor in the AUROC analyses of short-term mortality, with clear implications for the 30- (AUC: 0.789; sensitivity: 0.93, specificity: 0.61; Youden Index: 0.54; $p < 0.001$), 60- (AUC: 0.744; sensitivity: 0.86, specificity: 0.63; Youden Index: 0.49; $p < 0.001$), and 120-day postoperative periods (AUC: 0.714; sensitivity: 0.81, specificity: 0.64; Youden Index: 0.44; $p = 0.001$). In the context of binary logistic regression, CK-MB levels measured at 24 hours postoperatively, and the minimum hemoglobin during the surgical procedure emerged as independent and predictive factors for the development of AKI.

Conclusion: This study underscores the pivotal role of creatinine levels in detecting acute kidney injury and prognosticating short-term mortality following valve surgery in endocarditis patients. The identification of a specific creatinine threshold (1.35 mg/dl) as a relevant marker for both AKI and mortality offers a practical and clinically significant parameter for risk stratification. These insights could potentially guide clinicians in refining perioperative strategies, enhancing patient care, and optimizing outcomes in this challenging patient population. Further exploration of these findings may contribute to the development of targeted interventions aimed at improving renal outcomes and overall survival in individuals undergoing valve surgery for endocarditis.

21-2

MELD XI score, but not MELD score predicts short-term outcome in interventional treatment of tricuspid regurgitation.

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Introduction: Interventional treatment of tricuspid regurgitation is a growing field, although there are currently gaps in knowledge regarding the identification of patients who could potentially benefit. It is known that the MELD ("model of end stage liver diseases") score correlates with the outcome of various cardiological diseases and could be particularly helpful in right ventricular diseases with chronic hepatic congestion. The MELD XI score, a further development of the conventional MELD-score, may be more suitable for cardiology patients, as it may not be influenced by the intake of oral anticoagulants. The aim of the present study was to compare the predictive value of the conventional MELD score with the MELD-XI score in terms of rehospitalization due to decompensated heart failure in patients after interventional tricuspid valve treatment.

Methods: In this single-center prospective cohort study, data from 36 consecutive patients undergoing "edge to edge" repair (n = 28) or "heterotopic minimal invasive tricuspid valve repair" (n = 8) were analyzed. Both, the conventional MELD score (serum creatinine, bilirubin, INR) and the modified MELD XI score (serum creatinine, bilirubin) were recorded before the procedure. Clinical data were collected up to 3 months after the intervention. Receiver operator characteristics with calculation of the area under the curve (AUC) were performed to illustrate the predictive value of both scores for rehospitalization and mortality.

Results: Mean age of patients was 80.2 SD 5.9 years; 33.3% were male. Baseline characteristics of the patients are shown in table 1. Rehospitalization due to decompensated heart failure occurred in 25% of patients. Mortality within the first 3 months was 11%. The predictive value for prehospitalization for the modified MELD IX score was AUC 0.82 (95% CI 0.63-0.99;

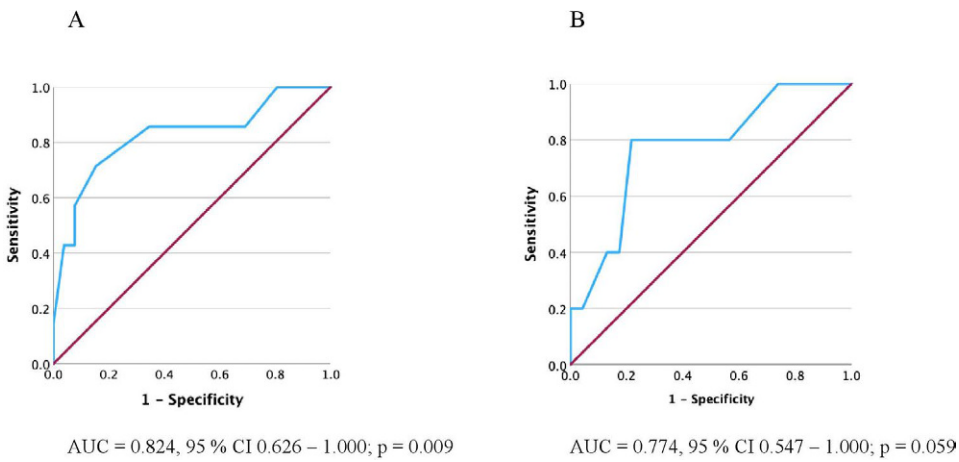

Fig. 1 Predictive value of MELD X1-Score (A) and MELD Score (B)

Tab. 1 Baseline patients' characteristics

	All
Sex male [%]	33.3
Age [years]	80.2 ± 5.9
Body mass index [kg/m²]	27.5 ± 6.8
"Edge-to Edge (TriClip) [%]	25.0
"Edge-to Edge (Pascal) [%]	52.8
"Heterotopic minimal invasive tricuspid valve repair" (TricValve)[%]	22.2
MELD score	13,1 ± 13,7
MELD XI score	14.2 ± 4.3
eGFR [mL/min/1.73 m2]	42.0 ± 16.3
Type II diabetes [%]	52.7
Coronary artery disease [%]	63.9

p = 0.009), while the conventional MELD score had an AUC of 0.77 (95% CI 0.55-0.99, p = 0.059).

Conclusion: In this pilot-study, the modified MELD XI score was identified as a potential marker for short-term outcome after interventional tricuspid valve treatment.

21-3

Prognostic value of pre-interventional hemodynamics and organ function for 3-month outcome after tricuspid valve intervention

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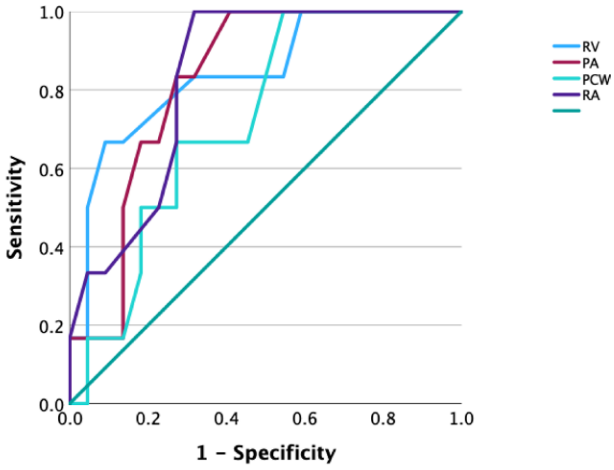
Introduction: The interventional treatment of symptomatic tricuspid regurgitation is an innovative treatment concept requiring a high level of clinical expertise and a comprehensive assessment of the patients' overall condition. In addition to a profound knowledge of the cardiopulmonary parameters resulting from the right heart catheterization, chronic impairment of other organ systems, especially the liver and kidneys, may be prognostically relevant. The aim of this pilot study was to determine whether data from pre-interventional right heart catheterization and cardio-renal function before the procedure may have predictive value for 3-month outcome.

Methods: In this single-center prospective cohort study, data from 36 consecutive patients undergoing "edge to edge" repair (n = 28) or "heterotopic minimal invasive tricuspid valve repair" (n = 8) were analyzed. Serum creatinine and bilirubin were measured and the MELD XI score was calculated. A right heart catheterization was performed in all patients before the intervention. Receiver operator characteristics with calculation of the area under the curve (AUC) were performed to determine the predictive value for the combined endpoint of rehospitalization due to decompensated heart failure and mortality within 3-months.



RV_AUC 0.841, 95% CI 0.66–1.00, p=0.012

PA_AUC 0.83, 95% CI 0.67–0.98, p = 0.016 ±7.8)

PCW_AUC 0.72, 95% CI 0.53– 0.92, p = 0.099

RA_AUC 0.83, 95% CI 0.68– 0.99, p = 0.078

Fig. 1 Parameters of right heart catheterisation as predictors for the combined endpoint of rehospitalisation and death

Results: Mean age of patients was 80.2 SD 5.9 years; 33.3% were male. Baseline characteristics of the patients are shown in table 1. Rehospitalization due to decompensated heart failure occurred in 25% of patients. Mortality within the first 3 months was 11%. Out of the parameters determined during right-heart catheterization, RV pressure (AUC 0.84, 95% CI 0.66–1.00, p = 0.012) and RA pressure (AUC 0.83, 95% CI 0.67-0.98, p = 0.016) had a good predictive value for the composite endpoint (figure1). Among the routine laboratory parameters, both serum creatinine (AUC 0.84, 95% CI 0.67–1.00, p = 0.004) and the MELD XI score (AUC 0.82 95% CI 0.63-0.99, p = 0.009) had a high predictive value.); figure 2. The combination of MELD XI (at admission) and RV or PA pressure slightly improved the AUC (MELD XI + RV: AUC 0.85; MELD XI + PA: AUC 0.84).

Conclusion: This pilot study showed that both the pre-interventional right heart catheterization and the routine laboratory can provide important predictive values for the chances of success of interventional tricuspid valve treatment.

Tab. 1 Baseline characteristics

	All
Sex male [%]	33.3
Age [years]	80.2 ± 5.9
Body mass index [kg/m²]	27.5 ± 6.8
"Edge-to Edge (TriClip) [%]	25.0
"Edge-to Edge (Pascal) [%]	52.8
"Heterotopic minimal invasive tricuspid valve repair" (TricValve)[%]	22.2
MELD XI score	14.2 ± 4.3
eGFR [mL/min/1.73 m2]	42.0 ± 16.3
Type II diabetes [%]	52.7
Coronary artery disease [%]	63.9

21-4

"Longitudinal Analysis of Tricuspid Regurgitation Phenotypes: Epidemiology, Echocardiographic Characteristics and Outcomes: A Population-Based Study"

Jantsch C., Koschatko S., Heitzinger G., Wu T., Torrefranca C., Halavina K., Dannenberg V., Spinka G., Mascherbauer K., Donà C., Koschutnik M., Nitsche C., Demirel C., Pavo N., Hülsmann M., Goliasch G., Hengstenberg C., Bartko P.

Medizinische Universität Wien, Wien, Austria

Introduction: Severe functional tricuspid regurgitation (FTR) is associated with high excess mortality.[1,2] Previous studies have investigated two morphologically distinct FTR phenotypes, namely atrial and ventricular FTR, with different mechanisms and prognosis.[3] However, a standardized definition of phenotypes based on echocardiographic data is lacking and epidemiological insights are currently missing. This study aims to provide an echocardiographic definition of FTR phenotypes, based on right-sided cardiac morphology, function and valvular geometry. Additionally, the objective is to investigate the epidemiologic impact of FTR phenotypes and examine long-term outcomes of AFTR and VFTR.

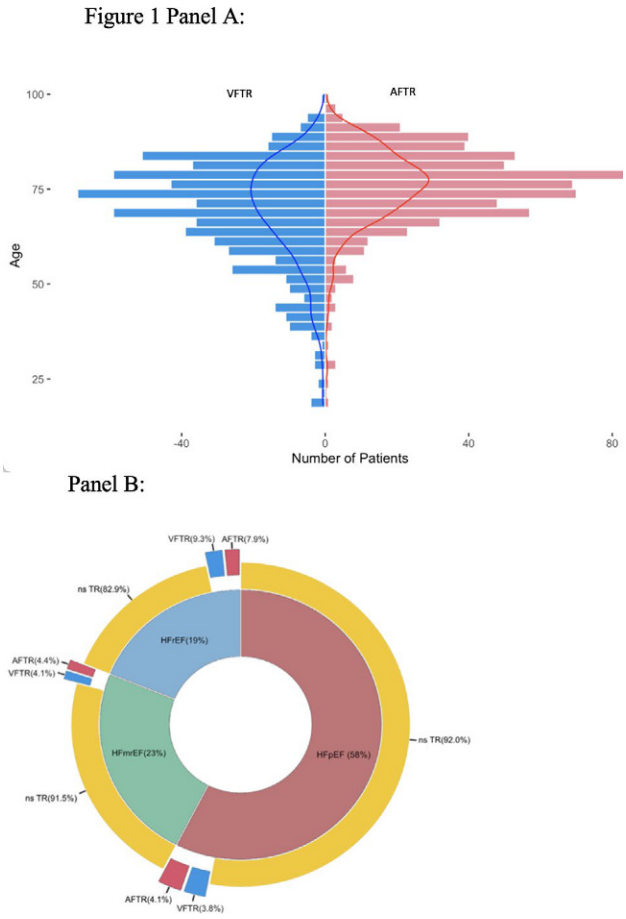


Fig. 1 Panel A: Age distribution of FTR phenotypes, AFTR (red) and VFTR (blue). Panel B: Distribution of FTR phenotypes across the heart failure spectrum. FTR = functional tricuspid regurgitation; AFTR = atrial functional tricuspid regurgitation; VFTR = ventricular functional tricuspid regurgitation; ns TR = non-severe functional tricuspid regurgitation

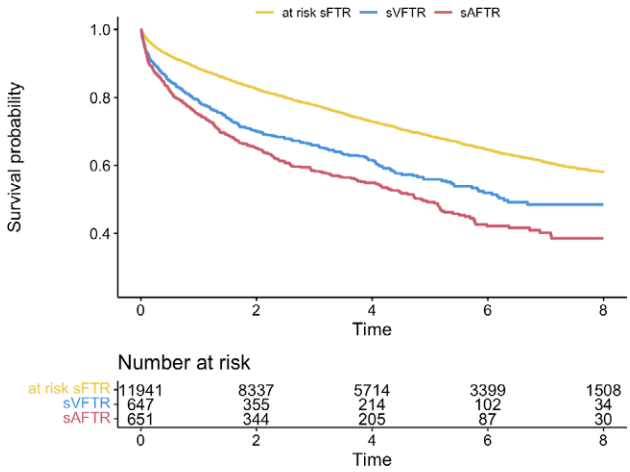


Fig. 2 Long term outcomes of AFTR, VFTR, and those at risk of developing FTR after eight years, using Kaplan meier survival analysis. FTR = functional tricuspid regurgitation; AFTR = atrial functional tricuspid regurgitation; VFTR = ventricular functional tricuspid regurgitation

Methods: This observational study included 11,955 patients from 2010–2020 with FTR, of which 1,302 had severe FTR. Patients were allocated to the atrial and ventricular phenotype based on their right atrial area to right ventricular area ratio.

Results: AFTR patients had higher age compared to VFTR (age 77 vs 71, $p < 0.001$) (Fig. 1, Panel A) and women were affected by VFTR more frequently (62 vs 50%, $p < 0.001$). Distribution of FTR phenotypes across the heart failure spectrum was similar for both groups ($p = 0.12$, (Fig. 1, Panel B)). Phenotypes also presented with distinct echocardiographic features such as increased right atrial size and flatter tricuspid annuli in AFTR and ventricular right remodeling and increased tenting in VFTR.Both AFTR and VFTR patients had impaired survival in comparison to patients at risk of severe FTR (AFTR: hazard ratio [HR] 2.01, 95% confidence interval [CI] 1.79–2.26, $p < 0.001$; VFTR: HR 1.59, 95%CI 1.40–1.81 $p < 0.001$) (Fig. 2). Even after adjustment for confounders the pronounced adverse effect of AFTR on survival remained significant.

Conclusion: FTR phenotypes present with distinct clinical and morphological profiles. Both AFTR and VFTR are associated with excess mortality, while the atrial phenotype confers the worst prognosis. This study provides epidemiological insights and echocardiographic characterizations to support future investigations regarding treatment options.

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21-5

Transcatheter Tricuspid Valve Replacement using the Vdyne System – the first two successful cases in Austria

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Introduction: Severe tricuspid regurgitation (TR) has been associated with poor long-term outcomes including right heart failure, end-organ damage (mainly renal and liver failure) and mortality. Functional TR due to annular dilatation and leaflet tethering is the most common etiology. The management of functional TR includes surgical and interventional treatment options. However, surgical repair or replacement is associated with a high periprocedural mortality reflecting the baseline high-risk patient profile. Therefore, there is a demand for minimally invasive, off-pump techniques to treat significant TR. Anatomical challenges for transcatheter techniques range from a variable number of leaflets, a variable annulus size, a valvular asymmetry to the potential interaction with the chordal apparatus and the right ventricular septum. These challenges limit the utilization of currently available devices such as transcatheter tricuspid edge-to-edge repair (TEER) systems. To overcome these problems, a novel trans catheter tricuspid valve replacement (TTVR) device has been designed: The VDyne bioprosthesis.

Methods: The TTVR system VDyne (VDyne Valve, VDyne) is a novel bioprosthesis that intends to preserve the asymmetric shape of the tricuspid annulus. It is a self-expanding, double frame, nitinol prosthesis which contains a 30 mm porcine trileaflet valve that is delivered in a 28-french guiding catheter via femoral access. The outer frame is designed to fit a tricuspid annulus with a perimeter of up to 180 mm and features unique securement mechanisms for valve stabilization.In addition, a paravalvular pop-off aperture can be opened in case of an afterload mismatch situation.We herein describe the first two successful cases of VDyne implantations in Austria.

Results: Two patients (male 79-years, female 78-years) with torrential functional TR due to annular dilatation in the setting of atrial fibrillation were admitted to the Kepler University Hospital. Both patients showed clinical signs of acute right heart decompensation and were in functional class NYHA III. Transesophageal echocardiography (TOE) after recompensation with furosemide revealed preserved right heart function and torrential TR with a central gap >12 mm. Hence, both patients were not eligible for tricuspid TEER. Full-cycle computed-tomography (CT) was used for annular measurements and 3D printing of a right heart model. Both patients showed a favorable anatomy for the TTVR system VDyne. In February 2024 the VDyne prosthesis was successfully implanted via a transfemoral access in both patients. Each step of the flouroscopic-driven procedure such as valve deployment and annular engagement was confirmed via TOE. TR was finally reduced from grade 5 (torrential) to grade 0 (none) in both patients. There was no paravalvular leakage. The female patient developed a complete heart block (AV block 3rd degree) intraprocedurally with the need of a permanent pacemaker. At 1 month follow-up both patients were in functional class NYHA I.

Conclusion: The VDyne TTVR system is a novel effective option to treat significant TR.

21-6

Enhanced sternal closure after minimally invasive cardiac surgery – first report on the use of a specially designed rigid plate fixation system

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Introduction: Partial upper sternotomy (MICS) has gained popularity over the last decades aiming to reduce the surgical burden. While sternal plating has been shown to reduce postoperative sternal complications after full sternotomy, reports about rigid plate fixation (RPF) after MICS are scarce. In this retrospective study we provide, to the best of our knowledge, the first data on a specially designed RPF system for MICS.

Methods: This retrospective analysis included all patients undergoing MICS with RPF at our institution. Primary endpoint was the incidence of sternal complications at discharge. Data are presented as mean and standard deviation and median and interquartile ranges.

Results: Between June and December 2023, 12 patients underwent MICS followed by RPF. Median (IQR) age was 63.5 years (61.5 to 66.5) and 25% (n=3) were female. All patients underwent aortic valve replacement, with one patient (8%) undergoing concomitant replacement of the ascending aorta and hemiarch. RPF was successfully performed in all patients. Median operative time was 207.1 minutes (188.7 to 223). Median length of intensive care unit (ICU) and in-hospital stay were 1 day (1 to 1) and 8.5 days (7.75 to 10.75), respectively. Median time to first mobilization was 2 (1 to 2) days and 33% (n=4) required opiates once admitted to the general ward. In-hospi-

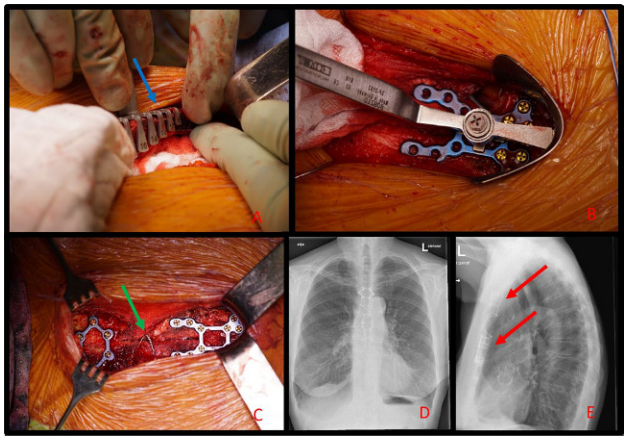

Fig. 1 Rigid plate fixation after minimally invasive cardiac surgery. In all intraoperative images cranial is to the left and caudal is to the right. A) Measurement of screw length using a specific designed tool (blue arrow) prior to rigid plate fixation to avoid perforation of the posterior bone lamella. B) Fixation of the caudal plate with a holding tool and pre-measured screws. C) Completed rigid plate fixation. A conventional sternal wire is used to optimize approximation (green arrow). D) & E) postoperative chest radiography showing the osteosynthesis material with optimal screw length (red arrows)

tal mortality was 0%. At discharge, there was no case of sternal pain, sternal instability or infection.

Conclusion: This is, to the best of our knowledge, the first report on the use of a specially designed RPF system for sternal closure after MICS. These first results showed the technique to be safe and feasible. Follow-up data are currently collected. Nevertheless, a randomized controlled trial of RPF versus sternal wiring after MICS is needed for further conclusions.

21-7

Klinische und echokardiographische Ergebnisse nach kathetergestützter Mitralklappenreparatur mittels MitraClip®

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Einleitung: Mitralklappeninsuffizienz (MI) ist in Europa, nach der Aortenklappenstenose, die häufigste Erkrankung der Herzklappen. Die Prävalenz ist altersabhängig steigend, in den USA liegt sie bei ~1,7 %, steigt bei einem Alter über 75 Jahren auf bis zu ~9,3 %. Aufgrund demographischer Entwicklungen der europäischen Bevölkerung ist ein weiterer Anstieg anzunehmen. MI wird durch anatomische oder funktionelle Beeinträchtigungen des Mitralklappenapparats verursacht, wodurch ein dichtes Schließen der Klappe nicht mehr möglich ist. Aufgrund der Rückstauung des Blutes kommt es zu vielseitigen Umbauvorgängen des Herzens, die den Krankheitsverlauf maßgeblich beeinflussen.

Methoden: Im Rahmen unserer retrospektiven, single-center Datenanalyse wurden 150 Patient*innen, die im Ordensklinikum Linz Elisabethinen mittels MitraClip® behandelt wurden eingeschlossen. Die Datenanalyse erfolgte unterstützt durch IBM® SPSS® Statistics, Version 24. Es wurden T-Test sowie U-Test zum Vergleich von Stichproben herangezogen. Ein Signifikanzniveau von $p < 0{,}05$ wurde als statistisch signifikant angenommen.

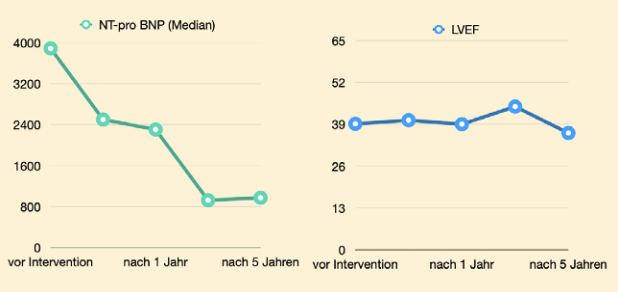

Fig. 1 NT-pro BNP und LVEF im Verlauf

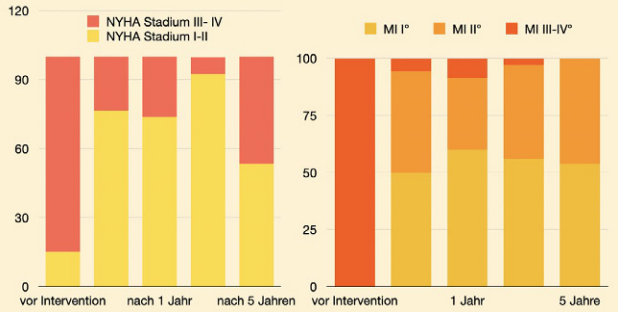

Fig. 2 NYHA-Stadium und Schweregrad der Mitralinsuffizienz im Verlauf

Resultate: Klinisch konnte im 5-Jahres Follow-up eine signifikante Verbesserung, gemessen am NYHA-Stadium und NT-pro BNP gezeigt werden. Auch echokardiographisch konnten diese Erfolge bestätigt werden. Der Schweregrad der Mitralklappeninsuffizienz konnte anhaltend signifikant reduziert werden. Das mittlere Überleben der Studienteilnehmer*innen betrug 1724,74 Tage.

Schlussfolgerungen: Die MitraClip® Prozedur stellt ein komplikationsarmes, sicher anwendbares und effektives Interventionsverfahren dar. Es kann ein anhaltendes Ergebnis erzielt werden und das Ausmaß der Insuffizienz signifikant reduziert werden. Am meisten profitieren Patient*innen klinisch innerhalb der ersten drei Jahre nach Intervention.

21-8

Sex differences in outcomes among patients undergoing transcatheter atrial septal defect closure: Do they benefit equally?

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Introduction: Although sex differences in congenital heart disease are prevalent and relevant, there is limited research on their role in atrial septal defect (ASD) closure. We aimed to investigate sex differences in baseline characteristics, procedural and long-term outcomes of patients with transcatheter ASD closure.

Methods: Data from adult patients undergoing ASD closure between 2005–2016 were retrospectively analyzed.

Results: Of the 853 patients included, 281 (32.9%) were male and 572 (67.1%) were female. Females were more symptomatic at presentation than males ($p < 0.001$). Males had a higher frequency of cardiovascular comorbidities than females ($p < 0.001$). Although echocardiographic right ventricular (RV) diameter relative to body surface area was equal in males and females (2.49 cm/m2 versus 2.57 cm/m2; $p = 0.072$), males had more RV dysfunction (12.1% versus 7.6%; $p = 0.028$). In contrast, females had higher RV systolic pressures (39.71 mmHg versus 37.23 mmHg; $p = 0.025$), and were more likely to have moderate to severe tricuspid regurgitation (15.4% versus 8.9%; $p = 0.007$). Males had larger defects with use of larger implants ($p < 0.05$). Procedure-related complications were rare and did not differ by sex. At 12-month follow-up, both male and females showed comparable decreases in RV diameter (−0.57 cm versus −0.59 cm; $p = 0.751$), RV systolic pressure (−4.57 mmHg versus −6.31 mmHg; $p = 0.094$), and severity of tricuspid regurgitation ($p = 0.173$; Figure). After a mean follow-up of 3 years (SD = 5), no significant differences were observed in the incidence of death (incidence rate ratio (IRR) = 0.49 [95% CI 0.27-0.83]; $p = 0.402$), new onset atrial fibrillation (IRR = 3.22 [95% CI 2.57–3.99]; 0.063), cardioversion or ablation (IRR = 0.40 [95% CI 0.20-0.71], $p = 0.335$), stroke/TIA (IRR = 0.29 [95% CI 0.12-0.56]; $p = 0.745$), and pacemaker implantation (IRR = 0.29 [95% CI 0.12-0.57], $p = 0.728$).

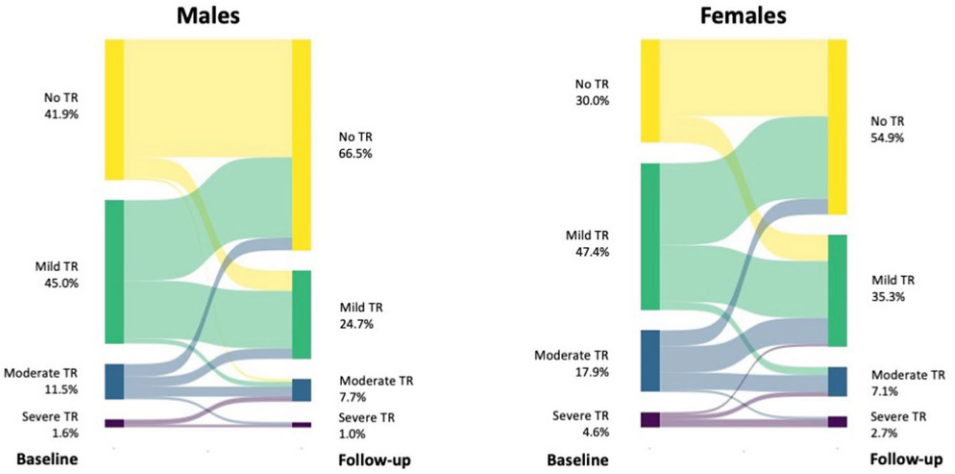

Fig. 1 Sankey Plot

Conclusion: Although patient profiles differed by sex, procedural and long-term outcomes were comparable, suggesting that transcatheter ASD closure can be safely performed in both males and females.

21-9

Langzeit Single-Center-Erfahrung mit MTEER – 10-Jahres-Ergebnisse aus der frühen Anwendung des MitraClip™-Systems

Vockenhuber T., Baldinger L., Schmid M., Schmidbauer P., Schneiderbauer-Porod S., Strießnig M., Sturmberger T., Martinek M., Ebner C.

Ordensklinikum Linz Elisabethinen, Linz, Österreich

Einleitung: Für inoperable Patienten mit einer hochgradigen Mitralinsuffizienz wird an der kardiologischen Abteilung des Ordensklinikum Linz Elisabethinen seit 2009 eine interventionelle Behandlung mittels Transcatheter Edge-To-Edge Repair (TEER) angeboten. Zum Einsatz kommt dabei das MitraClip™-System der Firma Abbott. Im Folgenden präsentieren wir eine retrospektive Auswertung der 10-Jahres-Outcomedaten unseres Zentrums.

Methoden: Für die vorliegende Arbeit wurden in einer retrospektiven Single-Center-Analyse Daten und klinische Outcomes von Patienten, welche zwischen August 2009 und Mai 2014 an unserer Abteilung einer MitraClip™-Prozedur zugeführt wurden, ausgewertet und das Outcome dieser Patienten bis Mai 2024 über einen Nachbeobachtungszeitraum von mindestens 10 Jahren analysiert. Die Daten wurden unserem elektronischen Register entnommen und mittels Microsoft® Excel® 2019 bzw. IBM® SPSS®, Version 22 statistisch und grafisch aufbereitet.

Resultate: Zwischen August 2009 und Mai 2014 wurden an unserem Zentrum 55 Patienten mit einer hochgradigen Mitralinsuffizienz (MR Grad III/IV) einem Transcatheter Edge-To-Edge Repair unterzogen. Bei 96,4 % (53/55) konnte mindestens ein Clip platziert werden, während bei zwei Patienten eine Implantation nicht erfolgreich gelang. Beim Großteil aller Patienten lag eine funktionelle oder gemischte Genese der MR vor, während auch 6 Patienten mit einer degenerativen/primären MR interventionell behandelt wurden. Periprozedurale Todesfälle waren nicht zu verzeichnen. Weitere Patientencharakteristika sind in Tab. 1 angeführt. Während 5 Jahre nach Implantation noch 34,5 % der Patienten (19/55) am Leben waren, betrug das 10-Jahres-Überleben 14,5 % (8/55). Anzumerken ist, dass bei 2 dieser 8 Patienten nach 4 bzw. 25 Monaten nach MitraClip™-Implantation eine Herztransplantation durchgeführt wurde und der TEER somit im Sinne einer „bridge to transplant" Lösung erfolgt ist. Eine Patientin mit degenerativer MR, welche sich zunächst gegen eine Operation aussprach, erhielt ca. 2,5 Jahre nach TEER einen mechanischen MKE bei schwerer Reinsuffizienz. Eine weitere Patientin mit funktioneller MR erhielt ca. eine Woche nach TEER bei mäßiggradiger Mitralstenose und zunehmender Verschlechterung der RV-Funktion einen biologischen MKE. Die anderen 4 Patienten zeigten ein stabiles und gutes Langzeitergebnis und waren nach einem Zeitraum von 10,7 bis 13,9 Jahren nach MitraClip™-Prozedur noch am Leben.

Schlussfolgerungen: Die kardiologische Abteilung des Ordensklinikum Linz Elisabethinen führte 2009 als österreichweit erstes interventionelles Zentrum Transcatheter Edge-To-Edge Repairs der Mitralklappe mit dem MitraClip™-System von Abbott durch. Anfangs lagen keine Langzeiterfahrungen vor, v. a. was die Selektion geeigneter Patienten betraf. Mit der Pu-

Alter	
Bereich, Jahre (Mittelwert)	32 - 92 (71,1)
≥ 75 Jahre, n (%)	25 (45,4)
Männlich, n (%)	33 (60)
Ätiologie, n (%)	
Funktionell	43 (78)
Degenerativ	6 (11)
Gemischt	6 (11)
LVEF	
Bereich, % (Mittelwert)	15 - 65 (32)
≤ 25 %, n (%)	21 (38,2)
Kardiomyopathien, n (%)	
Dilatative CMP	21 (38,2)
Ischämische CMP	23 (41,8)
Valvuläre CMP	5 (9,1)
Keine CMP	6 (10,9)
NYHA-Stadium, n (%)	
III	6 (10,9)
III-IV	24 (43,6)
IV	25 (45,5)
BMI, kg/m² (Mittelwert)	17,8 - 37,8 (24,5)
NT-proBNP, pg/ml (Mittelwert)	324 - 35000 (8435)
6MWD, Meter (Mittelwert)	0 - 507 (213)

Fig. 1 Patientencharakteristika

blikation zweier randomisierter kontrollierter Studien im Jahr 2018 (MITRA-FR und COAPT) konnte gezeigt werden, dass ein TEER mittels MitraClip™ für Patienten mit hochgradiger sekundärer Mitralinsuffizienz und symptomatischer Herzinsuffizienz unter optimaler medikamentöser Therapie eine sichere und effektive Behandlungsoption darstellt, wenn diese für eine operative Sanierung ungeeignet erscheinen. Im Laufe der vergangenen 15 Jahre konnte auch an unserem Zentrum eine große Menge an Erfahrung und Erkenntnissen gewonnen werden, was die Auswahl geeigneter Patienten, aber auch prozedurale Aspekte betrifft. Unsere retrospektive Auswertung konnte zeigen, dass auch mit zu Beginn noch geringer Erfahrung und einem sehr heterogenen Patientenkollektiv gute Langzeitergebnisse über mehr als 10 Jahre möglich waren.

POSTERSITZUNG 22 – BASIC SCIENCE 2

22-1

SGLT-2 inhibitors Dapagliflozin and Empagliflozin reduce cardiac calcium transients in health and disease – insights from a rat model of diabetic cardiomyopathy with preserved ejection fraction

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Introduction: Sodium-glucose cotransporter 2 (SGLT2) inhibitors, such as Empagliflozin (EMPA) and Dapagliflozin (DAPA) are commonly used to treat type 2 diabetes mellitus (T2 DM) by primarily working on the kidney as antihyperglycemic agents. Previously published studies have shown that SGLT2 inhibitors successfully reduce the risk for cardiovascular events and hospitalization in heart failure with preserved ejection fraction (HFpEF). Additionally, their administration had overall positive effects on both, structural and functional characteristics in diabetic cardiomyopathy. Recent experimental models in rodents revealed modulatory effects of DAPA on the calcium (Ca2+) transients in diabetes. However, the underlying mechanisms of protection and the physiological behavior of cardiomyocytes affected by diabetic cardiomyopathy are still not fully investigated.

Methods: We performed echocardiography of Otsuka Long-Evans Tokushima Fatty (OLETF) rats at baseline (18 weeks) and at the stage of diabetic cardiomyopathy (44 weeks of age). Age-matched Long-Evans (LE) rats served as a healthy control group. The diabetic status was confirmed by blood glucose measurements at the age of 44 weeks. Additionally, the body and heart weights were evaluated at the same age. Furthermore, cytosolic calcium transients were analyzed in isolated cardiomyocytes of OLETF and LE rats. Upon continuous contraction in a field stimulation chamber, the fluorescent signals (Fluo-4, AM) of DAPA and EMPA (each 1 µM and 10 µM in concentration) treated cardiomyocytes as well as untreated cells were recorded at 37 °C.

Results: Echocardiography and blood glucose measurements confirmed diabetic cardiomyopathy in OLETF rats. Importantly, the intraventricular septum thickness (IVS) as well as a biatriale enlargement were observed in 44 weeks old rats, indicating diastolic dysfunction. Nevertheless, ejection fraction (EF) was still preserved in 44 weeks old OLETF rats (EF>75). Cytosolic Ca2+ measurements unveiled significantly reduced Ca2+ transients in OLETF cardiomyocytes in comparison to healthy control cells. On the contrary, the resting Ca2+ levels remained unaffected by diabetic cardiomyopathy. The treatment with 1 µM or 10 µM DAPA or EMPA, respectively, led to a further reduction of the cytosolic Ca2+ amplitude and time to peak (TPK). The cytosolic Ca2+ decay was solely decreased by DAPA treatment (1 µM: $p = 0.0071$; 10 µM: $p = 0.0421$), but not by EMPA. The 10-fold reduction of the DAPA or EMPA concentrations (from 10 µM to 1 µM), respectively, was shown to have a minor impact on the Ca2+ transients measured. Overall, cytosolic Ca2+ transient data reveal that DAPA or EMPA treatment had a greater effect in OLETF compared to LE cardiomyocytes.

Conclusion: To conclude, the analyses of the Ca2+ transients in our animal model showed a reduced Ca2+ trafficking in diabetic cardiomyopathy with preserved EF. Furthermore, DAPA as well as EMPA treatment significantly decreased all cytosolic Ca2+ transients with the greatest effect on the diseased cardiomyocytes. Further studies need to investigate the effect of SGLT-2 inhibitors on the cardiomyocytes' function, as well as their electrophysiological properties in more detail. This study was supported by Paracelsus Medical University (R-018/02/105/-JIR and FMS_023-23-KNMS) and by the Austrian Cardiology Society.

22-2

Drug eluting stents trigger the secretion of inflammatory proteins in an experimental in vitro study

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Introduction: Ischemic cardiovascular diseases commonly appear following the occlusion of one or more of the coronary arteries. Drug eluting stents (DES) constitute the gold standard to help to keep open the arteries and maintain the blood flow. After their placement into the coronary arteries, they stay in direct contact with the blood stream, disturbing the physiological conditions and interacting with several cells and pro-

teins within the surrounding blood and vessel wall. Besides the beneficial effects of DES, their clinical application is also associated with complications, such as (late) stent thromboses. Previous studies have shown that thrombosis and inflammation are tightly linked with each other by activating inflammatory cells and secreting cytokines and chemokines to further promote an inflammatory surrounding. However, the influence of DES and their components on the inflammatory cascade and their corresponding players was not investigated yet.

Methods: To investigate the inflammatory secretome in response to DES, we performed an in vitro study with isolated human peripheral blood mononuclear cells (PBMCs). Therefore, PBMCs were isolated from the whole blood of four healthy volunteers. In total, 63 stents were used in the study, including Medtronic Resolute Onyx (n = 37), Abbott XIENCE® Sierra (n = 5), Boston Scientific SYNERGY (n = 4), Terumo Ultimaster (n = 3), and Biotronik Orsiro (n = 14). We measured the secretion of cytokines and chemokines, including IL-1β, IL-6, TNF-α, IL-8, and IL-12, as well as ICAM-1, VCAM-1, and MCP-1 by commercially available enzyme-linked immunosorbent assay (ELISA).

Results: Our results showed that DES significantly increase the secretion of the cytokines IL-1β ($p = 0.0005$), and IL-6 ($p = 0.0002$), as well as the chemokine IL-8 ($p = 0.0010$). Additionally, we also detected an elevation of the reaction product ICAM-1 ($p = 0.0003$). Further analyses resulted in a reduced secretion of IL-1β, IL-6, TNF-α, IL-8, and ICAM-1 into the cells' supernatants in response to Resolute Onyx stents, in comparison to the other stents. Moreover, multiple regression analysis revealed a high dependency of the inflammatory reaction on the elution drug, the polymer type and the stent's length. Additionally, the material of the stent platform, as well as the polymer thickness further have impact on the cytokine and chemokine response of PBMCs.

Conclusion: Our study indicate that DES by themselves trigger an inflammatory reaction of blood cells by the secretion of cytokines and chemokines. Furthermore, we provided first insights into the composition of the inflammosome in response to DES. A triggered inflammation may increase the vulnerability for complications and the failure of the DES. As these complications were already observed in clinical studies, our results would potentially provide predictions about the application of certain DES designs and may help to choose the appropriate stents in the clinical setting.

22-3

Effects of fisetin on senescence and calcification of vascular smooth muscle cells

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Introduction: Medial vascular calcification (VC) is associated with hyperphosphatemia in chronic kidney disease (CKD). Vascular smooth muscle cells (VSMCs) play the main role in VC by actively accelerating inflammatory pathways and cellular senescence. The flavonol fisetin was associated with senolytic effects. This study evaluated the impact of fisetin on senescence and calcification of vascular smooth muscle cells.

Methods: In this study, primary human aortic VSMCs were utilized in vitro, cultured mouse aortic rings and mice treated with cholecalciferol were used for ex vivo and in vivo experiments, respectively.

Results: The augmentation of osteogenic and senescence markers expression in VSMCs during high phosphate or angiotensin-II exposure was ameliorated by fisetin. Moreover, fisetin down-regulated the calcification in VSMCs. The anti-calcifying and anti-senescence effects of fisetin were inhibited by silencing of the phosphatase DUSP1 in VSMCs. Furthermore, the expression of osteogenic and senescence markers in VSMCs was aggravated by DUSP1 silencing, while p38 MAPK inhibition reduced these effects. In addition, fisetin treatment diminished osteogenic marker expression and calcification in cultured murine aortic rings after phosphate exposure. Meanwhile, in vivo, fisetin treatment significantly decreased aortic calcification and up-regulation of aortic osteogenic and senescence markers in mice treated with high doses of cholecalciferol.

Conclusion: Fisetin is able to inhibit the high phosphate-induced calcification of VSMCs. The phosphatase DUSP1 plays a key role in the anti-calcifying and anti-senescence effects of fisetin.

22-4

Enhancing effects of leukemia inhibitory factor highlights a crucial role of TYK2 signaling during vascular calcification

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Introduction: Chronic kidney disease (CKD) fosters medial vascular calcification (VC) by increasing systemic inflammation during hyperphosphatemia. Vascular smooth muscle cells (VSMCs) could actively augment calcification, an effect exacerbated by pro-inflammatory mediators. This study investigated the role of leukemia inhibitory factor (LIF) in VSMC calcification.

Methods: The study entailed experiments in primary human aortic VSMCs, cultured mouse aortic rings, and mice treated with cholecalciferol.

Results: VSMCs increased LIF expression after high-phosphate treatment. Silencing of endogenous LIF or LIF receptor (LIFR) dampened the pro-calcific effects of phosphate in VSMCs, whereas LIF supplementation reinforced these effects. The soluble LIFR, as an antagonist for LIF, ameliorated the calcification of VSMCs. Furthermore, LIF enhanced the phosphorylation of the non-receptor tyrosine-protein kinase 2 (TYK2) and activated signal transducer and activator of transcription 3 (STAT3) in VSMCs. TYK2 inhibition diminished, while TYK2 overexpression aggravated VSMC calcification. Pharmacological inhibition of Tyk2 as well as Tyk2 deficiency attenuated the ex vivo phosphate-induced calcification in mouse aortic rings. Consistently, Tyk2 inhibition and Tyk2 deficiency diminished the vascular calcification induced by cholecalciferol in vivo.

Conclusion: This study demonstrates a promoting effect of LIF on VC. Furthermore, the downstream pathways of LIF identify a central pro-calcific role of TYK2 signaling, suggesting TYK2 as a potential therapeutic target to prevent VC in CKD patients.

22-5

Elevated platelet-leukocyte aggregates as markers of chronic inflammatory thrombosis in chronic thromboembolic pulmonary hypertension

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Introduction: Chronic thromboembolic pulmonary hypertension (CTEPH) is a late sequela of acute pulmonary embolism (APE), but also carries features of arterial vascular disease. Therefore, we investigated platelet function in CTEPH.

Methods: CTEPH platelets were characterized in samples of our prospective CTEPH registry and biobank (n = 85). Platelet function was measured by cone and plate(let) (CPA) analyzer and multiplate analyzer. Plasma and platelet lysate concentrations of platelet activation markers (soluble P-selectin (sP-sel), platelet factor 4), granule proteins (von Willebrand factor (VWF), plasminogen activator inhibitor-1) and neutrophil protein S100A8/A9 were determined by enzyme immunoassays. Platelet surface P-selectin and activated glycoprotein (GP) IIb/IIIa, as well as circulating monocyte-, leukocyte-, and neutrophil-platelet aggregates were measured in whole blood by flow cytometry. Nuclear factor-κB (NF-κB) signaling was assessed by IκB kinase β (IKKβ) immunoblotting in lysates of isolated platelets.

Results: We found that a large proportion of CTEPH platelets were complexed with leukocytes. As compared to APE, monocyte- and neutrophil-platelet aggregates were significantly elevated in CTEPH patients after the addition of agonists. CTEPH platelet lysates showed low sP-sel concentrations, and high ratios of phosphorylated IKKα/β to IKKβ. CTEPH patients with ongoing systemic inflammation like inflammatory bowel disease and/or anti-phospholipid syndrome, demonstrated higher plasma levels of neutrophil-derived S100A8/A9.

Conclusion: CTEPH platelets form high levels of aggregates with leukocytes which might be mediated by increased NF-κB signaling. These data speak to chronic inflammatory thrombosis in CTEPH.

22-6

Cardiometabolic effects of exercise in rats fed a free-choice diet

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Introduction: The obesity epidemic is a major cause of the rising prevalence of cardiovascular and metabolic diseases. Often linked to a sedentary lifestyle and increased intake of hypercaloric diets, obesity disrupts metabolic regulation and impairs cardiac function. In this pilot study, our aims were to (1) determine the effect of a free-choice diet (FCD) on the development of cardiometabolic syndrome in rats and, (2) test whether regular exercise ameliorates cardiometabolic syndrome in rats fed FCD, which recapitulates key features of excessive fat and sugar consumption typically observed in humans.

Methods: Six-month-old F344 female rats had ad libitum access to FCD, consisting of a standard chow and 45% high-fat/0.5% high-cholesterol (HF/HC) diet in combination with 10% fructose-enriched and regular drinking water, in a single cage for 16 weeks. A group of rats fed FCD was subjected to a running protocol on a treadmill 5 days per week for 16 weeks. A subset of sedentary rats that received either FCD or a standard diet (SD) served as a diseased or healthy control, respectively. Body weight, food and water intake were monitored every week. Blood pressure was measured using a tail-cuff method every 4 weeks, while transthoracic echocardiography was performed after 16 weeks of diet feeding. Organs were harvested and weighed, and mitochondria were isolated from the heart and skeletal muscle (gastrocnemius) to measure oxygen consumption rate (OCR) using a Seahorse XFPro Analyzer.

Results: We found that rats fed FCD alone had increased body weight gain as compared to healthy control animals and those that exercised and consumed FCD. Rats fed FCD alone or in combination with exercise preferred the HF/HC diet over SD and fructose-enriched water over normal drinking water. However, the calorie intake was comparable between animals fed SD and FCD (both alone and in combination with exercise) after 3 weeks of feeding, indicating that the food composition but not the amount of ingested food was largely responsible for only moderately increased body weight gain of FCD-treated rats. Sedentary rats fed FCD displayed a higher relative liver weight and adiposity index than healthy control rats. Conversely, exercise normalized the adiposity index in FCD rats, validating that regular physical exercise protects against excessive body weight gain. In addition, rats fed FCD had a normal ejection fraction and did not develop cardiac hypertrophy or diastolic dysfunction, but they had higher systemic blood pressure than control animals after 16 weeks. Isolated mitochondria from the hearts of control rats displayed increased OCR in the presence of pyruvate/malate and succinate as compared to the cardiac mitochondria from both sedentary and trained rats fed FCD. By contrast, mitochondria from the skeletal muscle of exercised FCD rats showed higher OCR than those isolated from sedentary rats fed either FCD or SD.

Conclusion: Our preliminary results show that rats fed FCD for 16 weeks did not develop cardiac dysfunction or severe obesity. Therefore, dietary modifications and increased duration of feeding protocol are needed to induce a superior model of diet-

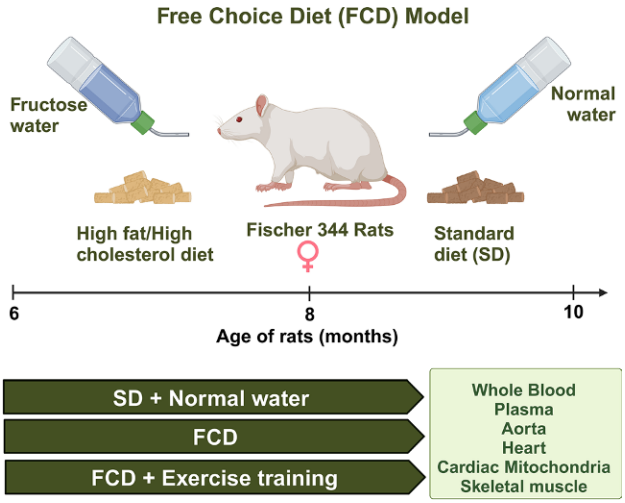

Fig. 1 Experimental model and design

induced obesity and with diastolic dysfunction. This protocol adaptation will allow us to comprehensively evaluate the impact of regular exercise training in combination with a caloric restriction mimetic on the cardiometabolic phenotype of rats fed FCD, and study the mechanisms underlying these beneficial effects.

22-7

The Clinic Ottakring – Lipid Registry (The COR – Lipid Registry): a contemporary single-center real-world analysis from a tertiary hospital

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Introduction: Background: In the real world only 20.4% of patients with atherosclerotic cardiovascular disease are at the target range, as shown by the SANTORINI trial [1]. Therefore, there is still a great necessity for the improvement of lipid-lowering therapy (LLT).

Methods: Methods: This Lipid Registry was set up as a retrospective, single-centre study including patients who visited our special clinic for optimization of LLT (between August 2020-December 2023) focusing on cholesterol goal achievement. The indications to the special clinic were: low-density lipoprotein cholesterol (LDL-c) >130 mg/dL in LLT- naïve patients with acute coronary syndrome (ACS), coronary artery disease (CAD) not on optimal LLT, familial hypercholesterolemia and LLT intolerance. We collected baseline characteristics as well as laboratory parameters of these patients and evaluated their follow-up visits at our clinic. The dual LLT (high-potency statin and ezetimibe) was initiated in every patient during the hospitalization, if not contraindicated.

Results: Results: In total 181 patients with indication to the LLT department were invited to the control. Altogether 136 (75.1%) patients came to our clinic. The patients who did not visit the LLT department were predominately men and often had no preexisting experience with LLT. In total 41 (36.9%) patients had a BMI over 30, 126 (92.6%) of patients had CAD out of which 85 (63%) had the diagnosis of the recent ACS. Arterial hyperten-

Tab. 1 Baseline Characteristics: ACS = acute coronary syndrome, BMI = body mass index, CAVK = cerebral arterial disease, non-HDL = non-high-density lipoprotein cholesterol, LLT = lipid lowering therapy, PAVK = peripheral arterial disease (PAD), SD = standard deviation

Baseline characteristics	All patients (n = 136)	ACS-Cohort (n = 85)
Age (mean, +-SD)	61 (11.6)	59 (11.3)
Male (n, %)	89 (65.4)	59 (69.4)
CAVK (n, %)	15 (11.0)	5 (5.9)
PAVK (n, %)	8 (5.9)	5 (5.9)
Arterial hypertension (n, %)	107 (78.7)	66 (77.6)
Diabetes Mellitus Type 2 (n, %)	32 (23.5)	21 (24.7)
BMI >30 (n, %)	41 (36.9)	28 (39.2)
Smoking (n, %) Ex-Smoker (n, %)	53 (39.6) 26 (19.4)	42 (49.4) 15 (17.6)
LLT naive at admission (n, %)	36 (26.5)	27 (31.8)
Non-HDL target achieved at Visit 1 (4–6 weeks after hospitalization), (n, %)	86 (61.9)	60 (69.8)
Non-HDL target achieved at Visit 2 (8–12 weeks after hospitalization), (n, %)	117 (86.2)	77 (90.6)

Tab. 2 LLT & Laboratory values: ACS = acute coronary syndrome, non-HDL = non-high-density lipoprotein cholesterol, IQR = interquartile range, LLT = lipid lowering therapy

All patients	At discharge N = 136	Visit 1 N = 136	Visit 2 N = 43
LLT			
Dual LLT (Statin + Ezetemibe), (n, %)	108 (79.4)	99 (74.4)	25 (61.0)
PCSK-9 Inhibitors, (n, %)	4 (2.9)	41 (31.0)	32 (78.0)
Bempedoic Acid, (n, %)	5 (3.7)	27 (19.9)	12 (29.3)
Laboratory values			
Total Cholesterol (median, IQR)	217 (57.6)	122 (57.0)	104 (70.0)
Non-HDL (median, IQR)	169.4 (60.0)	75 (48.0)	61 (45.0)
ACS population	N = 85	N = 85	N = 20
LLT			
Dual LLT (Statin + Ezetemibe), (n, %)	81 (95.3)	75 (88.2)	–
PCSK-9 Inhibitors, (n, %)	1 (1.2)	17 (20.0)	13 (65.0)
Bempedoic Acid, (n, %)	2 (2.4)	14 (16.5)	7 (35.0)
Laboratory values			
Total Cholesterol (median, IQR)	238.5 (55)	113 (48.0)	104 (58.8)
Non-HDL (median, IQR)	188 (46.5)	65 (43.0)	61.5 (45.5)

sion was present in 78.7% and diabetes mellitus type 2 in 23.5% of cases. At the 1st visit to our LLT department, which was performed 4–6 weeks after hospitalization, 86 patients (61.9%) reached the ESC/EAS 2019 non-HDL-c goal. At the 2nd visit (8–12 weeks after index hospitalization), 117 patients (86.2%) and at the 3rd visit 120 patients (88.2%) reached their target. The subanalysis of patients with ACS showed that 60 (69.8%) after 4–6 weeks and 77 (90.6%) after 8–12 weeks reached the recommended non-HDL-c goal. Among the whole study population 108 (79.4%) of patients, and 81 (95.3%) of ACS patients received dual LLT immediately during the index event. After the first visit, 31 (36.5%) of ACS patients needed the addition of the third lipid-lowering drug to achieve the recommended goal.

Conclusion: Conclusion: Our strategy for the management of hyperlipidemia in patients with very-high CVD risk showed high achievement of the non-HDL-c goal as recommended by ESC/EAS 2019 hyperlipidemia guidelines and ESC 2023 guidelines for ACS. Real-world data for LLT showed unsatisfactory results. However, with the right strategy accomplishment of low cholesterol values is possible in almost every patient.

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POSTERSITZUNG 23 – BILDGEBUNG 2

23-1

Cardiopulmonary Long-Term Effects 6, 18 and 30 Months After Severe Covid-19 Infection

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Introduction: SARS-CoV-2 infection affects the cardiopulmonary system in both the acute and long-term phase. This study aimed to comprehensively assess symptoms and potential long-term impairments 6, 18 and 30 months in patients previously hospitalized for severe Covid-19 infection.

Methods: This prospective registry included patients hospitalized for PCR-confirmed Covid-19 infection. Approximately 6 months post-discharge, follow-up examination included patient history, clinical examination, echocardiography, electrocardiogram, cardiac magnetic resonance imaging (cMRI), chest computed tomography (CT) scan, pulmonary function test (PFT), six-minute walk test (6 MWT) and a comprehensive laboratory panel. Patients with pathologic findings during the first visit underwent a second (at 18 months) and third (at 30 months) follow-up examination. Those without pathologic findings or who refused further medical examinations were contacted via phone to inquire about symptoms.

Results: Between July 2020 and April 2022, 200 patients (91% general ward, 9% intensive care unit) were recruited. Due

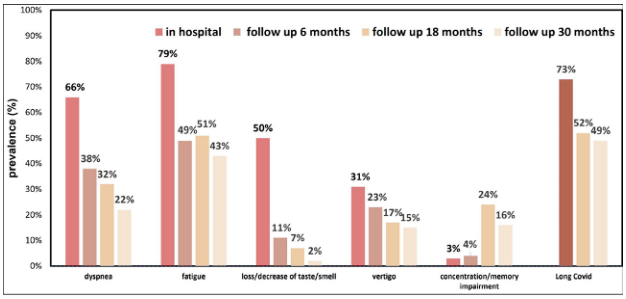

Fig. 1 Spectrum of Long Covid symptoms 6, 18 and 30 months post discharge in relation to acute phase symptoms during hospital stay

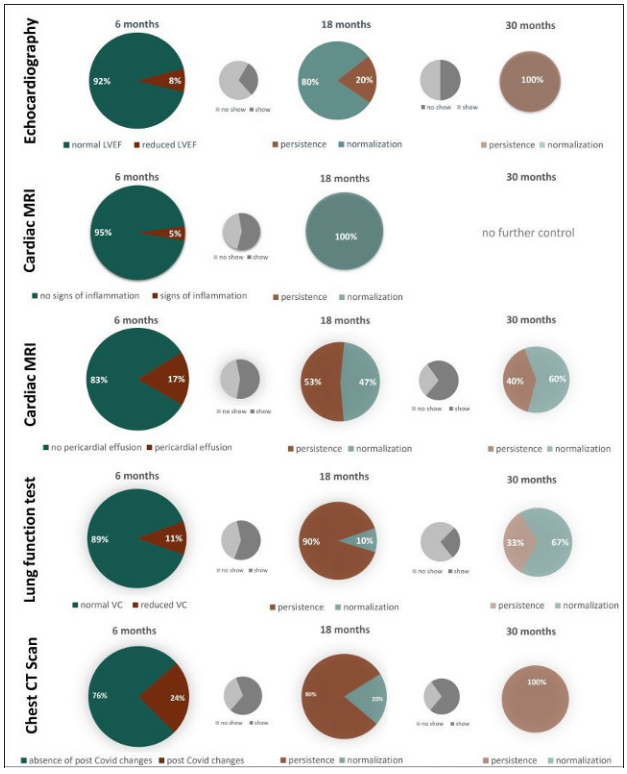

Fig. 2 Cardiac and pulmonary structural and functional changes 6, 18 and 30 months post Covid-19 in comparison with a separate graph pointing out the percentage of patients showing up for each control after previous abnormalities. LVEF, left ventricular function; MRI, magnetic resonance imaging; VC, vital capacity; CT, computed tomography

to dropouts, the second visit was conducted in 170 patients and the third visit in 139 (74 in person, 65 via telephone). Long Covid criteria were fulfilled by 73% at 6 months, 52% at 18 months and 49% at 30 months post-discharge, with fatigue being the most common symptom (Fig. 1). Echocardiography at 6 months showed impaired left ventricular function in 15 patients, with normalization in 80% at 18 months and further 66% at 30 months (Fig. 2). cMRI revealed pericardial effusions in 28 patients at 6 months, which resolved in 47% at 18 months and in further 60% at 30 months. Signs of peri- or myocarditis were present in 7 patients at 6 months and were resolved in all 4 patients, who attended control studies at 18 months. PFT at 6 months detected reduced vital capacity in 17 patients, of whom 10% returned to normal at 18 months and a further 66% showed normalization at 30 months. Chest CT scans at 6 months identified post-infectious residues in 41 patients, with full recovery in 20% at 18 months without further normalization after 30 months. The length of in-hospital stay was identified as a significant predictor for persisting Long Covid 6 months after discharge (95% CI: 1.005–1.12, p = 0.03). No predictors have been found for Long Covid at 18 and 30 months.

Conclusion: While the prevalence of Long Covid decreased over time, a significant symptom burden persisted at 6, 18 and even 30 months after severe Covid-19 infection. Structural and functional abnormalities were less frequent compared to reported symptoms, posing a challenge in substantiating the causes of these symptoms.

23-2

Comprehensive Remote Myocardium Characterization using T1 Mapping in Patients with ST-segment elevation myocardial infarction

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Introduction: Myocardial tissue injury due to acute myocardial infarction does not only occur in the myocardium that is supplied by the culprit lesion, but can also extend to the remote, non-infarcted myocardium. The prognostic implications of remote myocardium changes assessed by cardiac magnetic resonance (CMR) are not fully understood. The aim was to investigate the prognostic relevance of remote myocardium alterations assessed by CMR T1 mapping (native T1 and extracellular volume (ECV)) in patients after ST-segment elevation myocardial infarction (STEMI).

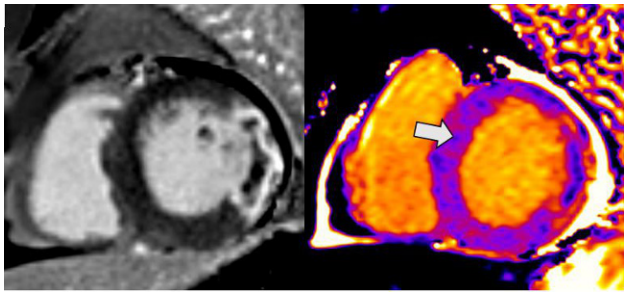

Fig. 1 Phase-sensitive inversion recovery (PSIR, left) & T1 mapping (right) with remote zone (arrow)

	Univariable OR (95% CI)	p-value	Multivariable OR (95% CI)	p-value
Clinical parameters for MACE				
Infarct size, % of LVMM	1.67 [1.25-2.23]	**<0.001**	-	-
MVO, % of LVMM	1-48 [1-18-1.86]	**<0.001**	-	-
LV ejection fraction, %	0.55 [0.41-0.74]	**<0.001**	0.63 [0.43-0.92]	**0.017**
T1-remote (non-contrast), ms	1.50 [1.11-2.03]	**0.009**	-	-
ECV-remote, %	1.63 [1.21-2.22]	**0.002**	1.53 [1.07-2.19]	**0.020**

Fig. 2 Independent predictors for MACE

Methods: This study analyzed 491 STEMI patients treated with primary percutaneous coronary intervention (PCI) that were included in the prospective MARINA-STEMI study (NCT04113356). CMR imaging was performed 4 (Interquartile range [IQR]: 3–5) days after PCI. CMR images were analyzed for left ventricular (LV) function, standard infarct characteristics as well as native remote T1 and remote ECV. The primary clinical endpoint was the composite of all-cause mortality, re-infarction and new congestive heart failure (Major adverse cardiovascular events, MACE).

Results: Remote native T1 (median: 1009 [IQR: 979–1044] ms) was associated with female sex, peak NT-pro-BNP levels, peak hs-cTnT elevations, TIMI-risk score, admission Killip class, anterior infarct location, post-interventional TIMI-flow, LV ejection fraction and microvascular injury. Remote ECV (median: 26.37 [IQR: 24.28–29.27] %) was associated with age, female sex, peak NT-pro-BNP levels, diabetes, TIMI-risk score, admission Killip class, anterior infarct location, LV ejection fraction and microvascular injury. Over a median follow-up of 12 months (IQR: 12–13) after STEMI, 42 MACE outcomes occurred. Higher native remote T1-times (1018.5 [IQR: 997.0–1064.0] ms vs. 1007.0 [IQR: 977.0–1041.5] ms, p = 0.033) as well as higher remote ECV-values (28.07 vs. 26.27%, p = 0.009) were observed in patients with MACE. Multivariable Cox regression analysis demonstrated that remote ECV (hazard ratio (HR): 1.53 [confidence interval (CI): 1.07–2.19], p = 0.020) but not native remote T1 is associated with MACE.

Conclusion: A comprehensive assessment of the remote myocardium with native T1 and ECV provides prognostic information in a contemporary cohort of low risk STEMI patients. Remote ECV, but not remote native T1, was found to be an independent predictor of MACE.

23-3

Right ventricular strain parameters on echocardiography are associated with mortality in patients with inferior ST-elevation myocardial infarction

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Introduction: Patients with inferior ST-segment elevation myocardial infarction (STEMI) face a substantial risk for cardiovascular death. Whereas markers of left ventricular (LV) function are well known to be associated with clinical outcome in these patients, data on the prognostic impact of right ventricular (RV) function is scarce.

Methods: We included 207 patients (69.6% male, 61.4 ± 13.0 years) with acute inferior STEMI undergoing percutaneous coronary intervention between 01/2012 and 08/2015. The prognostic impact of conventional (tricuspid annular plane systolic excursion [TAPSE]) and advanced measures of RV function (free wall strain [FWS], global longitudinal strain [RVGLS], regional wall strain) on all-cause mortality was assessed using Cox regression analysis.

Results: Patients were followed for 7.3 ± 2.4 years. Within the observation period, 49 patients (23.7%) deceased. Baseline RVGLS, FWS, and TAPSE were significantly associated with all-cause mortality in univariate and multivariable analysis after adjustment for clinical variables and global LV strain (adj. HR per 1-SD worsening of RV function: 1.54 [95% CI: 1.14–2.09, p = 0.005], 1.53 [95% CI: 1.16–2.01, p = 0.003], 1.53 [95% CI: 1.13–2.07, p = 0.006], respectively). Basal free wall strain (adj. HR: 1.57 [95% CI: 1.24–1.97]) was the only single segment associated with death in multivariable analysis. Patients in the third RVGLS, FWS, and TAPSE tertile had a 3.73, 3.83, and 3.94-fold increased hazard of death as compared to the first respective tertiles. Additionally, we found significant associations between worse RV function and peak troponin T and creatine kinase.

Conclusion: Among patients with inferior STEMI, RVGLS, FWS, and TAPSE carry important prognostic information, and might help to identify patients at increased risk who require intensified monitoring and therapy.

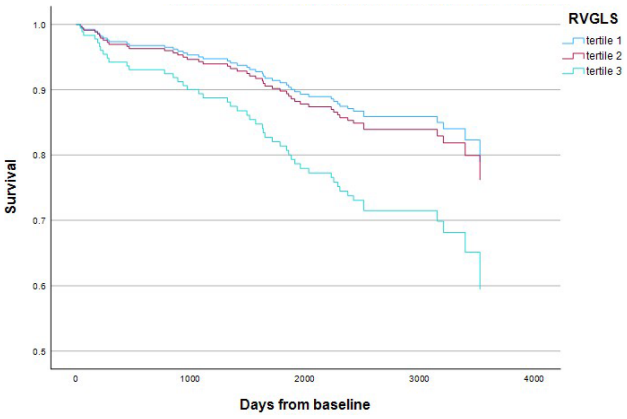

Fig. 1 Kaplan Meier curve for all-cause mortality – RVGLS tertiles

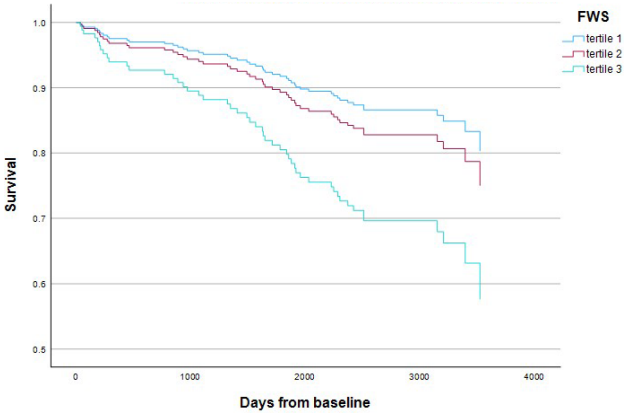

Fig. 2 Kaplan Meier curve for all-cause mortality – FWS tertiles

23-4

Prognostic implications of pericardial effusion in transthyretin cardiac amyloidosis: Insights from CMR imaging

Rettl R., Kronberger C., Binder C., Willixhofer R., Poledniczek M., Donà C., Koschutnik M., Beitzke D., Loewe C., Nitsche C., Hengstenberg C., Badr Eslam R., Kastner J., Bergler-Klein J., Kammerlander A., Duca F.

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Introduction: Pericardial effusion is a common finding in patients with transthyretin amyloid cardiomyopathy (ATTR-CM). However, its prognostic implications remain poorly understood. We aimed to investigate the relationship between pericardial effusion area and cardiac structure as well as function, and their association with outcomes in patients with ATTR-CM.

Methods: Consecutive ATTR-CM patients (n = 153) underwent cardiac magnetic resonance (CMR) imaging, including T1-mapping and quantification of pericardial effusion. ATTR-CM patients with the presence of pericardial effusion (n = 99) were divided into two cohorts based on the median of

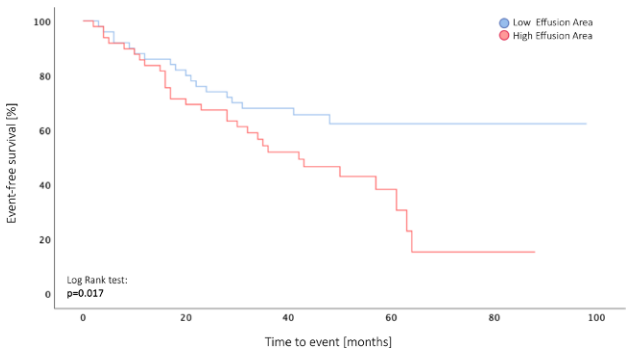

Fig. 1 Kaplan-Meier curve for composite endpoint (all-cause mortality or cardiovascular-related hospitalization) stratfied by median pericardial effusion area

Tab. 1 Baseline Characteristics

	All patients n = 153	No Pericardial Effusion n = 54	Pericardial Effusion n = 99	p-Value	Low Effusion Area n = 50	High Effusion Area n = 49	p-Value
Clinical Parameters							
Age, years	75.9 (8.6)	75.7 (9.5)	76.1 (8.1)	0.832	74.5 (8.6)	77.7 (7.3)	0.050
NYHA class ≥ III, n (%)	63 (41.4)	25 (46.3)	38 (38.4)	0.298	(24.0)	26 (53.1)	0.003
6-minute walk distance, m	383.0 (136.1)	387.0 (119.6)	380.9 (144.8)	0.803	395.6 (142.7)	365.8 (147.0)	0.340
NAC ATTR stage							
I	83 (54.3)	33 (61.1)	50 (50.5)	0.209	34 (68.0)	16 (32.7)	<0.001
II	43 (28.1)	15 (27.8)	28 (28.3)	0.947	8 (16.0)	20 (40.8)	0.006
III	27 (17.6)	6 (11.1)	21 (21.2)	0.093	8 (16.0)	13 (26.5)	0.205
Laboratory Parameters							
Hemoglobin, g/dL	13.4 (1.6)	13.1 (1.5)	13.6 (1.7)	0.084	13.8 (1.7)	13.4 (1.6)	0.194
Creatinine, mg/dL	1.3 (0.7)	1.2 (0.3)	1.3 (0.9)	0.306	1.2 (0.4)	1.5 (1.2)	0.083
eGFR, mL/min/1.73 m2	59.7 (20.2)	60.5 (18.1)	59.3 (21.3)	0.724	61.9 (18.5)	56.5 (23.7)	0.208
Troponin T, ng/L	55.8 (46.5)	59.3 (36.0)	54.0 (51.4)	0.515	45.6 (35.5)	63.1 (63.6)	0.100
NT-proBNP, pg/mL	2048 (827–4110)	1874 (827–3244)	2265 (754–4462)	0.598	1471 (504–3222)	3504 (1779–5275)	<0.001

pericardial effusion area (low effusion area: ≤ 601 mm2, n = 50; high effusion area: > 601 mm2, n = 49).

Results: We observed significant differences between cohorts in terms of ventricular structure [native T1 time: 1086.4 ms vs. 1118.4 ms, p = 0.046; left ventricular (LV) mass: 179.2 g vs. 204.5 g, p = 0.047], atrial structure [left atrial (LA) area: 28.7 cm2 vs. 35.0 cm2, p < 0.001; right atrial (RA) area: 27.7 cm2 vs. 33.5 cm2, p < 0.001], cardiac biomarkers [NT-proBNP: 1471 pg/mL vs. 3504 pg/mL, p < 0.001], clinical status [NYHA functional class ≥ III: 24.0% vs. 53.1%, p = 0.003], and disease stage [National Amyloidosis Centre (NAC) ATTR stage I: 68.0% vs. 32.7%, p < 0.001; II: 16.0% vs. 40.8%, p = 0.006]. We furthermore observed significant correlations (r, Pearson correlation coefficient) between the pericardial effusion area and LV structure (native T1 time: r = 0.263, p = 0.010; LV mass: r = 0.304, p = 0.005; interventricular septal thickness: r = 0.245, p = 0.015), right ventricular function (RV ejection fraction: r = −0.237, p = 0.018), atrial structure (LA area: r = 0.348, p < 0.001; RA area: r = 0.260, p = 0.010), cardiac biomarkers (NT-proBNP: r = 0.407, p < 0.001; troponin T: r = 0.371, p < 0.001), clinical status (NYHA functional class ≥ III: r = 0.237, p = 0.018) and disease stage (NAC ATTR stage: r = 0.285, p = 0.004]. ATTR-CM patients with advanced pericardial effusion area experienced adverse outcomes [composite endpoint: all-cause mortality or cardiovascular-related hospitalization, hazard ratio (HR): 1.000, 95% confidence interval (CI): 1.000–1.001, p = 0.045].

Conclusion: In ATTR-CM, pericardial effusion area correlates with ventricular and atrial structure, cardiac function, cardiac biomarkers, clinical status, and disease stage. Furthermore, more advanced pericardial effusion is associated with adverse outcomes.

23-5

Prognostic value of quantitative cardiac DPD uptake in transthyretin amyloid cardiomyopathy

Rettl R., Calabretta R., Duca F., Kronberger C., Binder C., Willixhofer R., Poledniczek M., Nitsche C., Kastl S., Hengstenberg C., Badr Eslam R., Kastner J., Bergler-Klein J., Hacker M., Kammerlander A.

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Introduction: Transthyretin amyloid cardiomyopathy (ATTR-CM) is associated with poor survival, and the prognostic implications of quantitative cardiac 99mTc-3,3 diphosphono-1,2 propanodicarboxylic acid (99mTc-DPD) uptake remain poorly understood.

Methods: We aimed to investigate the relationship between quantitative cardiac 99mTc-DPD uptake and cardiac structure as well as function, and their association with outcomes in patients with ATTR-CM. Consecutive ATTR-CM patients (n = 83) underwent 99mTc-DPD single-photon emission computed

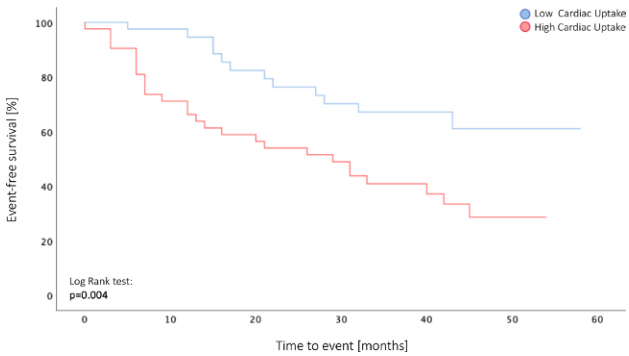

Fig. 1 Kaplan-Meier curve for composite endpoint (all-cause mortality or cardiovascular-related hospitalization) stratified by median SUV retention index

Tab. 1 Baseline Characteristics and Cohort Comparison

	All Patients (n = 83)	Low Cardiac Uptake (n = 41)	High Cardiac Uptake (n = 42)	p-Value
Clinical Parameters				
Age (years), mean (SD)	78.0 (8.6)	76.3 (7.7)	79.7 (9.2)	0.070
Sex male, n (%)	66 (79.5)	35 (85.4)	31 (73.8)	0.196
NYHA functional class ≥ III, n (%)	41 (49.4)	16 (39.0)	25 (59.5)	0.063
6-min walk distance (m), mean (SD)	355.6 (141.2)	392.6 (132.8)	320.5 (141.4)	0.023
NAC ATTR stage, n (%)				
I	40 (48.2)	25 (61.0)	15 (35.7)	0.021
II	29 (34.9)	14 (34.1)	15 (35.7)	0.883
III	14 (16.9)	2 (4.9)	12 (28.6)	0.004
Laboratory Parameters				
Hemoglobin (g/dL), mean (SD)	13.4 (1.6)	13.5 (1.4)	13.3 (1.7)	0.608
Creatinine (mg/dL), mean (SD)	1.4 (0.6)	1.2 (0.4)	1.5 (0.8)	0.103
eGFR (mL/min/1.73 m2), mean (SD)	58.3 (20.9)	63.4 (20.9)	53.2 (19.8)	0.025
Troponin T (ng/L), mean (SD)	63.4 (37.8)	52.5 (26.3)	73.8 (44.1)	0.010
NT-proBNP (pg/mL), median (IQR)	2635 (1334–4126)	1788 (933–3134)	3164 (2181–5246)	0.007
Nuclear Imaging Parameters				
Perugini grade 2, n (%)	22 (26.5)	13 (31.7)	9 (21.4)	0.295
Perugini grade 3, n (%)	61 (73.5)	28 (68.3)	33 (78.6)	0.295
SUV retention index (g/mL), mean (SD)	6.41 (4.30)	3.24 (1.21)	9.51 (3.96)	<0.001
Echocardiographic Parameters				
IVS (mm), mean (SD)	19.7 (3.7)	19.4 (3.7)	19.9 (3.7)	0.528
LVEDD (mm), mean (SD)	41.1 (6.8)	42.1 (6.3)	40.2 (7.1)	0.208
LVEF (%), mean (SD)	47.3 (10.0)	49.0 (10.0)	45.7 (10.0)	0.142
LV-GLS (-%), mean (SD)	11.7 (3.7)	12.6 (3.7)	10.7 (3.4)	0.015
LA length (mm), mean (SD)	60.8 (8.3)	59.9 (9.0)	61.7 (7.6)	0.318
LAVI (mL/m2), mean (SD)	39.1 (14.4)	38.2 (15.2)	40.0 (13.8)	0.583
RVEDD (mm), mean (SD)	33.3 (5.4)	32.7 (5.1)	34.0 (5.6)	0.265
RV-LS (-%), mean (SD)	15.6 (5.3)	17.2 (6.4)	14.0 (5.8)	0.026
RA length (mm), mean (SD)	58.9 (8.7)	57.9 (8.0)	60.0 (9.2)	0.269

Values are given as mean ± standard deviation (SD), or median and interquartile range (IQR), or total numbers (n) and percent (%). Bold indicates $p < 0.05$. ATTR = transthyretin amyloid, eGFR = estimated glomerular filtration rate, IVS = interventricular septum, LA = left atrium, LAVI = left atrial volume index, LV = left ventricle, LVEDD = left ventricular end-diastolic diameter, LV-GLS = left ventricular global longitudinal strain, NAC = National Amyloidosis Centre, NTproBNP = N-terminal prohormone of brain natriuretic peptide, NYHA = New York Heart Association, RA = right atrium, RV = right ventricle, RVEDD = right ventricular end-diastolic diameter, SUV = standardized uptake value.

tomography/computed tomography (SPECT/CT) and two-dimensional speckle-tracking echocardiography.

Results: ATTR-CM patients were divided into two cohorts based on the median of the standardized uptake value (SUV) retention index (low cardiac uptake: < 5.47 mg/dL, n = 41; high cardiac uptake: ≥ 5.47 mg/dL, n = 42). We observed significant differences between cohorts in left ventricular global longitudinal strain (LV-GLS: p = 0.015), right ventricular longitudinal strain (RV-LS: p = 0.026), NT-proBNP (p = 0.007), troponin T (p = 0.010), 6-minute walk distance (6MWD: p = 0.023) and National Amyloidosis Centre (NAC) ATTR stage (I: p = 0.021, III: p = 0.004). We furthermore observed significant correlations (r, Spearman's correlation coefficient) between the SUV retention index and longitudinal cardiac function (LV-GLS: r = 0.369, p < 0.001; RV-LS: r = 0.251, p = 0.029), cardiac biomarkers (NT-proBNP: r = 0.330, p = 0.002; troponin T: r = 0.265, p = 0.017), exercise capacity (6MWD: r = –0.249, p = 0.028) and disease stage (NAC ATTR stage: r = 0.325, p = 0.003]. ATTR-CM patients with high SUV retention index experienced adverse outcomes [composite endpoint: all-cause mortality or cardiovascular-related hospitalization, hazard ratio (HR): 1.124, 95% confidence interval (CI): 1.060–1.192, p < 0.001].

Conclusion: In ATTR-CM, quantitative cardiac 99mTc-DPD uptake correlates with longitudinal cardiac function, cardiac biomarkers, exercise capacity, and disease stage, and enhanced cardiac DPD uptake is associated with adverse outcomes.

23-6

DPD quantification correlates with ECV and disease severity in transthyretin cardiac amyloidosis

Rettl R., Calabretta R., Duca F., Kronberger C., Binder C., Willixhofer R., Poledniczek M., Donà C., Beitzke D., Loewe C., Nitsche C., Hengstenberg C., Badr Eslam R., Kastner J., Bergler-Klein J., Hacker M., Kammerlander A.

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Introduction: The pathophysiological hallmark of transthyretin amyloid cardiomyopathy (ATTR-CM) is the deposition of amyloid within the myocardium. However, the association between myocardial amyloid load and quantitative cardiac 99mTc-3,3-diphosphono-1,2-propanodicarboxylic acid (99mTc-DPD) uptake is barely investigated. We aimed to investigate the relationship between quantitative cardiac 99mTc-DPD uptake and myocardial amyloid load, assessed by extracellular volume (ECV) on cardiac magnetic resonance (CMR) imaging, along with cardiac function in patients with ATTR-CM.

Methods: Consecutive ATTR-CM patients (n = 40) underwent 99mTc-DPD single-photon emission computed tomography/computed tomography (SPECT/CT) and CMR imaging.

Results: We observed significant correlations (r, Spearman's correlation coefficient) between the standardized uptake value (SUV) retention index and myocardial amyloid load (ECV:

Tab. 1 Baseline Characteristics and Cohort Comparison

	All Patients (n = 40)	Low Cardiac Uptake (n = 20)	High Cardiac Uptake (n = 20)	p-Value
Clinical Parameters				
Age (years), mean (SD)	76.2 (8.8)	76.0 (8.2)	76.4 (9.6)	0.888
Sex male, n (%)	30 (75.0)	17 (85.0)	13 (65.0)	0.152
NYHA functional class ≥ III, n (%)	19 (47.5)	7 (35.0)	12 (60.0)	0.119
6-min walking distance (m), mean (SD)	375.7 (133.6)	439.2 (119.4)	312.3 (117.9)	0.002
NAC ATTR stage				
I	25 (62.5)	18 (90.0)	7 (35.0)	<0.001
II	10 (25.0)	2 (10.0)	8 (40.0)	0.030
III	5 (12.5)	0 (0.0)	5 (25.0)	0.021
Laboratory Parameters				
Hemoglobin (g/dL), mean (SD)	13.7 (1.3)	13.8 (1.1)	13.6 (1.5)	0.677
Creatinine (mg/dL), mean (SD)	1.15 (0.35)	1.10 (0.27)	1.20 (0.41)	0.351
eGFR (mL/min/1.73 m2), mean (SD)	65.7 (24.0)	68.5 (19.7)	62.9 (27.8)	0.463
Troponin T (ng/L), mean (SD)	48.9 (22.9)	41.3 (16.9)	56.9 (25.9)	0.030
NT-proBNP (pg/mL), median (IQR)	1893 (999–3249)	1276 (683–1833)	3198 (1952–4701)	<0.001
Nuclear Imaging Parameters				
Perugini grade 2, n (%)	11 (27.5)	8 (40.0)	3 (15.0)	0.081
Perugini grade 3, n (%)	29 (72.5)	12 (60.0)	17 (85.0)	0.081
SUV retention index (g/mL), mean (SD)	5.26 (2.61)	3.15 (1.12)	7.37 (1.82)	<0.001
DPD activity (MBq), mean (SD)	721.7 (26.7)	723.4 (22.8)	720.1 (30.6)	0.701
DLP (mGy*cm), mean (SD)	91.0 (39.5)	85.8 (31.2)	96.0 (46.3)	0.440
CMR Imaging Parameters				
Extracellular volume (%), mean (SD)	49.2 (12.6)	42.8 (10.5)	55.6 (11.3)	<0.001
Native T1 time (ms), mean (SD)	1117.8 (57.3)	1095.3 (54.0)	1140.4 (52.4)	0.011
Interventricular septum (mm), mean (SD)	17.9 (4.6)	17.2 (3.8)	18.7 (5.2)	0.303
LV mass index (g/m2), mean (SD)	95.4 (27.3)	93.6 (25.4)	97.3 (29.6)	0.678
LV ejection fraction (%), mean (SD)	49.0 (11.9)	49.9 (11.8)	48.2 (12.3)	0.667
LV cardiac index (L/min/m2), mean (SD)	2.96 (0.86)	3.08 (0.87)	2.83 (0.84)	0.362
LV global longitudinal strain (-%), mean (SD)	11.65 (3.82)	12.25 (3.16)	11.05 (4.38)	0.327
RV ejection fraction (%), mean (SD)	45.5 (10.4)	47.7 (10.2)	43.2 (10.4)	0.169
RV cardiac index (L/min/m2), mean (SD)	2.76 (0.88)	2.82 (0.87)	2.70 (0.90)	0.664
RV longitudinal strain (-%), mean (SD)	13.82 (5.69)	16.16 (5.21)	11.47 (5.26)	0.007

Values are given as mean ± standard deviation (SD), or median and interquartile range (IQR), or total numbers (n) and percent (%). Bold indicates p < 0.05. ACE = angiotensin-converting enzyme, ATTR = transthyretin amyloid, CMR = cardiac magnetic resonance, DLP = dose length product, eGFR = estimated glomerular filtration rate, LV = left ventricle, NAC = National Amyloidosis Centre, NT-proBNP = N-terminal prohormone of brain natriuretic peptide, NYHA = New York Heart Association, RA = right atrium, RV = right ventricle, SUV = standardized uptake value, 99mTc-DPD = 99mTc-3,3-diphosphono-1,2-propanodicarboxylic acid.

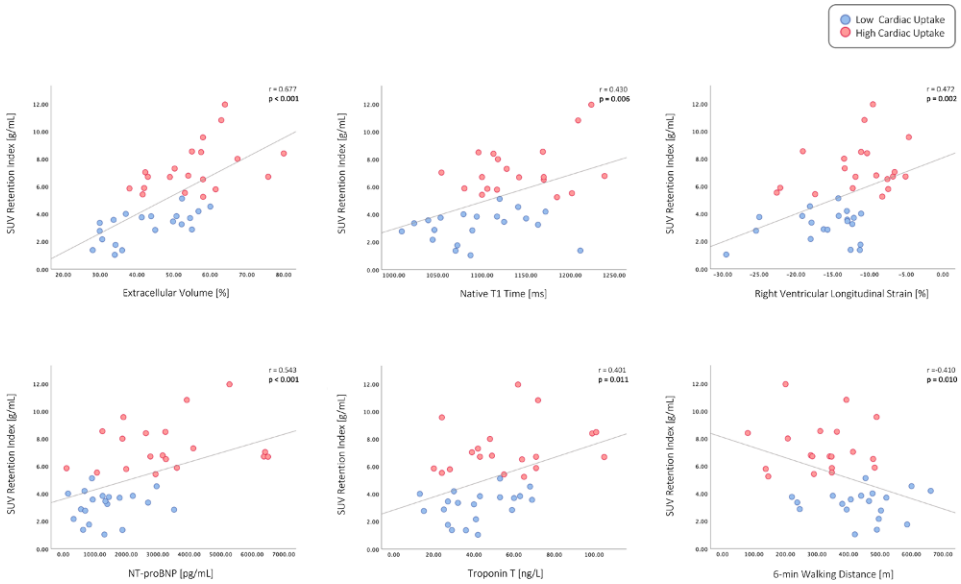

Fig. 1 Correlation of Nuclear Imaging with Cardiac Magnetic Resonance Imaging, Clinical, and Laboratory Parameters

r = 0.677, p < 0.001; native T1 time: r = 0.430, p = 0.006), longitudinal cardiac function [right ventricular longitudinal strain (RV-LS): r = 0.472, p = 0.002], cardiac biomarkers (NT-proBNP: r = 0.543, p < 0.001; troponin T: r = 0.401, p = 0.011), exercise capacity [6-min walking distance (6MWD): r = −0.410, p = 0.010] and disease stage [National Amyloidosis Centre (NAC) ATTR stage: r = 0.479, p = 0.002]. ATTR-CM patients were divided into two cohorts based on the median of the SUV retention index (low cardiac uptake: < 5.19 mg/dL, n = 20; high cardiac uptake: ≥ 5.19 mg/dL, n = 20). We observed significant between-cohort differences in terms of ECV (p < 0.001), native T1 time (p = 0.011), RV-LS (p = 0.007), NT-proBNP (p < 0.001), troponin T (p = 0.030), 6MWD (p = 0.002) and NAC ATTR stage (I: p < 0.001, II: p = 0.030, III: p = 0.021).

Conclusion: In ATTR-CM, quantitative cardiac 99mTc-DPD uptake correlates with myocardial amyloid load, longitudinal cardiac function, cardiac biomarkers, exercise capacity, and disease stage. DPD quantification may provide a valuable tool for quantifying and monitoring cardiac disease burden in affected individuals.

23-7

Culprit lesion vessel size and risk of reperfusion injury in ST-segment elevation myocardial infarction A cardiac magnetic resonance imaging study

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Introduction: Microvascular obstruction (MVO) and intramyocardial hemorrhage (IMH) are well-established imaging biomarkers of failed myocardial tissue reperfusion in patients with ST-segment elevation myocardial infarction (STEMI) treated with primary percutaneous coronary intervention (PCI). MVO and IMH are associated with an increased risk of death and heart failure independent of infarct size,

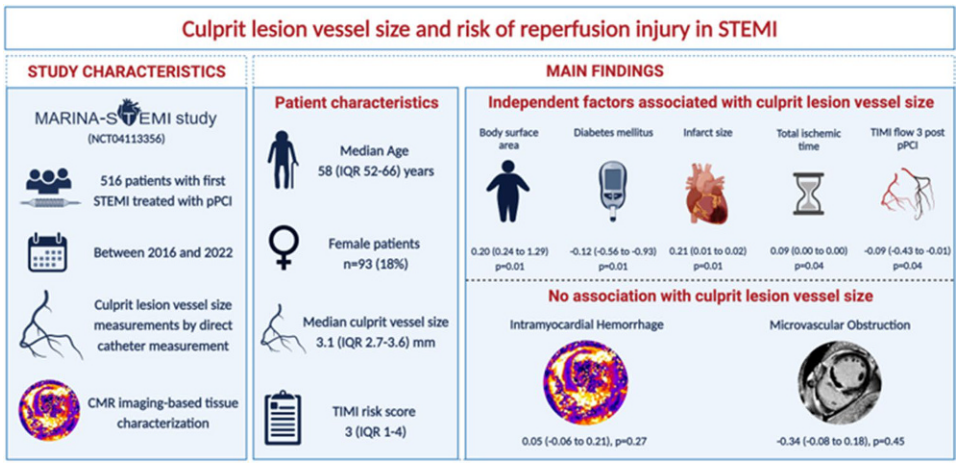

Fig. 1

but whether the size of the culprit lesion vessel plays a role in the occurrence and severity of reperfusion injury is currently unknown. The goal of this study was to evaluate the association between culprit lesion vessel size and the occurrence and severity of reperfusion injury as determined by cardiac magnetic resonance (CMR) imaging-based tissue characterization.

Methods: Patients (n = 516) with first-time STEMI treated with primary PCI underwent evaluation with CMR imaging at 4 (3–5) days after infarction. A comprehensive imaging protocol including late gadolinium enhancement imaging for MVO assessment and T2* mapping for IMH assessment was used. Vessel dimensions were determined by direct measurement using the catheter as reference.

Results: Median culprit lesion vessel size was 3.1 (2.7–3.6) mm. MVO and IMH were found in 299 (58%) and 182 (35%) patients. Culprit lesion vessel size was associated with body surface area, diabetes mellitus and infarct size. There was no association between vessel size and MVO or IMH in univariable as well as multivariable analysis ($p > 0.05$). These findings were replicated in the subgroups of patients with LAD (n = 226) and non-LAD (= 290) infarction as well as in patients with Thrombolysis in Myocardial Infarction 3 flow after PCI (n = 464).

Conclusion: Comprehensive characterization of myocardial tissue reperfusion injury by CMR revealed no association between culprit lesion vessel size and the occurrence of MVO and IMH in patients treated with primary PCI for STEMI.

23-8

Residual mitral leaflet length independently indicates left ventricular outflow tract obstruction in hypertrophic cardiomyopathy

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Introduction: Due to its dynamic character, the diagnosis of left ventricular outflow tract obstruction (LVOTO) in hypertrophic cardiomyopathy (HCM) often requires extensive exercise testing. Mitral valve alterations represent structural parameters that are not affected by load or contractility and influence left ventricular outflow tract (LVOT) gradients. The residual portion of the mitral valve extending past its coaptation (RML) has been postulated as a necessity to exhibit LVOTO. This study aims to assess the impact of RML length on the likelihood of LVOTO in HCM patients.

Methods: This is a cross-sectional, multi-center, registry-based analysis conducted at two HCM referral centers. The study included HCM patients with valid standardized transthoracic echocardiographic examinations. Blinded investigators performed post-processing echocardiographic analyses.

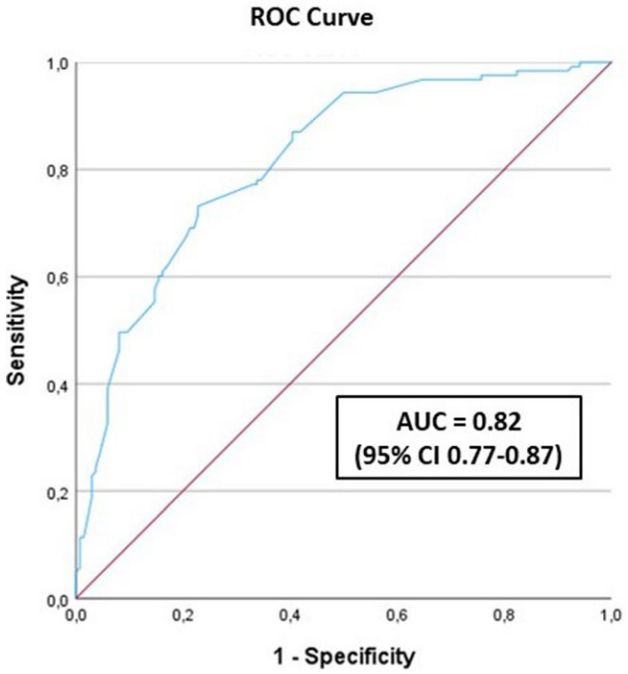

Fig. 1 Diagnostic Accuracy of RML; Receiver-operating characteristic (ROC) curve analysis depicting the diagnostic accuracy of residual mitral leaflet length in identifying left ventricular outflow tract obstruction in hypertrophic cardiomyopathy patients. AUC, area under the curve

LVOTO was defined as resting or dynamic peak LVOT gradients ≥ 30 mmHg.

Results: Among 270 HCM patients studied (43% women, mean age 58 ± 14 years), 131 patients (49%) exhibited LVOTO, with 76 (28%) having undergone septal reduction therapy (SRT). Patients with obstructive HCM exhibited a more pronounced end-diastolic interventricular septum (IVSd) thickness (2.2 ± 0.4 vs. 1.8 ± 0.5 cm; $p < 0.001$) and higher left ventricular ejection fraction (LVEF) (65 ± 9 vs. 62 ± 10%; $p = 0.009$) compared to those without LVOTO (nHCM). Obstructive HCM patients demonstrated longer anterior (29 ± 4 vs. 26 ± 4 mm; $p < 0.001$), posterior (23 ± 4 vs. 20 ± 4 mm; $p < 0.001$), and residual mitral leaflets (11 ± 3 vs. 7 ± 3 mm; $p < 0.001$) than nHCM patients. Multivariable logistic regression analysis adjusting for age, IVSd thickness, LVEF, anterior, and posterior mitral leaflet length identified RML length as an independent predictor of LVOTO [OR = 1.47 (95% CI 1.30–1.66); $p < 0.001$]. The area under the receiver-operating characteristic curve for RML length in identifying LVOTO was 0.82 (95% CI 0.77-0.87). RML length ≥ 9 mm demonstrated 73% sensitivity and 77% specificity in identifying obstructive HCM patients. Notably, these results remained statistically significant in sensitivity analyses selectively performed in HCM patients who had previously undergone SRT as well as in those who were SRT-naïve, respectively.

Conclusion: This study indicates RML length as an independent predictor of LVOTO in HCM patients. Moreover, RML length demonstrated high diagnostic accuracy in identifying LVOTO among HCM patients. Prospective studies are warranted to assess the added value of RML length in the diagnostic work-up of HCM patients.

POSTERSITZUNG 24 – DIGITAL CARDIOLOGY 2

24-1

Accuracy of Four Consumer-Grade Optical Heart Rate Sensors for Assessing Volume and Intensity Distribution of Physical Activity

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Introduction: Physical inactivity is a major modifiable risk factor for non-communicable diseases, which is the leading cause of death worldwide. Projections indicate that by 2030 about 499 million new cases of non-communicable diseases will occur, if the prevalence of physical inactivity does not change[1[. The World Health Organization currently recommends 150 to 300 min per week of moderate-intensity aerobic physical activity (MPA) or 75 to 150 min per week of vigorous-intensity physical activity (VPA), or an equivalent combination of moderate- and vigorous-intensity physical activity (MVPA) for substantial health benefits. More recent studies advocate more personalized exercise intensity recommendations for additional health benefits, even for public health purposes[2]. In light of these advancements, it becomes crucial to precisely measure both the volume and intensity of physical activity (PA) throughout a 24-hour period. Consumer-grade optical heart rate sensors emerged as promising tools to monitor volume and intensity of physical activity (PA). However, no validation study of optical heart rate sensors included recent comprehensive validation recommendations[3], required for facilitating usage for medical purposes.

Methods: The validity of continuous heart-rate data measured by four consumer-grade optical sensors, the wrist-worn Garmin Venu 2S and Polar Vantage M2, and the upper arm-worn Polar Verity Sense and Scosche Rhythm24 was assessed in 32 participants over 24 hours, including various laboratory-based and free-living activities (Fig. 1). A medical-grade ECG served as gold standard reference. Furthermore, validity of time in moderate and vigorous PA intensity zones was analyzed. Reliability was assessed by analyzing data of laboratory-based activities of two separate visits.

Results: Across activities, the mean absolute percentage error (MAPE) ranged from 2.2% to 4.7% and intraclass correlation coefficients (ICCs) ranged from 0.91 to 0.98, indicating high validity for all optical sensors. All optical sensors presented high validity for detecting time at MVPA (Fig. 2), except for Polar M2 for moderate PA (mean error 12.8%) and Garmin Venu V2 for vigorous PA (mean error −15.9%). Sensor reliability was high, indicated by a mean absolute error between activities of < 5%. Upper arm-worn sensors consistently outperformed wrist-worn sensors, particularly in activities involving increased arm movement.

Conclusion: Our findings suggest that the validity of four consumer-grade and widely used optical heart rate sensors is high, also for assessing volume of moderate- and vigorous-intensity PA. However, differences were observed between sensors regarding activity subtypes and intensity levels, which can inform decision-making when selecting optical heart rate sensors for PA monitoring and intervention.

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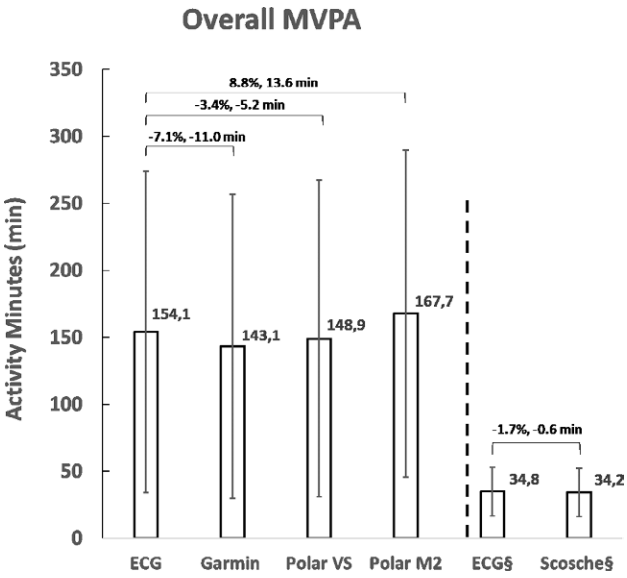

Fig. 2 Volume of activity minutes each sensor recorded for the intensity zone moderate to vigorous physical activity (MVPA) compared to the ECG. Validity is considered high, if mean percentage difference is below 10%. Scosche has less data points since it was not used during the free-living phase due to its limited internal memory

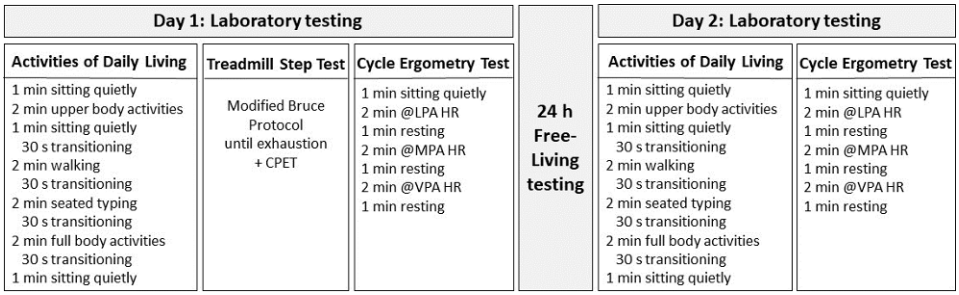

Fig. 1 Summary of all activities for validity and reliability assessment. Adapted from Mühlen JM et al., 2021. CPET, cardiopulmonary exercise testing; LPA, light physical activity; MPA, moderate physical activity; VPA, vigorous physical activity; HR, heart rate

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24-2

Validity of the Polar Fitness Test for Estimating Maximum Oxygen Consumption Versus Cardio Pulmonary Exercise Testing and Estimations Based on the Six Minute Walk Test

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Introduction: Maximum oxygen consumption (V̇O2max) is an accepted surrogate for cardiorespiratory fitness (CRF). A laboratory-based cardiopulmonary exercise test (CPET) represents the standard to determine V̇O2max. If CPET is not feasible, alternative methods may be justified. The Polar® Fitness Test (PFT) is a heart-rate based test utilizing a sports-wearable, neither requiring physical exercise nor a laboratory to estimate VO2max. This makes the PFT attractive for estimating V̇O2max in untrained, older people and those with health issues. However, the developer validated the PFT in healthy 20-60-year olds and there is a lack of studies on the validity of V̇O2maxPFT in older populations. To this end, we aimed to validate the V̇O2maxPFT in middle-aged to older people with and without heart rate limiting medication and to compare V̇O2maxPFT with another clinically established surrogate for CRF, the 6-Minute Walk Test (6 MWT) and five 6 MWT-based V̇O2max estimation equations. We also aimed to explore influencing factors on the PFT's accuracy.

Methods: Thirty-two participants (11 female, age 60 ± 10.2 years, V̇O2max 33 ± 7.7 mL/min/kg, 11 with regular heart-rate limiting medication) conducted a PFT with photoplethysmographic measurements at the wrist. V̇O2maxPFT was compared with V̇O2maxCPET and 6 MWT based estimates. We analysed the data using mean absolute percentage error (MAPE), intraclass correlation coefficients (ICC), Bland-Altman plots, Pearson correlation and paired t-tests.

Results: MAPE of V̇O2maxCPET vs. V̇O2maxPFT was 17%, ICC was moderate with 0.654 (95% CI [0.402, 0.814]). The upper and lower limits of agreement in the Bland-Altman analysis were 25 mL/min/kg apart. V̇O2maxPFT and V̇O2maxCPET were strongly correlated ($r = 0.670$, $p < 0.001$) without significant difference ($p = 0.074$). V̇O2maxCPET and the distance covered in the 6 MWT were strongly correlated ($r = 0.676$, $p < 0.001$). Moreover, two of the five equations estimating v̇O2max based on the 6 MWT [1,2] indicated stronger correlation with v̇O2maxCPET ($r = 0.804$ and 0.743, respectively) than v̇O2maxPFT did. Exploratory analysis revealed no influence of any of the captured anthropometric, physiological or medication variables on the difference of V̇O2maxCPET-PFT.

Conclusion: The MAPE of V̇O2maxPFT is 1.7-fold higher than the cut-off of 10% used in similar validation studies. Further, the limits of agreement of the v̇O2maxPFT are too wide to allow for an individually valid classification into the clinical fitness category proposed by e. g. the American College of Sports Medicine [3]. Hence, the PFT has insufficient validity to substitute CPET-assessments and specific 6 MWT derived estimates in the population studied. PFT may be a viable alternative if patients are impaired in their ability to perform a 6 MWT.

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24-3

Telemedizinisches Monitoring für die Prävention von schweren kardialen Dekompensationen bei Herzinsuffizienzpatienten

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Einleitung: Die Herzinsuffizienz ist eine schwerwiegende Erkrankung mit jährlich steigender Prävalenz. Eine Verschlechterung der Herzinsuffizienz (HI), die zu Hospitalisierungen führt, hat signifikante Auswirkungen auf die Prognose. Eine frühzeitige Diagnose der Krankheit, eine adäquate Behandlung und ganzheitliche Betreuung der Patienten ist daher entscheidend. (1) Daher haben die Firma Boston mit Heartlogic (HL) und die Firma Biotronic mit HeartInsight (HeIn) zwei telemedizinische Konzepte entwickelt, die Patienten mit erhöhtem Dekompensationsrisiko identifizieren und so eine rechtzeitige Erkennung einer Verschlechterung der HI ermöglichen. Dies gibt dem medizinischen Personal die Gelegenheit, frühzeitig Kontakt mit den Personen aufzunehmen, um etwaige Hospitalisierungen durch HI frühzeitig vorzubeugen. Beide Konzepte haben einen Algorithmus entwickelt, der anhand verschiedener personenspezifischer Faktoren bei Patienten mit implantiertem Defibrillator (VVI, DDD oder CRT-Gerät) ermittelt wird. Berücksichtigt werden dabei unter anderem die Herzfrequenz, die Atemfrequenz, die Thoraximpedanz und die Patientenaktivität, die über die implantieren Geräte gemessen werden. Wird ein gewisser Grenzwert überschritten, so deutet dies auf eine Verschlechterung der HI hin. Das System Heartlogic (HL) der Firma Boston wurde in der MULTISENSE-Studie an 974 Patienten aus 81 Zentren untersucht.

Methoden: Der Anstieg des HL-Algorithmus über den Wert 16 zeigte eine 70 % Sensitivität für eine Vorhersage für eine drohende Verschlechterung der HI und die Warnung erfolgte im Median 34 Tage vor einem Ereignis. Die falsch positiven Alarme lagen bei 1,47 pro Patientenjahr. (2) Das System HeartInsight (HeIn) der Firma Biotronik wurde in der multizentrischen

Tab. 1 Überblick Heartlogic mit HeartInsight

	Heartlogic	HeartInsight
Firma	Boston	Biotronic
Studie	MULTISENSE-HF	SELENE HF
Algorithmus-Faktoren	Erste und dritte Herzton Atemfrequenz Thoraximpedanz Verhältnis von Atemfrequenz zum Tidalvolumen Herzfrequenz Patienten-Aktivität	Mittlere 24 h Herzfrequenz Ruhe-Herzfrequenz (niedrigste 10 min-Durchschnitt in der Nacht) Herzfrequenzvariabilität Thoraximpedanz vorzeitige ventrikuläre Kontraktionen/Tag, die Patientenaktivität Vorhofflimmer-Last SHFM-Score vor Implantation des Devices
Aktualisierung	täglich	täglich
Grenzwert	16 (nicht indexiert)	4,5 (indexiert)
Einschlusskriterien	Eine herzinsuffizienzbedingte Hospitalisierung oder einmalig die Notwendigkeit einer parenteralen Diurese in den letzten 6 Monaten, bzw. 2 Ereignisse innerhalb der letzten 12 Monate oder Patienten mit einer NYHA Klasse II, III oder IV in den letzten 6 Monaten	LVEF <= 35% mit einer Belastungsdyspnoe der NYHA Klasse II-III vor Implantation
Definition Herzinsuffizienz (HI)-Ereignis	Stationäre Aufnahme wegen Herzinsuffizienz oder Notwendigkeit der parenteralen Gabe von einem oder mehr Medikamenten (Diuretika, positiv inotrope Substanzen oder Vasodilatatoren)	Ersthospitalisierung nach Implantation des Devices aufgrund einer kardialen Dekompensation, definiert als nicht elektive Krankenhausaufnahme mit Übernachtung, die durch Symptome und Zeichen oder objektiven Beweisen für eine Verschlechterung der Herzinsuffizienz begründet wurde (LVEF, EKG, andere …) und eine parenterale HI-Therapie benötigt haben (Diuretika, Vasodilatatoren, positiv inotrope Substanzen)
Detektion des HI-Ereignisses	70%ige Sensitivität für HI-Ereignisse mit der Warnung vor einer drohenden Verschlechterung im Median 34 Tage vorher	65,5%ige Sensitivität für HI-Ereignis mit einer mittleren Alarmierungszeit von 42 Tagen
Falsch positive Alarme pro Patientenjahr	1,47	0,69 (davon 0,63 völlig unerklärbar)

SELENE-HF Studie bei insgesamt 917 Patienten untersucht. Der Anstieg des HeIn-Algorithmus über einen definierten Grenzwert zeigte eine 65,5 %ige Sensitivität für eine Vorhersage einer HI assoziierten Verschlechterung mit einer mittleren Alarmierungszeit von 42 Tagen. Die Anzahl der falsch positiven Ereignisse lag bei 0,69 pro Patientenjahr. (3) Ein Überblick über beide Systeme ist in Tab. 1 dargestellt. Projektbeschreibung: Seit Dezember 2023 beobachten wir 15 Patienten mittels kardialem Telemonitoring bei Herzinsuffizienz (Heartlogic bzw. HeartInsight), acht davon sind mit einem CRT-D-Gerät, sechs mit einem VVI-ICD und einer mit einem DDD-ICD versorgt. Einschlusskriterium war ein NT-pro-BNP-Wert von über 1000 pg/ml vor Implantation. Insgesamt wurde bei fünf Patienten jeweils ein Alarm detektiert, einen kurzen Überblick dieser Patienten ist in Tab. 2 dargestellt. Von diesen fünf Patienten berichtete ein Patient (Pat. 6) bei telefonischer Kontaktaufnahme über Symptome einer kardialen Dekompensation, vier Patienten (Pat. 1, 2, 8, 13) waren asymptomatisch.

Resultate: Bei Pat. 6 mit Zeichen einer kardiale Dekompensation wurde die diuretische Therapie gesteigert. Zwei Monate nach telefonischer Kontaktaufnahme wurde der Patient im Rahmen einer geplanten Kontrolle vorstellig. Seine HL-Werte waren nach wie vor erhöht. Bei einem NYHA Stadium III und Beinödemen bds. wurde die Diurese nochmals gesteigert. Ein Monat später war der HL-Wert im Normbereich, der Patient präsentierte sich mit gebesserter Klinik im NYHA-Stadium II. Die restlichen vier Patienten verneinten eine Verschlechterung ihrer Herzinsuffizienzsymptomatik bei telefonischer Kontaktaufnahme. Diese wurde auf die strikte Einhaltung der max. Flüssigkeitsaufnahme von 1,5 Liter täglich hingewiesen und um eine frühzeitige Kontaktaufnahme bei Verschlechterung der Symptomatik hingewiesen. Bei Patient 1 wurde in weiterer Folge repetitive Gaben von positiv inotropen Substanzen (Levosimendan) durchgeführt. Bei Patient 13 konnte seit Beginn der Alarmierung eine atriale Tachykardie als Risikofaktor für eine kardiale Dekompensation detektiert werden. Patient 2 und Patient 8 berichteten von einer gewollten Gewichtsabnahme, ob dies zu einer Erhöhung des HL- bzw. HeIn-Wertes geführt hat ist derzeit noch unklar. Somit konnte bei zwei Patienten (Pat. 6 und 1) durch eine rechtzeitige Steigerung der Diurese bzw. durch Gabe von Levosimendan eine Hospitalisierung durch eine kardiale Dekompensation verhindert werden. Die Patienten ohne Alarmierung zeigten keine Zeichen einer Verschlechterung der HI.

Schlussfolgerungen: Telemedizinisches Monitoring bei Herzinsuffizienz ermöglicht eine intensivierte und individualisierte Betreuung für Herzinsuffizienzpatienten und dadurch kann ein positiver Nutzen für diese gewonnen werden. Dabei

Patient	System	Maximalwert	Kontaktaufnahme	Symptome	Kommentar
Pat. 1	HL, CRT-D	28 (NW 16)	32 Tage	Nein	Levosimendangabe
Pat. 2	HL, CRT-D	32(NW 16)	22 Tage	Nein	Gewichtsabnahme
Pat. 6	HL, CRT-D	31 (NW16)	30 Tage	Ja	Diuretikadosis wurde erhöht
Pat. 8	HeIn, CRT-D	54 (NW 46)	49 Tage	Nein	Gewichtsabnahme
Pat. 13	HeIn, DDD-ICD	70 (NW 48)	21 Tage	Nein	Neu aufgetretene atriale Tachykardie

NW= Normwert

Abb. 1 Kardiovaskuläre Risikofaktoren im Vergleich Frauen vs. Männer mit morbider Adipositas

handelt es sich um Frühwarnsysteme, die Personen mit bekannter Herzinsuffizienz bereits vor Beginn von Symptomen identifizieren, um so schwere kardiale Dekompensation mit Hospitalisierungsfolge zu verhindern. Eine Herausforderung besteht im Umgang mit asymptomatischen Patienten, da es einerseits schwierig ist, Patienten mit einer drohenden kardialen Dekompensation von Patienten mit falsch positiven Alarmen zu unterscheiden, andererseits gibt es noch keine klaren Vorgaben, welche Empfehlungen diesen Patienten gegeben werden soll. Weitere Studien sind notwendig, um dies zu klären.

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24-4

Erkennung und Risikovorhersage von kardialer Amyloidose durch Integration von Bildgebungs- und Nicht-Bildgebungsdaten mittels maschinellem Lernen

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Einleitung: Mit dem Aufkommen von Amyloid-gerichteten Therapien sind eine frühe und zuverlässige Diagnose sowie eine präzise Risikoeinschätzung der kardialen Amyloidose (CA) von erheblicher Bedeutung geworden. Während der aktuelle diagnostische Ansatz auf schwer zu standardisierender, visueller Interpretation von 99mTc-Szintigraphie basiert, beruht die Risikobewertung größtenteils auf einer Kombination aus Blut- und Bildgebungsparametern. Ziel dieser Studie ist es, die Möglichkeit die Integration von Szintigraphie, Echokardiographie und Nicht-Bildgebungsparametern wie Blutparametern und Komorbiditäten mittels maschinellem Lernen zur Erkennung und Risikostratifizierung von Patienten mit CA zu bewerten.

Methoden: Diese Studie umfasste alle Patienten, die zwischen 2010 und 2023 eine 99mTc-Szintigraphie durchlaufen haben. Es wurden zwei maschinelle Lernmodelle entwickelt, und die relative prädiktive Bedeutung der Parameter bewertet (Abb. 1): Erstens, ein Modell zur Erkennung von Patienten mit CA-suggestiver Aufnahme (Perugini-Grad 2/3) auf 99mTc-Szintigraphie Scans; Zweitens, ein Modell zur Bewertung des Risikos von Patienten mit CA-suggestiver Aufnahme für zukünftige Krankenhausaufenthalte aufgrund von Herzinsuffizienz (HFH). Insgesamt wurden 58 Parameter aus elektronischen Patientenakten extrahiert, einschließlich Blut-, echokardiographischen, demographischen Parametern und Komorbiditäten. Bildgebungsmerkmale der Szintigraphie wurden aus den Rohbilddaten unter Verwendung eines Deep Learning Ansatzes extrahiert.

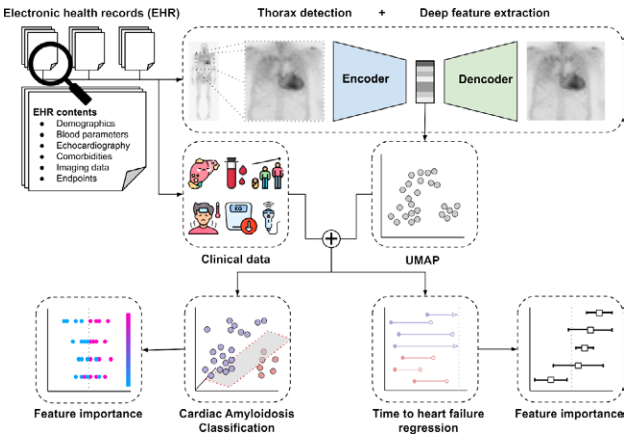

Abb. 1 Studienablauf. Die Daten der Patienten wurden aus elektronischen Patientenakten extrahiert, einschließlich Bildgebungs- und Nicht-Bildgebungsdaten. Szintigraphieparameter wurden durch die Anwendung eines Deep Learning Modells extrahiert. Zuerst wurden 1024 numerische Werte aus der reduzierten Darstellung im latenten Raum gewonnen und dann auf drei Parameter komprimiert. Basierend auf der Kombination von Szintigraphie, Echokardiographie und weiteren klinischen Parametern wurden im Anschluss zwei maschinelle Lernmodelle entwickelt. Diese inkludieren ein Modell für die Detektion von kardialer Amyloidose und ein Modell für diee Vorhersage von HFH unter Patienten mit CA-suggestiver Traceraufnahme auf der Szintigraphie

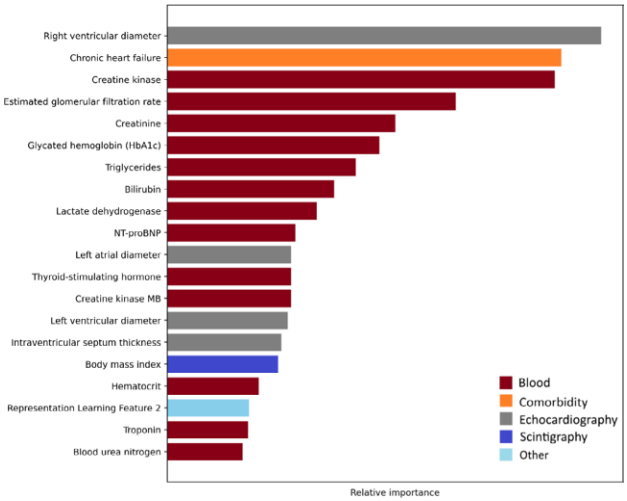

Abb. 2 Relative Gewichtung der 20 prediktivsten Parameter für die Vorhersage der HFH unter Patienten mit CA-suggestiver Traceraufnahme

Für die Vorhersage der Zeit bis zur HFH wurde ein Random Survival Modell verwendet.

Resultate: Insgesamt wurden 12 380 konsekutiv eingeschriebene Patienten einbezogen, von denen 279 (2.3 %) von CA-suggestiver Traceraufnahme betroffen waren. Das maschinelle Lernmodell zeigte eine höhere Genauigkeit bei der Erkennung von CA (AUC 0,96 [95 % KI 0,95-0,97], Sensitivität 0,78 [95 % KI 0.77-0.80] und Spezifität 0,99 [95 % KI 0.99-0.99]). In der Risikovorhersage zeigte das Vorhersagemodell eine gute Genauigkeit bei der Vorhersage zukünftiger HFH (C-Index 0,71 [95 % KI 0,68-0,75]). Die Parametergewichtung für die Zeit-bis-Ereignis-Analyse ergab, dass der rechtsventrikuläre Durchmesser, die vorherige Diagnose einer chronischen Herzinsuffizienz und die Kreatinkinasekonzentration im Blut die drei wichtigsten Prädiktoren waren (Abb. 2).

Schlussfolgerungen: Die Erkennung von Patienten mit kardialer Amyloidose und ihre Risikoeinschätzung für Herzinsuffizienz kann mit Hilfe der maschinellen Lernen-basierten Integration von Bildgebungs- und Nicht-Bildgebungsdaten unterstützt werden. Unsere Ergebnisse können dazu benutzt werden, neue Ansätze zur Beurteilung des Krankheitsverlaufs zu entwickeln und um das Therapieansprechens besser zu bewerten.

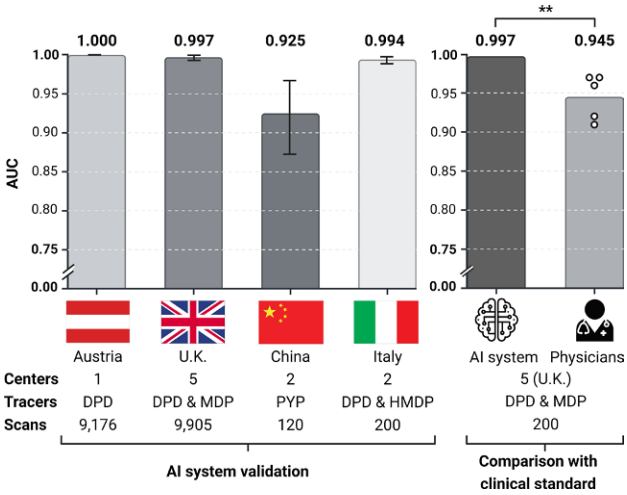

Fig. 1 Performance des künstlichen Intelligenz (KI) Systems bei der Detektion von CA-suggestivem Uptake auf 99 m-Tc Scintigraphie Scans. Das linke Balkendiagramm zeigt die Performance nach Herkunftsland der Kohorte. Das rechte Balkendiagramm zeigt die Ergebnisse der Vergleichsstudie zwischen KI System und Nuklearmedizinern

24-5

Screening nach abnormer kardialer Szintigraphie suggestiv für kardiale Amyloidose mittels Deep Learning: Eine internationale, multizentrische, tracerübergreifende Studie

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Einleitung: Die Kardiale Amyloidose ist eine progressive und tödlich Erkrankung, charakterisiert durch die Aggregation von fehlgefalteten Proteinen, die sich im Myokardium anreichern und letztlich zu Herzversagen führen. Der aktuelle diagnostische Ansatz basiert auf einer schwer zu standardisierenden, visuellen Interpretation der 99mTc-Szintigraphie. Neben der daraus resultierenden Variabilität in den Bildbewertungen wird CA manchmal als Zufallsbefund auf der 99mTc-Szintigraphie identifiziert und nicht immer korrekt erkannt oder dem überweisenden Arzt gemeldet. Wir haben ein künstliche Intelligenz (KI)-System zum Screening von CA auf 99mTc-Szintigraphie Scans entwickelt, das eine standardisierte und genaue Detektion ermöglichen soll. Die Robustheit, prognostische Wert, Sicherheit und klinische Anwendbarkeit des KI-Systems wurden durch eine multizentrische Validierung, prognostische Bewertung, einen medizinischen Algorithmus Audit und eine diagnostische Vergleichsstudie mit einer Gruppe von Experten bewertet.

Methoden: Insgesamt wurden 19401 Scans von 16241 Patienten aus neun Zentren in Europa und Asien in die Studie miteinbezogen. Das KI-System wurde mit Daten aus einem einzigen Zentrum entwickelt und an den verbleibenden acht Zentren validiert. Das KI-System wurde darauf trainiert, das Vorhandensein eines mit CA assoziierten Musters (Perugini Grad ≥ 2) zu erkennen. Die Leistung des Systems wurde mit der diagnostischen Leistung von fünf erfahrenen Nuklearmedizinern verglichen. Die Ergebnisbewertung erfolgte mittels univariater und multivariater Cox-Regression, korrigiert für relevante Störfaktoren.

Resultate: Das KI-System erreichte eine 10-fache Kreuzvalidierungsleistung von AUC 1.000 (95 % KI [1.000, 1.000]) für die Entwicklungs Kohorte und eine durchschnittliche unabhängige externe Validierungs-AUC von 0.995 (95 % KI [0.991, 0.997]) über die acht externen Zentren. Die Vorhersagen des KI-Systems waren prognostisch für die Gesamtmortalität (HR 1.67; 95 % KI [1.36, 2.06]; $p < 0.0001$) und Herzinsuffizienz (HR 17.52; 95 % KI [11.05, 27.76]; $p < 0.0001$). Die Ergebnisse blieben nach multivariater Anpassung signifikant. Die mediane Nachbeobachtungszeit betrug 4,6 Jahre (IQR 1.4–5.6), nach der 25.7 % der Patienten verstorben waren. In der MCMR-Studie kam es bei 11 % der Fälle zu Uneinigkeiten unter den Ärzten (Fleiss Kappa 0.88) und mit einer durchschnittlichen Leistung von AUC 0.945 (Bereich 0.911-0.970), während das KI-System eine AUC von 0.997 erreichte. Der medizinische Algorithmus-Audit bestätigte die Robustheit über Tracer, Scanner, demografische Faktoren und Zentren.

Schlussfolgerungen: Das entwickelte KI-System erreicht diagnostische Leistungen, die mit Nuklearmedizinern vergleichbar sind, und bietet einen standardisierten und schnellen Ansatz zur zuverlässigen Erkennung von CA-Patienten unter Verwendung von 99mTc-Szintigraphie Scans. Das KI-System kann für das Screening auf CA bei Patienten eingesetzt werden, die zur 99mTc-Szintigraphie überwiesen werden.

24-6

A novel 12-lead standard ECG derived scoring system for risk stratification in the emergency department

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Introduction: The ECG represents a routinely used diagnostic tool in the assessment of patients in the emergency department. Beside specific alterations within the ECG indicative of underlying pathologies, such as ST-elevation in myocardial infarction, several other parameters have been developed over the past decades that proofed themselves as strong and independent predictors of worsened outcome independent of a specific underlying pathology. These include basic metrics such as heart rate and QRS duration, but also more advanced biomarkers such as QRS microfragmentation (QRSμf)1 and total cosine R to T (TCRT)2. In this work, we aimed to summarize all these markers derived from 12-lead standard ECGs into one novel risk score and evaluate its performance as mortality predictor in the emergency department.

Methods: We retrospectively collected 10- second 12- lead ECG recordings from unselected patients presenting to the emergency department of the Medical University Innsbruck between September 2019 and June 2022. For each patient a risk score was calculated from the first retrieved ECG using the criteria displayed in Fig. 1. Calculation of all parameters was done as previously published. Patients with a total score of 0–1 points, 2–3 points, 4–6 points and 7 points were considered as low, intermediate, high and very high risk, respectively. The performance of the risk score was evaluated using Cox regression analysis and Kaplan-Meier curves with all-cause mortality within one year as primary endpoint.

Results: In total, 10 781 patients were included in our analyses. Median age was 69 (IQR 54–80) years, 5 588 (52%) were male and 5 193 (48%) were female. 6 966 (65%) patients were considered as low risk, 2 656 (25%) patients as intermediate risk, 1 098 (10%) patients as high risk and 61 (1%) patients as very high risk according to the ECG risk score with one year mortality rates of 8%, 17%, 26% and 43%, respectively ($p < 0.001$ for difference). In cox regression analysis the novel ECG risk score was a strong and independent predictor of one-year all-cause mortality with a hazard ratio of 1.35 (95% CI 1.31–1.39, $p < 0.001$). Kaplan-

Non-sinus rhythm	+ 2 points
Heart rate ≥ 110 bpm or > 70 bpm	+ 1 points
QRS duration > 120 ms	+ 1 points
QTc interval > 450 ms	+ 1 points
QRSμf > 3.5 %	+ 1 points
TCRT > 110 °	+ 1 points
Risk score = sum of points	

Fig. 1 Calculation of ECG risk score

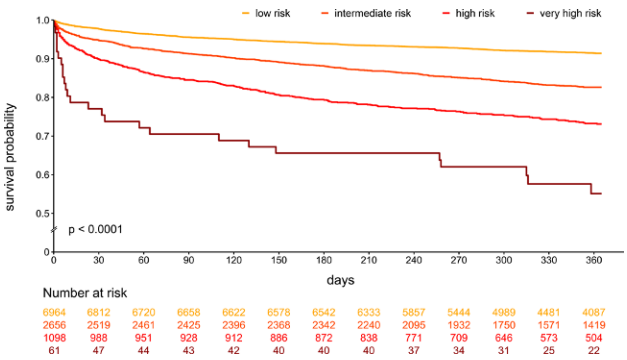

Fig. 2

Meier survival curves for different risk categories are displayed in Fig. 2.

Conclusion: In an unselected population of patients presenting to the emergency department of a large university hospital a novel risk score calculated from standard 12-lead ECGs recorded during clinical routine was a strong and independent mortality predictor. Further studies are needed to evaluate how incorporation of the novel score into existing triage systems can improve patient care.

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POSTERSITZUNG 25 – DIVERSE 2

25-1

Mathematisches Modell zur Berechnung der Batterieentladekurve des MicraTM sondenlosen Herzschrittmachers – Analyse von 10-Jahres-Follow-up-Daten

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Einleitung: Die Entwicklung sondenloser Herzschrittmachersysteme verfolgt insbesondere das Ziel, die mittel- und langfristigen Komplikationen im Bereich des Generators und der Sonden konventioneller Herzschrittmachersysteme zu vermeiden. Zugleich bedingt die kompakte Bauweise dieser intra-

ventrikulären sondenlosen Systeme eine Limitierung der Batteriekapazität und erfordert eine stromsparende Arbeitsweise. Seit seiner Erstimplantation im Menschen im Dezember 2013 an unserer Abteilung ist der MicraTM (Medtronic Inc., Minneapolis, MN, USA) derjenige sondenlose Herzschrittmacher, der seit Einführung dieser Systeme schon am längsten implantiert wird. Bisherige Studien zeigen die Stabilität der elektrischen Parameter in den ersten Monaten nach der Implantation. Die langfristige Sicherheit des sondenlosen Herzschrittmachersystems hängt weitestgehend auch von seiner Batterielaufzeit ab. Initial wurde vom Hersteller eine geschätzte Batterielaufzeit von etwa zehn Jahren vorhergesagt. Auf Basis vorliegender Daten bereits implantierter Systeme erwartet man derzeit je nach Auslastung sogar potentielle Laufzeiten von bis zu 14 Jahren. Zum jetzigen Zeitpunkt liegen noch keine größeren Erhebungen über die langfristige Batterieentladung des MicraTM-Herzschrittmachers vor. Ziel dieser Studie war es, anhand von retrospektiv erhobenen Nachsorgedaten ein mathematisches Modell der Entladekurve des Micra-Schrittmachers zu erstellen.

Methoden: Für alle PatientInnen, denen von Dezember 2013 bis September 2022 ein MicraTM-Schrittmacher an unserer Abteilung implantiert wurde, wurden retrospektiv Daten zur Implantation und Nachsorgedaten bis zum April 2023 erhoben. Nachsorgeuntersuchungen (Follow Up, FU) fanden alle ein bis zwei Jahre statt. Daten von FUs, die an anderen Krankenhäusern oder Ambulanzen durchgeführt wurden, wurden angefordert und in die Datenbank mit einbezogen. Zur Modellierung der Entladekurve wurden nur Daten jener PatientInnen verwendet, von denen mindestens vier Schrittmacherabfragen im postinterventionellen Verlauf vorliegen. Die Entladekurve wurde mittels eines linearen Regressionsmodells als kubische Funktion des zeitlichen Abstands der FUs zur Implantation modelliert. Zusätzlich wurden als Kovariable die Wahrnehmungs- und Reizschwelle, die Impedanz, der programmierte Schrittmachermodus sowie die Stimulationsfrequenz bei Implantation und der Stimulationsanteil im Verlauf berücksichtigt. Die geschätzten Effekte werden mit ihren Standardfehlern, den t-verteilten Prüfgrößen und p-Werten angegeben. Der Entladeverlauf mit dem zugehörigem 95 %igen Konfidenzintervall wurde für eine Person mit Referenzwerten in den Kovariablen dargestellt. Zur Beurteilung der Anpassungsgüte wurde das Bestimmtheitsmaß berechnet. Die statistische Analyse wurde mit der Statistik-Software R (Version 4.3.1) durchgeführt.

Resultate: Bis September 2022 erhielten 385 PatientInnen einen MicraTM-Herzschrittmacher. Davon wurden 90 (23,4 %) PatientInnen in unsere Untersuchung inkludiert. Häufigste Indikationen für die Schrittmacherimplantationen bildeten bradykardes Vorhofflimmern (47,1 %), AV-Block III° (21,8 %) und Sick-Sinus-Syndrom (17,2 %). Der programmierte Schrittmachermodus war bei 60 % der PatientInnen VVIR und bei 40 % VVI. Folgende Parameter wurden bei der Implantation erhoben: Wahrnehmungsschwelle im Median 9,7 (IQR: 6,82–12,83) mV, Reizschwelle 0,4 (IQR: 0,38-0,62) V, Impedanz 690 (IQR: 613–810) Ohm, Stimulationsfrequenz 60 (IRQ: 50–60) 1/min. Im Verlauf lag der mediane ventrikuläre Stimulationsanteil bei 72 (IQR: 28–97) %. Diese medianen Werte und der Schrittmachermodus VVI wurden als Referenzwerte in der Regressionsanalyse verwendet. Die längste FU-Dauer betrug acht Jahre – zu diesem Zeitpunkt lagen Daten der Schrittmacherabfrage von 4 (4,4 %) PatientInnen vor. Tab. 1 fasst die Ergebnisse zusammen. In Abb. 1 wird die modellierte kubische Funktion für eine/n Patientin/en mit Referenzwerten in allen Kovariablen dargestellt. Das Bestimmtheitsmaß betrug 0,7906. Somit werden 79,06 % der Variabilität der Batterieentladung durch die geschätzten Effekte modelliert.

	Regressionskoeffizient	Standardfehler	t-Wert	p-Wert
y-Achsenabschnitt	3,11	0,0040	783,44	**<0,001**
Jahre bis FU**	-80,61	0,0000	-18,59	**<0,001**
Wahrnehmungsschwelle*	-0,31	0,0003	-1,22	0,223
Reizschwelle*	-23,04	0,0035	-6,66	**<0,001**
Impedanz*	24,01	0,0000	3,69	**<0,001**
VVIR-Mode*	1,89	0,0028	0,66	0,507
Stimulationsfrequenz*	-0,49	0,0002	-2,29	**0,023**
Stimulationsanteil**	-0,32	0,0000	-8,37	**<0,001**

Abb. 1 Ergebnisse der polynomialen Regressionsanalyse für einen kubischen Zeiteffekt. Batteriespannung in V bei 3 Monaten (y-Achsenabschnitt), Impedanz in kOhm. *Parameter erhoben bei Implantation. **Parameter erhoben im postinterventionellen Verlauf

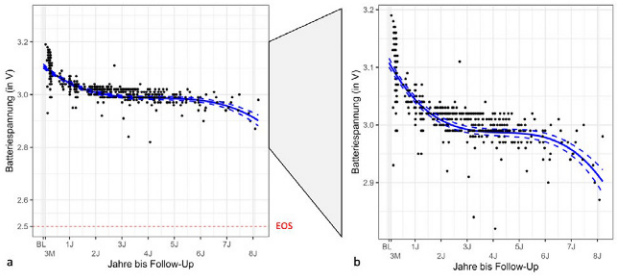

Abb. 2 Regressionsmodell für die Batteriespannung als Proxy-Parameter für die Batterieentladung im Verlauf. Panel a stellt die Entladekurve der Batterie mit Kennzeichnung der Batteriespannung bei End of Service (EOS, 2,5 V) dar. In Panel b ist der geschätzte Verlauf der Entladekurve zwischen einer Batteriespannung von 2,8 und 3,2 V dargestellt. Angenommene Werte: Wahrnehmungsschwelle bei Implantation: 9,7 mV, Reizschwelle bei Implantation: 0,4 V, Impedanz bei Implantation: 690 Ohm, programmierter Schrittmachermodus: VVI, Pacinganteil im Verlauf: 72%, Basis-Stimulationsfrequenz: 60/min. Die strichlierten Linien stellen das 95%ige Konfidenzintervall dar

Schlussfolgerungen: Die polynomiale Regressionsanalyse erlaubt eine mathematische Modellierung der Batterieentladekurve des MicraTM-Herzschrittmachers durch eine kubische Funktion bei hohem Bestimmtheitsmaß. Identifizierte signifikante Kovariablen sind die Reizschwelle, die Impedanz, die Stimulationsfrequenz und der Stimulationsanteil. Die Wahrnehmungsschwelle und der programmierte Schrittmachermodus waren nicht signifikant mit der Entladung assoziiert. Dabei ist anzumerken, dass es intraindividuell im Verlauf zu einer großen Variabilität der gemessenen Wahrnehmungsschwellen kam. Etwaige Umprogrammierungen des Stimulationsmodus im Verlauf wurden im Rahmen unserer Untersuchung nicht erfasst. Im Sinne des kubischen Verlaufs fällt die Batteriespannung anfangs stärker ab, was für die verwendete Li-SVO-CFx Batterie typisch ist und zusätzlich durch Gewebeveränderungen am Device-Myokard-Übergang nach Implantation erklärbar sein kann. Danach geht die Entladekurve in ein Plateau über, um gegen Ende der Laufzeit erneut stärker abzufallen. Dieser Abfall kann auf einen Anstieg des Innenwiderstands der Batterie zurückgeführt werden. Unserer Analyse lagen nur wenige Daten aus FUs nach längeren Laufzeiten vor, woraus ein mit zunehmender FU-Dauer breiter werdendes 95 %iges Konfidenzintervall resultiert. Von zukünftigen Schrittmacherabfragen sind ebendiese Daten und Daten bis zum Erreichen des End of Service essentiell, um die Batterieentladung während dieses wichtigen Zeitbereiches modellieren zu können.

25-2

Acute coronary syndrome caused by left ventricular pseudoaneurysm compressing a coronary artery after mitral valve replacement

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Introduction: Left ventricular pseudoaneurysm is a rare but life-threatening disorder that is often related to myocardial infarction but sometimes associated with valve surgery. We present the case of a pseudoaneurysm 3 months after mitral valve replacement, which was recognized because it caused acute coronary syndrome

Methods: Case report: A 73 year old women was admitted to the hospital because of congestive heart failure. She had undergone successful surgical mitral valve replacement and tricuspid valve repair 3 months before presentation. It had been re-do surgery after mitral valve repair 15 years ago. Echocardiography on admission showed recurrent severe tricuspid valve regurgitation, preserved left ventricular systolic function and a demarcated fluid accumulation lateral to the heart, which was classified as a localized pericardial effusion post surgery. During hospital stay the patient developed sudden severe chest pain. ECG showed strictly posterior infarction. Acute coronary angiography revealed normal coronary arteries, but a systolic compression of the mid circumflex artery, that caused ischemia. In cineangiography the contrast medium filled a huge structure beside the heart. The pain was relieved by administration of betablockers and nitrates and the ECG normalized. CT of the heart found a giant pseudoaneurysm of the left ventricle. A high risk re-re-do surgery was performed. It revealed a perforation of the ventricular myocardium near segment P1 with a diameter of

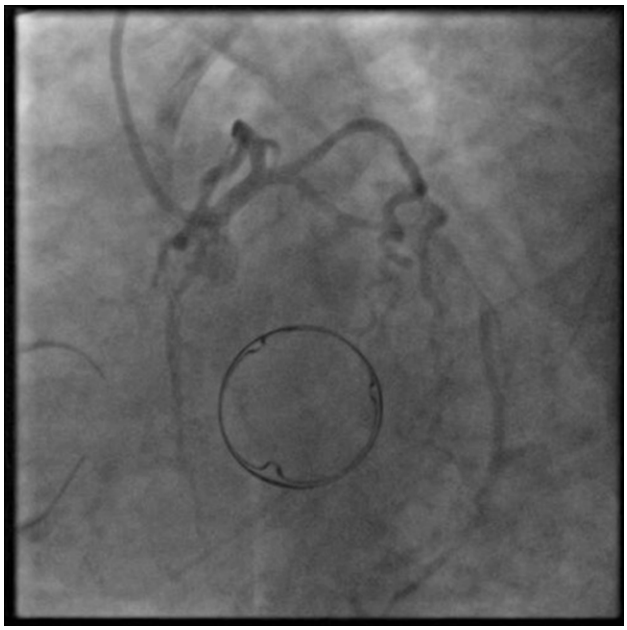

Fig. 1 Systolic compression of circumflex artery

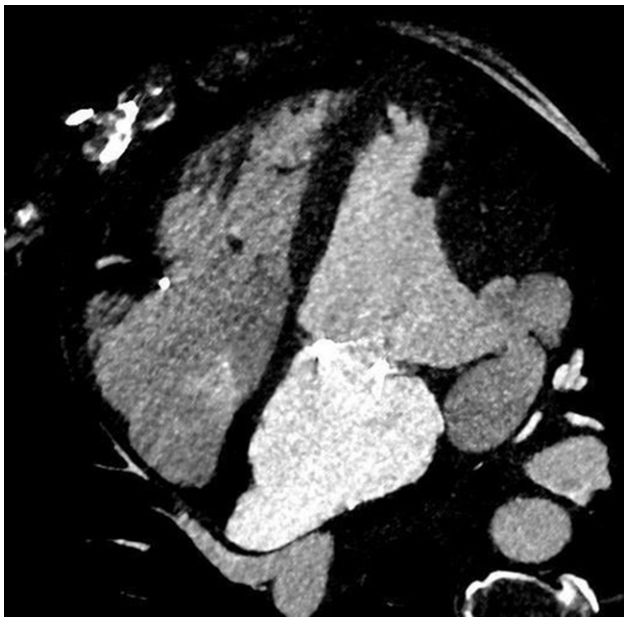

Fig. 2 Left ventricular pseudoaneurysm

3 cm and a fibrotic edge without involving the mitral annulus. It was sealed with a pericardial patch. Further a new bioprosthetic mitral valve as well as a bioprosthesis in tricuspid position were implanted. Unfortunately, the patient died of severe bleeding and heart failure despite ECMO-support the day after surgery.

Results: Left ventricular pseudoaneurysms can result from incomplete rupture of the ventricular wall contained by adherent pericardium or scar tissue. Clinical presentation is nonspecific and may be chest pain, congestive heart failure or dyspnea due to regurgitation volume and compression of other anatomic structures. Detailed anatomy of the aneurysm extension and the communication can be delineated with transesophageal echocardiography, cardiac MRI or contrast CT. Left ventricular pseudoaneurysms after replacement of the mitral valve complicates the postoperative course at a percentage between 0,02% and 2%. Some conditions may determine a rupture of the left ventricle post mitral surgery such as recent endocarditis, the need for extensive decalcification of the annulus or an oversized valve.

Conclusion: Left ventricular pseudoaneurysm is a rare complication of mitral valve replacement. Echocardiography as well as cardiac MRI or contrast CT are indispensable for diagnosis. The only therapeutic option is re-do surgery, since there is a significant risk of rupture. However, the perioperative risk of left ventricular pseudoaneurysm resection is high.

25-3

Psychokardiologische Rehabilitation – Psychische Belastung und Lebensqualität im Follow-up

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Einleitung: Komplexe Wechselwirkungen von kardiologischen und psychiatrischen Erkrankungen erfordern multiprofessionelle und integrative psychokardiologische Rehabili-

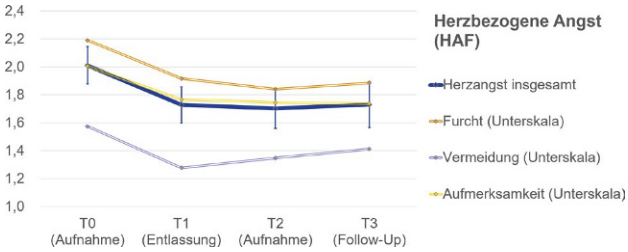

Fig. 1

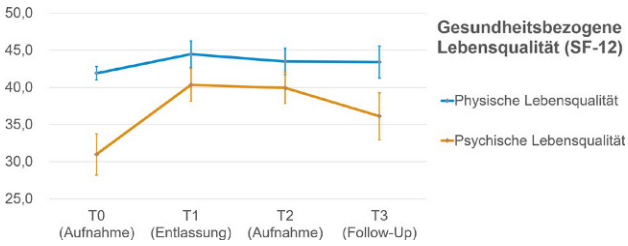

Fig. 2

tationsverfahren. Die Rehabilitand*innen sehen sich dabei in ihrer Lebensführung mitunter stärker durch ihre psychische Symptomatik beeinträchtigt als durch ihre organische Herzerkrankung [1]. Insbesondere herzbezogene Ängste, in Form von Befürchtungen, übersteigerter Körperwahrnehmung und entsprechendem Vermeidungsverhalten, sind in dieser Gruppe klinisch relevante therapeutische Herausforderungen [2]. Ein zweigeteiltes stationäres psychokardiologisches Heilverfahren (4 Wochen Grund- und 2 Wochen Auffrischungsmodul, im Abstand von ≤ 6 Monaten), das klassische Elemente kardiologischer und psychologisch-psychotherapeutischer Rehabilitation vereint, wurde in einer Follow-Up-Studie untersucht.

Methoden: Die vorliegende Studie ist eine prospektive, monozentrische, quantitative Follow-Up-Studie mit einer Interventionsgruppe. 90 psychokardiologische Rehabilitand*innen wurden zwischen Mai 2021 und Oktober 2022 rekrutiert (informed consent). Daten bei Aufnahme/Entlassung (1. Reha-Teil: T0/T1) und erneuter Aufnahme (2. Reha-Teil: T2) wurden aus dem digitalen Krankenakt-System und psychologischen Testsystemen entnommen. Die postalische Follow-up-Befragung (T3) erfolgte 6 Monate nach der Entlassung aus dem Auffrischungsmodul. Das primäre Erkenntnisinteresse galt der längerfristigen Veränderung (T0-T3) der herzbezogenen Ängste (Herzangstfragebogen [3]), psychischen Belastung (SCL-90-S: Global Severity Index) und physischen/psychischen gesundheitsbezogenen Lebensqualität (SF-12). Deskriptive Statistiken, t-Tests für abhängige Stichproben und Effektstärken (Cohen's d) wurden mit SAS® Studio, Version 5.2 (SAS Institute Inc., Cary, NC, USA) berechnet.

Resultate: Daten von 90 Rehabilitand*innen (Ø-Alter: 53,61 ± 6,71 Jahre; ♂ = 66 %) wurden analysiert. Häufigste Aufnahmediagnosen waren ischämische Herzkrankheiten (ICD-10: I20-I25; 63,3 %) und sonstige Formen der Herzkrankheiten (ICD-10: I30-I52; 27,8 %). Rund die Hälfte wies eine Diagnose aus den Gruppen der neurotischen, Belastungs- und somatoformen Störungen (ICD-10: F40-F48; 54,4 %) und/oder affektiven Störungen (ICD-10: F30-F39; 47,8 %) auf, wobei Mehrfachdiagnosen vorliegen konnten. Sechs Monate nach der Rehabilitation lassen sich statistisch signifikante Reduktionen der herzbezogenen Angst (t(89) = 3,691, p < '001; d = –0,391, 95 % CI [–0,604; –0,178]) und der generellen psychischen Belastung (t(88) = 2,069, p = '041; d = –0,169, 95 % CI [–0,324; –0,014]) sowie Steigerungen der psychischen gesundheitsbezogenen Lebensqualität (t(86) = –3,609, p < '001; d = 0,383, 95 % CI [0,180; 0,587]) im Vergleich zu den Aufnahmewerten feststellen. Die im Vergleich zur psychischen Lebensqualität bei allen Messzeitpunkten durchschnittlich höher ausgeprägte physische Lebensqualität blieb im Untersuchungszeitraum annähernd konstant (t(86) = –0,612, p = '542; d = 0,060, 95 % CI [–0,155; 0,275])).

Schlussfolgerungen: Die Studienergebnisse sind unter Berücksichtigung der methodischen Limitationen der Studie als Indizien für längerfristige Symptomreduktionen und Steigerungen der Lebensqualität nach der Rehabilitation zu werten. Eine frühzeitige und zielgerichtete Zuweisung zur psychokardiologischen Rehabilitation sowie bedarfsorientierte Nachsorgeangebote erscheinen essentiell, um optimale therapeutische Ergebnisse zu erzielen und langfristig im Sinne der Rehabilitand*innen zu erhalten.

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25-4

Prognostic value of growth-differentiation factor 15 (GDF-15), soluble ST2 (sST2) and galectin-3 in hospitalized patients with COVID-19

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Introduction: Cardiovascular (CV) manifestations of COVID-19 are frequently reported and associated with poor prognosis and excess mortality. The biomarkers galectin-3, solute ST2 (sST2) and growth-differentiation factor 15 (GDF-15) are valuable predictors of clinical outcomes in CV disease and to an extent in COVID-19 as well.

Age [IQR]		
	67 [51 – 80]	
Sex	Female	Male
	94 (48.2)	101 (51.8)
CVD	No	Yes
	151 (77.4)	44 (22.6)
Chronic kidney disease	No	Yes
	160 (82.1)	35 (17.9)
Arterial hypertension	No	Yes
	80 (41.0)	115 (59.0)
Dyspnea	No	Yes
	84 (43.1)	111 (56.9)

Patient characteristics (%)

Fig. 1 patient characteristics and comorbidities

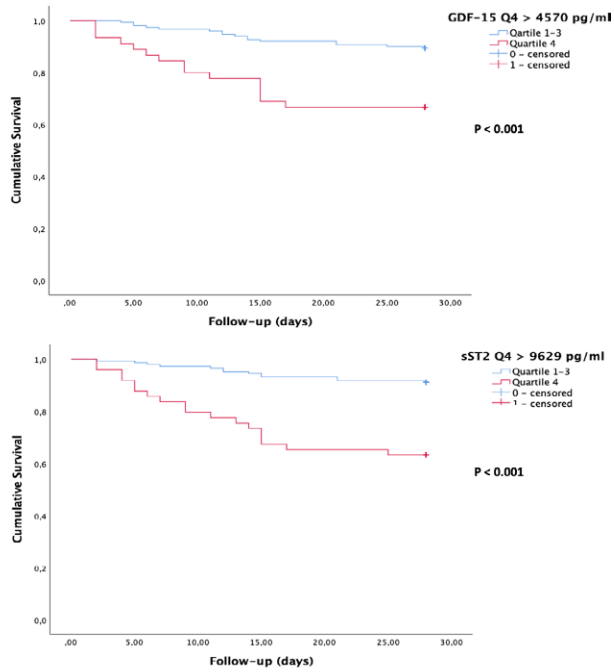

Fig. 2 kaplan meier survival curves of GDF15 and sST2

Methods: This prospective, observational study of patients with hospitalization for laboratory-confirmed COVID-19 infection was conducted from June 6th to December 22nd, 2020 in a tertiary care hospital in Vienna, Austria. GDF-15, sST2 and Galectin-3 levels on admission were collected and their association with short-term mortality was analyzed.

Results: 195 patients were enrolled (51.8% male; age 67 [IQR, 51–80]). 31 (15.9%) reached the primary endpoint of 28-day mortality. At admission, median GDF-15 and sST2 levels were significantly higher in deceased patients compared to survivors: GDF-15 (4663 pg/ml [IQR, 2914–6115] vs 2581 pg/ml [IQR, 1585–4263], P < 0.001); sST2 (11724 pg/ml [IQR, 5639–17220] vs 4393 pg/ml [IQR, 2659–8329], P < 0.001). No difference in Galectin-3 concentrations was observed (19.1 pg/ml [IQR, 14.0–26.5] vs 18.4 pg/ml, [IQR, 13.4–23.2], P = 0.287). Both GDF-15 and sST2 were strong predictors of the primary endpoint upon multivariable cox regression analysis: GDF-15 (HR 6.02 [95% CI, 1.27–28.55], P = 0.024); sST2 (HR 8.18 [95% CI, 2.61–25.64], P < 0.001), while galectin-3 failed to predict mortality (HR 2.95 [95% CI, 0.41–21.08], P = 0.281).

Conclusion: GDF-15 and sST2 represent robust short-term mortality predictors in COVID-19 infected patients and could be of importance for identifying at-risk patients. Galectin-3, on the contrary, did not show an association with 28-day mortality.

25-5

Predictors of survival after out-of-hospital cardiac arrest in Carinthia, Austria

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Introduction: Out-of-hospital cardiac arrest (OHCA) is associated with poor survival rates. The survival depends on the timing and quality of cardiopulmonary resuscitation (CPR) measures. Some factors associated with a favourable outcome have been defined but regional differences do not allow for generalisation. This analysis reflects the situation in Carinthia, Austria.

Methods: A retrospective analysis of medical emergencies that were classified as cardiac arrest and occurred in the year 2018 in Carinthia, Austria, was conducted. Original protocols of air and ground rescue operations performed by the Air Rescue Austria and the Austrian Red Cross Carinthia were evaluated. The clinical course of all OHCA survivors was assessed through

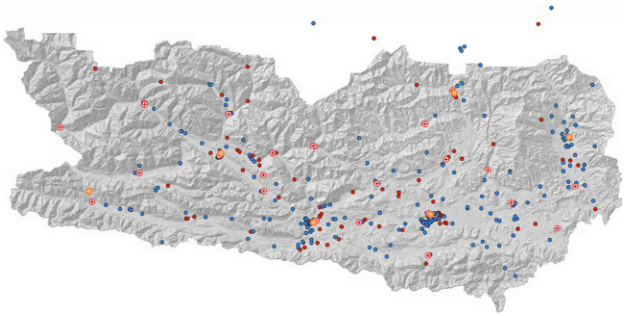

Fig. 1 Overview about spatial distribution of OHCA cases across Carinthia. Red dots = survived OHCA or transport du ring CPR. Blue dots = not survived OHCA. Orange dots = hospitals. White dots with red cross = base stations of advanced life support teams (air and ground rescue services)

Tab. 1 Characteristics of all patients with OHCA and CPR measures. *Mann-Whitney-U-Test, Chi-square

	Total (n = 441)	ROSC + ongoing CPR (n = 149)	Dead (n = 292)	p*
Age [median (IQR); years]	75 (62–85)	71 (60–82)	77 (64–89)	0.004
Female sex [%]	35	32	36	0.421
Arrival time of ALS team [median (IQR); minutes]	10 (7–16)	9 (7–14)	11 (7–16)	0.121
Duration of CPR [median (IQR); minutes]	25 (16–37)	15 (10–27)	29 (20–41)	<0.001
Bystander-CPR [%]	46	50	44	0.232
Defibrillation [%]	30	48	21	<0.001
Catecholamine use [%]	65	75	60	0.065

a retrospective analysis of the regional clinical information system.

Results: A total of 441 OHCA cases were identified, of which 106 (24%) resulted in return of spontaneous circulation (ROSC), 292 (66%) in death preceded by CPR, and in 43 patients (10%) transport with ongoing CPR was initiated. Clinical data of 125 patients having ROSC or arriving at the hospital under ongoing CPR was accessible. 30 (24%) of these patients survived with a favourable neurological outcome, two (2%) had a persistent vegetative state, and 93 (74%) did not survive the hospital stay. The median age of all analysed patients was 75 (interquartile range [IQR] 62–85) and 35% were female. The median arrival time of the advanced life support (ALS) team to the patient location was 10 minutes (IQR 7–16 minutes). In 47% of all OHCA cases, bystander CPR was performed. Pre-hospital defibrillation ($p = 0.002$), younger age ($p = 0.032$), and shorter duration of CPR ($p < 0.001$) were associated with increased ROSC rates. Younger age ($p = 0.012$), shorter CPR duration ($p < 0.001$), lower blood levels of lactate ($p < 0.001$), higher blood-pH levels ($p < 0.001$), and lower serum levels of the neuron specific enolase (NSE; $p = 0.031$) were associated with in-clinical survival. Based on the results of logistic regression, shorter duration of CPR was the strongest predictor for both, preclinical ROSC ($p < 0.001$) and overall survival ($p = 0.033$). Among blood biomarkers, lower lactate levels were a predictor for survival ($p = 0.012$). None of the patients with CPR during transport have survived.

Conclusion: ROSC is achieved in approximately 24% of OHCA patients in Carinthia. Pre-hospital defibrillation, younger age, and shorter duration of CPR contributed to a primarily positive outcome of OHCA. Also, age, duration of CPR, blood levels of lactate, pH, and NSE levels are predictors for survival. A shorter CPR duration was identified as the strongest predictor for survival.

Tab. 2 Characteristics of patients with ROSC or that were transported with ongoing CPR. *Mann-Whitney-U-Test, Chi-square

	Total (n = 125)	Survivors (n = 32)	Dead (n = 93)	p*
Age [median (IQR); years]	71 (59–81)	64 (56–75)	72 (61–82)	0.012
Female sex [%]	31	25	33	0.388
Arrival time of ALS team [median (IQR); minutes]	9 (7–14)	11 (8–15)	8 (6–12)	0.317
Duration of CPR [median (IQR); minutes]	15 (9–30)	10 (2–11)	23 (10–36)	<0.001
Bystander-CPR [%]	47	53	45	0.415
Transport during CPR [n]	28	0	28	–
Blood lactate levels [median (IQR); mmol/l]	7.4 (4.1–12.5)	3.3 (2.3–5.8)	9.9 (5.9–13.7)	<0.001
Blood pH level [median (IQR)]	7.1 (7.0–7.2)	7.3 (7.1–7.3)	7.1 (7.0–7.2)	<0.001
Blood arterial oxygen level [median (IQR); mmHg]	102 (64–173)	107 (62–185)	97 (65–173)	0.684
Blood arterial carbon dioxide level [median (IQR); mmHg]	55 (44–68)	50 (43–66)	57 (45–69)	0.296
Blood neuron specific enolase level [median (IQR); µg/l]	48 (29–95)	22 (17–60)	54 (33–112)	0.031
ECMO use [n]	4	0	4	–
Induced hypothermia [%]	44	44	44	0.107
Suspected primary cause of OHCA				
Thromboembolic event [%]	29	44	24	
Hypoxia [%]	20	34	15	
Hypo-/Hyperkalemia [%]	2	3	1	
Hypovolemia [%]	0.8	0	1	
Pneumothorax [%]	0.8	0	1	
Intoxication [%]	0.8	0	1	
Malign arrhythmia [%]	6	19	2	
Unknown [%]	51	0	54	

25-6

Gender-related differences in clinical characteristics of patients with hypertrophic cardiomyopathy in Vienna

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Introduction: Female patients with hypertrophic cardiomyopathy (HCM) tend to display a higher rate of heart failure as well as lower survival compared to male patients. Despite this, gender-related differences in the clinical characteristics of HCM patients remain unclear.

Methods: Consecutive HCM patients were prospectively enrolled at the outpatient clinic of the Medical University of Vienna, Austria, a tertiary referral center. The primary objective of this study was to investigate and emphasize gender differences in clinical characteristics including imaging and laboratory parameters.

Results: Between May 2018 and January 2024, a total of 301 HCM patients were included, of which 41.9% were female (n = 125). Female patients were significantly older and more symptomatic than male counterparts (59 years [IQR 47–67] vs. 53 years [IQR 39–61], p = 0.001; New York Heart Association functional class ^{3}III: 28.8% vs. 17.6%, p = 0.002, respectively). No significant differences in body mass index were found (28.4 kg/m2 [IQR 24.9–31.6] vs. 28.4 kg/m2 [IQR 25.9–31.8], p = 0.8). With respect to echocardiographic parameters, although interventricular septal thickness was comparable (19.0 mm [IQR 16.0–22.0] vs. 19.5 mm [IQR 17.0–22.0], p = 0.4) left atrial as well as right atrial volume index were higher in women (30.0 cm3/m2 [IQR 27.0–35.0] vs. 27.0 cm3/m2 [IQR 24.0–30.0], p < 0.001; 27.1 cm3/m2 [IQR 25.4–29.3] vs. 24.7 cm3/m2 [IQR 22.5–28.2], p < 0.001). These findings were further supported by elevated filling pressures in female patients reflected by E/e' ratio (16 [IQR 14–22] vs. 10 [IQR 9–12], p < 0.001). Moreover, these patients showed more frequent left ventricular (LV) outflow tract obstruction (50% vs. 33%, p = 0.029) which is accompanied by a slightly higher LV ejection fraction compared to men (69% [IQR 62–74] vs. 62% [IQR 55–67], p = 0.004). In terms of cardiac biomarkers, female HCM patients presented with higher levels of serum N-terminal pro brain natriuretic peptide (671 pg/ml [IQR 333–1613] vs. 357 pg/ml [IQR 115–959], p < 0,001) as well as lower concentrations of serum creatinine (0.

Conclusion: This single-center analysis illustrates profound gender-related differences among HCM patients in Vienna. Female patients tend to present in a more advanced clinical status, rather reflecting the phenotype of heart failure with preserved ejection fraction. Whether these findings should prompt an early HCM diagnosis in female patients with unspecific symptoms, or may result in early treatment initiation of e. g. sodium-glucose-transporter 2 inhibitors, should be part of future research.

25-7

Monitoring the progression of cardiac stroke volume during incremental exercise testing

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Introduction: Assessing cardiac output ($\dot{Q}$) and the course of the stroke volume SV during incremental exercise (i. e., increase, plateau, or decrease) offers clinically relevant insights for the diagnostic work-up of exertional dyspnea, reduced $\dot{V}O2max$, and allows to monitor the impact of pharmaceutical interventions. However, measuring $\dot{Q}$ and SV usually requires additional and often expensive methods. One option to quantify $\dot{Q}$ easily during routine cardio-pulmonary exercise testing (CPET) might be the Stringer formula (ST, Stringer et al. 1997). Based on the Fick equation, the ST formula considers the arterio-venous oxygen difference as a function of the percentage of maximum oxygen consumption ($\dot{V}O2max$), so that $\dot{Q}\_ST = \dot{V}O2/[5.72 + 0.105 * \%\dot{V}O2max]$. Thus, if heart rate (HR) is known, stroke volume (SV) can be calculated as $SV = \dot{Q}/HR$. However, the validity of Stringer formula to assess the course of SV is currently unclear. To this end, we compared the course of SV during incremental exercise testing obtained with Stringer formula with an established inert gas rebreathing method (RB).

Methods: After previous determination of $\dot{V}O2max$, 16 male participants (181 ± 8 cm, 78.0 ± 6.7 kg, 26 ± 4 years; $\dot{V}O2max$ 55 ± 10 mL/min/kg) completed an incremental exercise test (6 steps, 3 min) ranging 40–90% $\dot{V}O2max$ with CPET and RB (Innocor, Innovision, DK) on a cycle ergometer. At the end of each stage, $\dot{Q}\_RB$ was measured. The data set was analyzed graphically and statistically (regression, Bland-Altman plots, correlation). To assess individual progressions, SV_ST and SV_RB were normalized (nor) to their respective maximum. Positive correlations of SV_norRB and SV_norST were used as indicators of progression agreement (i. e., the SV progression determined with RB was mirrored by the ST based data) and also validated graphically.

Results: Ninety measurements above 40% of $\dot{V}O2max$ resulted in the following regressions: $\dot{Q}\_RB = 5.162 * \dot{V}O2 + 4.414$ (r = 0.84)

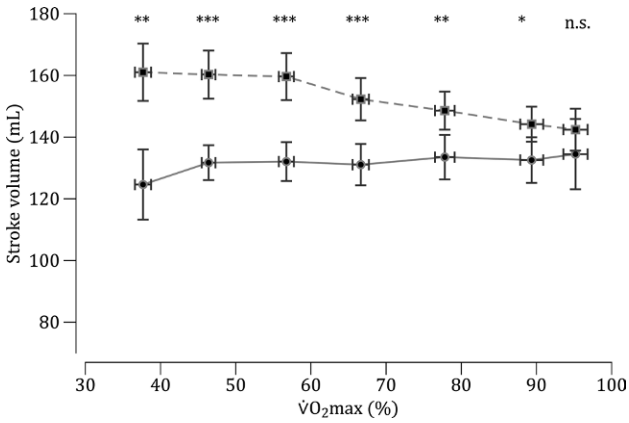

Fig. 1 Cardiac stroke volume obtained in 16 male participants during incremental exercise measured via inert-gas rebreathing technique (straight line) and estimated via Stringer-Formula (broken line). Data are arithmetic mean ± SEM

and Q̇_ST = 4.658*v̇O2 + 8.511 (r = 0.91). The correlation of absolute Q̇_ST vs. Q̇_RB was r = 0.83 and SV_ST vs. SV_RB was r = 0.71, respectively. Correlation of Q̇_norST vs. Q̇_norRB was r = 0.93 but SV_norST vs. SV_norRB was r = 0.21. The mean of the differences for Q̇_RB-ST was −2.6 ± 2.9 L/min and for SV_RB-ST −20 ± 19 mL. In 12 participants, correlations between SV_RB and SV_ST were positive (r ≥ 0.48 ≤ 0.86), indicating an agreement of the progression of SV_ST and SV_RB. Four correlation coefficients were negative. Graphical analysis confirmed the interpretation of the correlation coefficients.

Conclusion: Despite the strong correlation of Q̇_RB vs. Q̇_ST during incremental exercise, the progression of SV_RB was not validly determined when using the Stringer equation in 25% of the participants. Hence, the Stringer equation does not appear to be appropriate for this purpose.

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POSTERSITZUNG 26 – HERZINSUFFIZIENZ 3

26-1

Determinants of left ventricular outflow tract obstruction in patients with hypertrophic cardiomyopathy – a multicenter study

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Introduction: In patients with hypertrophic cardiomyopathy (HCM) and left ventricular outflow tract obstruction (LVOTO), the availability of different treatment options with distinct mechanistic targets warrants a precise understanding of mechanisms underlying LVOTO. In this multicenter study, we aimed to assess the association between genetic, clinical, and echocardiographic parameters associated with the presence of LVOTO.

Methods: We performed a cross-sectional analysis including 100 patients with HCM from three different HCM expert centers. Inclusion criteria were availability of a genetic testing result and clinical and echocardiographic data. Clinical characteristics were assessed via medical chart review, family history was raised by individual phone calls, and echocardiographic parameters were assessed via post-processing analysis performed by a blinded investigator. Obstructive HCM (oHCM) was defined by a resting LVOT gradient ≥ 30 mmHg.

	Overall (n=100)	oHCM (n=32)	nHCM (n=68)	P-Values*
Genotype-positive – n (%)	**44 (44)**	**9 (28)**	**35 (52)**	**0.033**
Age at diagnosis – yrs.	**52 ± 16**	**59 ± 16**	**49 ± 15**	**0.005**
Females – n (%)	42 (42)	13 (41)	29 (43)	1.000
BMI	26 [23-30]	26 [23-29]	26 [23-30]	0.723
Arterial hypertension – n (%)	70 (70)	25 (78)	45 (66)	0.252
Diabetes mellitus – n (%)	8 (8)	1 (3)	7 (10)	0.273
Atrial fibrillation – n (%)	26 (26)	6 (19)	20 (29)	0.332
NYHA Class – n (%)				
I	37 (37)	8 (25)	29 (43)	0.214
II	37 (37)	15 (47)	22 (33)	
II-III	13 (13)	6 (19)	7 (10)	
III	12 (12)	3 (9)	9 (13)	
Angina pectoris – n (%)	31 (31)	11 (34)	20 (30)	0.817
Syncope – n (%)	18 (18)	5 (16)	13 (19)	0.784
Coronary artery disease – n (%)	16 (16)	5 (16)	11 (16)	1.000
NT-proBNP – pg/ml	605 [214-1715]	697 [376-1620]	571 [181-2007]	0.486
Troponin T – pg/ml	12 [8-19]	12 [9-18]	13 [7-23]	0.970
eGFR - ml/min/1,73m²	83 ± 22	81 ± 16	84 ± 25	0.573
Septal morphology				
Sigmoid	**32 (32)**	**20 (63)**	**12 (18)**	**<0.001**
Reversed curvature	39 (39)	8 (25)	31 (46)	0.078
Neutral	**27 (27)**	**4 (13)**	**23 (34)**	**0.030**
Apical	2 (2)	0 (0)	2 (3)	0.560
LVEF - %	**59 [54-65]**	**61 [58-66]**	**57 [53-63]**	**0.008**
MWTH – mm	20.4 [18.1-22.8]	20.8 [19.1-23.0]	19.5 [17.6-22.8]	0.168
PWTH – mm	**11.5 [10.1-12.7]**	**11.9 [10.8-13.4]**	**11.0 [9.5-12.5]**	**0.038**
MWTH:PWTH	1.8 [1.6-2.0]	1.8 [1.7-1.9]	1.8 [1.6-2.1]	0.726
LV GLS	-19.0 [-20.8–-16.1]	-19.4 [-21.3–-16.5]	-18.4 [-20.6–-15.6]	0.263

Continours variables are counted as median [25th-75th percentile] or mean ± standard deviation, and count data as absolute frequencies (column%).
* Student´s t-test, Chi square test or Mann-Whitney-U test, as appropriate.

Abbreviations: BMI=body mass index; eGFR=estimated glomerular filtration rate; LVEF=left ventricular ejection fraction; LV GLS=left ventricular global longitudinal strain; MWTH=maximal wall thickness; nHCM=non obstructive hypertrophic cardiomyopathy; NT-proBNP=N-terminal pro-B-type natriuretic peptide; NYHA=New York Heat Association; oHCM=obstructive hypertrophic cardiomyopathy; PWTH=posterior wall thickness.

Fig. 1 Clinical and echocardiographic characteristics: Overall and stratified by left ventricular outflow tract obstruction

Results: The overall HCM cohort included 100 patients with a mean age at diagnosis of 52 ± 16 years, 42% were female, and median N-terminal pro-brain natriuretic peptide (NT-proBNP) was 605 [25-75th percentile: 214–1715] pg/ml. At the time of genetic testing, 32 patients (32%) presented with oHCM. When comparing patients with oHCM and non-obstructive HCM (nHCM), patients with oHCM had lower detection rates of disease-causing genetic variants (28 vs. 52%, p = 0.033). Clinical characteristics of oHCM and nHCM patients were overall comparable merely showing a higher age at diagnosis in oHCM patients (59 vs. 49 years, p = 0.005). In echocardiography, patients with oHCM showed higher values of left ventricular ejection fraction (LVEF) (61 vs. 57%, p = 0.008), higher posterior wall thickness (11.9 vs. 11.0 mm, p = 0.038), and more patients had a sigmoid shaped septum (63 vs. 18%, p < 0.001). Sigmoid septal shape was more common among patients without disease-causing genetic variant (45 vs. 16%, p = 0.003). Merely neutral septal shape was more prevalent in nHCM (34 vs. 13%, p = 0.030). In multivariate logistic regression analysis, LVEF (p = 0.045) and a sigmoid shaped septum (p = 0.008) remained significantly associated with LVOTO.

Conclusion: Our study indicates that both, high LVEF and sigmoid septal shape independently contribute to the presence of LVOTO. The higher prevalence of LVOTO among patients without disease-causing variant may be caused by the more common sigmoid shaped septum in those patients. Whether patients with nHCM and sigmoid septal shape are at risk of developing an LVOTO in later stages of disease, should be investigated in longitudinal studies.

26-2

Influence of cold temperature on the subsequent frequency of heart failure decompensations in an emergency department

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Introduction: Cold temperature increases venous pressure and reduces physical capacity in patients with heart failure (HF). Previous studies have described conflicting results regarding the effect of cold temperatures on subsequent risk of HF decompensations. The aim of this study was to evaluate the influence of cold temperatures on the subsequent frequency of HF decompensations in an emergency department (ED) located in a European landlocked country.

Methods: A systematic retrospective medical chart review of all patients presenting to the internal ED of a tertiary care center within one year was performed. Records of all patients (n = 32.028) were individually assessed for signs and symptoms of decompensated HF specified as presence of exertional or resting dyspnea, peripheral edema, pleural effusion, pulmonary congestion, pulmonary rales, and ascites. Echocardiography-derived left ventricular ejection fraction (LVEF) was collected from all decompensated HF visits. Meteorological data were obtained from the National Institute for Meteorology and Geodynamics. Maximal daily temperatures were grouped in deciles and group medians were correlated to the respective HF counts of the following day using a linear regression model.

Results: Between August 2018 and July 2019, 1.248 patient visits for HF decompensation with a median age of 80 [25-75th percentile: 74–87] years were counted. Among those patients, 50% were female, median N-terminal pro-brain natriuretic peptide (NT-proBNP) was 4080 [1741–9410] pg/ml, median estimated glomerular filtration rate (eGFR) 48 [31–62] ml/min/1.73 m2 and median C-reactive peptide (CRP) 13 [5–41] mg/l. Among 866 patients (69%) with available echocardiography, 43% had HF with preserved ejection fraction (HFpEF), 19% HF with mildly reduced ejection fraction (HFmrEF), and 38% HF with reduced ejection fraction (HFrEF). Overall, temperature was inversely associated with the frequency of subsequent HF decompensations (r = –0.96; p < 0.001) as seen in the Figure. This association remained significant in both patients with HFpEF

As an example, days in the highest temperature decile (30.3 - 37.2 °C) were on average followed by a mean of 2.6 HF decompensations on the subsequent day, compared to a mean of 4.6 HF decompensations following days in the lowest temperature decile. The HF total cohort consists of 1.248 patients, while only patients with echocardiography (n=866) are stratified into HF subgroups.

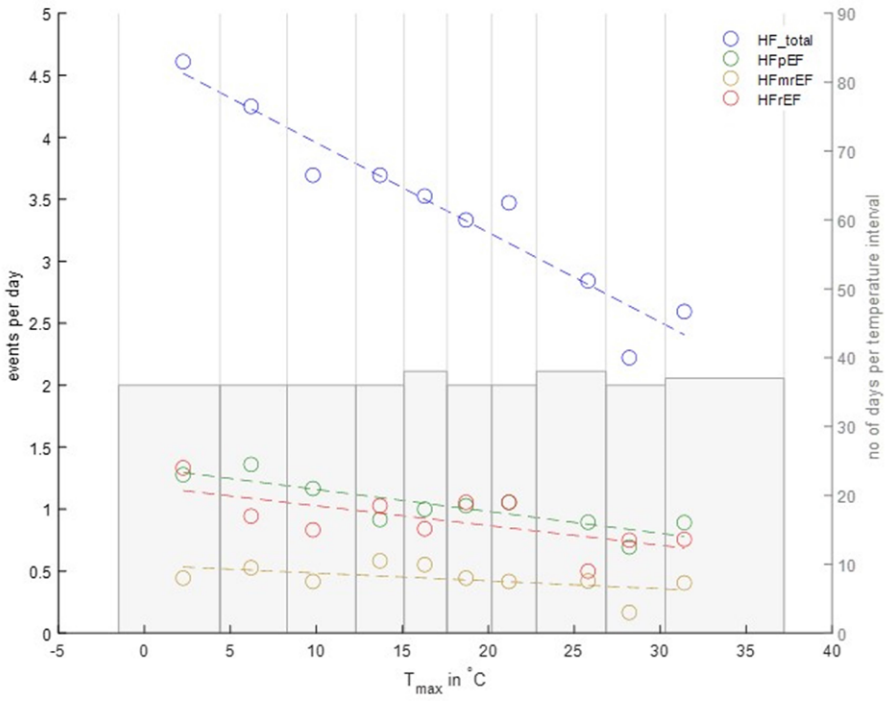

Fig. 1 Linear regression model of subsequent HF decompensations in dependence of temperature

Abbreviations: *ED=emergency department; HF=heart failure; HFmrEF=heart failure with mildly reduced ejection fraction; HFpEF=heart failure with preserved ejection fraction; HFrEF=heart failure with reduced ejection fraction, T_{max}=maximum temperature.*

(r = −0.86; p = 0.0016), as well as HFrEF (r = −0.67; p = 0.0336), but not in patients with HFmrEF (r = −0.53, p = 0.118).

Conclusion: Our study indicates that low temperature is associated with an increase in subsequent HF decompensations both in HFpEF and HFrEF. Patients and their treating physicians should be aware of a potentially higher risk of HF decompensations after cold days. Patients with HF should be educated to adhere to measures of caution particularly on cold days.

26-3

The Austrian Hypertrophic Cardiomyopathy Registry – A prospective, multicenter Registry

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Introduction: Hypertrophic Cardiomyopathy (HCM) is the most common inherited cardiomyopathy affecting up to 0.6% in the general population. However, in less than half of all HCM patients a monogenic variant in a sarcomeric protein gene can be detected leaving a diverse and under-investigated aetiology in the remaining patients. Moreover, HCM-specific algorithms to predict adverse events such as cavitary obstruction, heart failure, and atrial fibrillation, on top of sudden cardiac death (SCD) risk calculators, are not established yet. A large database comprising representative characteristics of a well geno- and phenotyped HCM cohort is warranted to perform cross-sectional and longitudinal analyses. We present the design and methods of the prospective, multicenter Austrian HCM Registry.

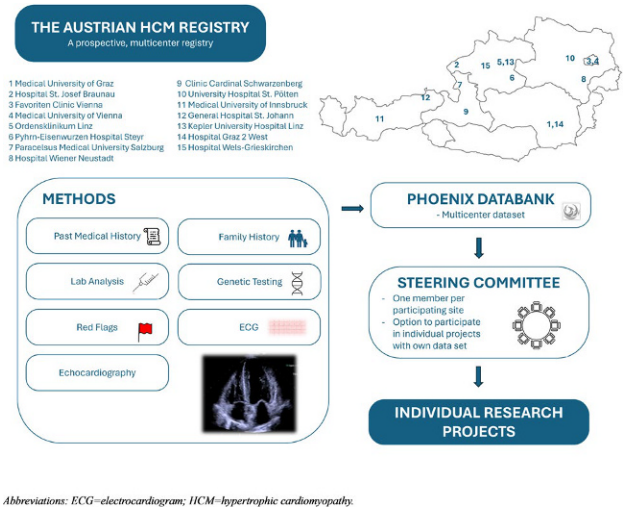

Fig. 1 Design and Methods of the Austrian HCM Registry

Methods: The Austrian HCM Registry is a prospective, multicenter registry enrolling patients at multiple outpatient clinics across Austria including academic and non-academic sites (Figure). Inclusion criteria are defined as increased left ventricular wall thickness not solely explained by abnormal loading conditions and willingness to provide informed consent. Patients with known cardiac amyloidosis are excluded in this registry. The protocol has been approved by the lead ethics committee. Patients will undergo a structured examination process including assessment for symptoms of HCM, past medical history, concomitant medication, family history and the presence of HCM-specific red flags. Furthermore, clinical data derived from electrocardiogram, echocardiography, laboratory analysis, and genetic testing will be collected focusing on a lean variable dictionary and, in addition, specific hypothesis-driven research parameters. All data are entered into an electronic case report form (eCRF) (Phoenix Clinical Trial Management System). Every site will nominate one representative for the steering committee which serves as the regulatory authority with the compentence to approve research proposals. In order to perform multicenter analyses, data can be extracted from the eCRF after approval by the steering committee. Regarding research projects, consent of participation in the specific project will be the decision of each site and lead authorships will be defined on individual project basis.

Results: First milestones including the completion of CRF and eCRF, approval by the lead ethics committee and conclusion of agreements with participating sites have been achieved. The official launch of the registry was in March 2024 with enrolment of the first patient. The target enrolment rate is set at one patient per participating site per month. Harmonization with other national registries, for instance the Dutch HCM Registry, is planned timely. The Austrian HCM-Registry currently comprises 15 different sites across Austria and is still open for further extension.

Conclusion: The Austrian multicenter HCM Registry is a prospective, multicenter registry including patients with HCM across Austria. Multicenter studies will facilitate a wide range of innovative cross-sectional and longitudinal epidemiological analyses unravelling gaps in evidence in HCM. The standardized clinical assessment might harmonize standards of clinical care in HCM patients in Austria. Our registry will foster the Heart Failure Network in Austria integrating both academic and non-academic sites and has the ability to enhance its international visibility.

26-4

Prognostic value of circulating glypican-4 in patients with chronic heart failure with reduced ejection fraction

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Introduction: Chronic heart failure is one of the leading causes of hospitalization and mortality worldwide, with an ever-increasing prevalence. Glypican-4 (GPC4) is a cell surface protein part of the endothelial glycocalyx which is actively released into the circulation in the context of ischemia, inflammation, neurohumoral activity, and shear stress. The current literature on the association between circulating GPC4 and heart failure is limited and its prognostic value on top of established risk markers in chronic heart failure is unknown. In the present study, we aim to investigate the prognostic value of circulating GPC4 on clinical outcomes in a contemporary cohort of patients with stable chronic heart failure with reduced ejection fraction (HFrEF).

Methods: Symptomatic outpatients with stable chronic HFrEF were consecutively enrolled in a prospective cohort study. Circulating serum GPC4 levels were assessed using an enzyme-linked immunosorbent at baseline. Patient outcomes were retrieved from medical and health insurance records.

Results: We enrolled 205 patients with a median (IQR) age of 66 (59–74) years, with 22% females. Median left ventricular ejection fraction (LVEF) was 37 (30–43)%, median estimated glomerular filtration rate (eGFR) was 64 (48–80) ml/min/1,73 m2, median N-terminal pro-brain natriuretic peptide (NT-proBNP) was 964 (336–2173) pg/ml, median interleukin 6 (IL6) was 4.7 (3.2–7.9) pg/ml, and median GPC4 was 1553 (1034–1950) pg/ml. During a median follow-up of 4.7 (4.0–5.3) years, 46 patients (22%) were hospitalized due to worsening heart failure (WHF), 18 patients (9%) died of cardiovascular (CV) cause, and 58 patients (28%) died of any cause. In univariate Cox-regression, serum GPC4 levels predicted WHF (HR 1.57, 95%CI 1.29–1.92, $p < 0.001$), CV death (HR 2.07, 95%CI 1.56–2.74, $p < 0.001$), and all-cause mortality (HR 1.93, 95%CI 1.59–2.34, $p < 0.001$). The association between serum GPC4 levels and both, CV death (HR 1.69, 95%CI 1.04–2.86, $p = 0.048$) and all-cause mortality (HR 1.56, 95%CI 1.14–2.14, $p = 0.006$) remained significant in a multivariable Cox-regression model adjusted for age, sex, eGFR, IL6, NT-proBNP, and LVEF.

Conclusion: In patients with stable chronic HFrEF, circulating GPC4 is significantly associated with cardiovascular outcome and is an independent predictor of all-cause mortality. The potential prognostic value in clinical routine of GPC4 should be addressed in prospective studies.

26-5

Clinical and prognostic significance of 99mTc-DPD uptake regression in transthyretin amyloid cardiomyopathy after tafamidis treatment

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Introduction: The clinical and prognostic relevance of repetitive 99mTc-DPD scintigraphy in wild-type transthyretin amyloid cardiomyopathy (ATTRwt-CM) remains unclear. We investigated the impact of tafamidis on cardiac 99mTc-DPD uptake, clinical and laboratory markers at 6 and 12 months and correlated 12-month 99mTc-DPD uptake regression with long-term survival.

Methods: This single-center study enrolled 39 ATTRwt-CM patients with baseline 99mTc-DPD scintigraphy (planar, SPECT/CT), and clinical and laboratory assessments. Upon treatment initiation with tafamidis 61 mg once daily, patients were followed up at 6- ($n = 26$) or 12 ($n = 33$) months, or both ($n = 20$). Follow-ups included repetitive 99mTc-DPD scintigraphy, and clinical and laboratory evaluations.

Results: Tafamidis therapy resulted in a significant decline in Perugini score (6 months $p = 0.008$, 12 months $p < 0.001$), accompanied by marked (semi-)quantitative 99mTc-DPD uptake regression (total cardiac uptake: baseline 816 [522–933] cps vs. 6 months 634 [502–734] cps, $p = 0.003$, vs. 12 months 523 [108–754] cps, $p = 0.001$). Parallel, improvements in clinical sta-

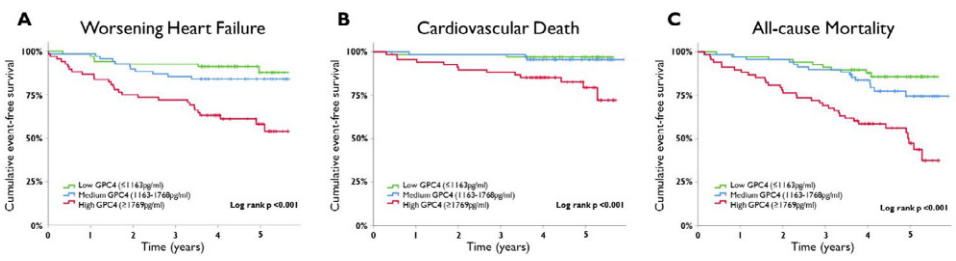

Fig. 1 Cumulative incidences of (A) worsening heart failure hospitalization. (B) cardiovascular death, and (C) all-cause mortality accroding to tertiles of circulating glypican-4 (GPC4) levels

tus (NYHA: 6 months p = 0.007, 12 months p = 0.033) and reductions in cardiac biomarkers (NT-proBNP: 6 months p = 0.016, 12 months p = 0.012) were observed. A longitudinal decrease in right ventricular 99mTc-DPD tracer uptake equal to or greater than the median value at 12 month (–30.1%) indicated significantly better long-term survival (HR = 0.11, 95% CI 0.014-0.914, p = 0.041).

Conclusion: Tafamidis treatment in ATTRwt-CM patients resulted in substantial regression of cardiac 99mTc-DPD uptake (planar, SPECT/CT) at 6 and 12 months, accompanied by clinical improvements and reduced cardiac biomarkers. Furthermore, a significant correlation was observed between regression of right ventricular 99mTc-DPD uptake at 12 months and long-term survival.

26-6

Non-Classifiable HFA patient profiles in HFrEF

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Introduction: An HFA position paper (1) proposed phenotypes based on conceivable individual tolerabilities, in order to aid prescription manners. These phenotypes, however, might lack practical applicability due to a substantial number of non-classifiable patients. This study aims to explore the prevalence, characteristics and outcomes of this non-classifiable group in a real-world setting.

Methods: 900 HFrEF patients from the outpatient HF unit were categorized into the HFA phenotypes at first presentation according to heart rate (HR), blood pressure (BP), the presence of chronic kidney disease (CKD), the presence of hyperkalaemia (HK) and the presence of atrial fibrillation (AF). Using the categories from the original work results in a total of 108 different possible combinations, while only 11 profiles are described. Patients not conforming to the 11 HFA profiles, were investigated further for distribution of profiles, clinical characteristics and prognosis.

Results: With 72% the majority of HFrEF patients could not be classified into the HFA phenotypes. Fig. 1 displays the distribution of non-classifiable patients into other profiles and survival based on the primary clinical trait. Of these, 75% (n = 418) of patients were sorted into 13 larger profiles while the remaining 25% (n = 142) spread across numerous other profiles each representing less than 2% of patients. The largest profile includes patients with normal clinical features according to the HFA classification (14.5%, n = 81), followed by patients with a CKD with an eGFR<60 ml/min/1.73 m2 and a HR of > 70 bpm (12.9%, n = 72), patients with a HR of > 70 bpm and a systolic BP>140 mmHG (9.8%, n = 55) and patients with a HR>70 bpm, a CKD with an eGFR<60 ml/min/1.73 m2 and AF (8.2%, n = 46), as main clinical traits. Patient groups showed varied overall survival (p < 0.0001 across all). Patients with normal clinical values showed best survival with a 5-year estimate of 86.5% (p < 0.0001 compared to all other groups), while those with high BP as main clinical trait showed comparable survival rates to these patients (p = 0.589). Conversely, patients with severe renal dysfunction (eGFR < 30 ml/min/1.73 m2 or HK) or AF exhibited worst survival with a 5-year estimate of 38.6% and 34.7%, respectively (p = 0.0003 and p < 0.0001 compared to all others).

Conclusion: Most patients in a real-world setting do not fit into the 11 HFA profiles. This non-classifiable patient group presents with heterogenous clinical profiles and prognosis, including very low- and very high-risk patients. This group is worth further discrimination when it comes to optimization of HF medication and identifying high-risk patients.

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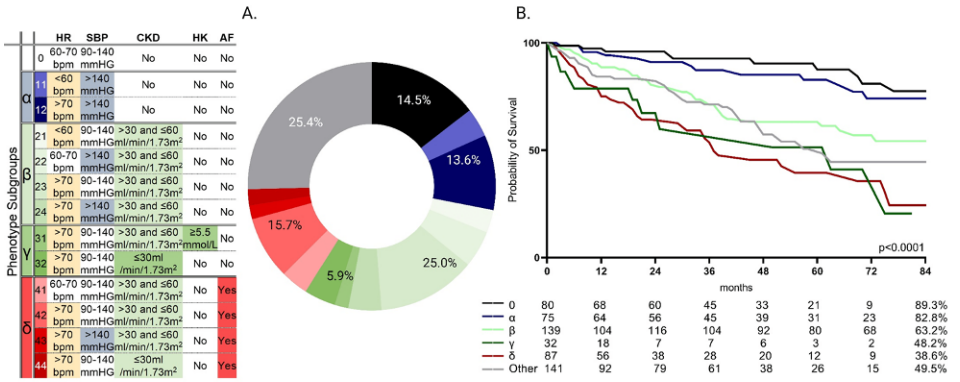
75% of non-classifiable patients could be sorted into 13 large clinical profiles, the characteristics of these profiles are shown in the left panel. The large clinical profiles were pooled according to their main clinical trait and termed group alpha, beta, gamma and delta with isolated high SBP (n=77), moderate CKD (n=140), significant CKD (n=33) and atrial fibrillation (n=88) as the main traits. The other profiles with a total of 142 (25%) of patients consisted of less than 2% of non-classifiable patients each and were summarized under "other". A. The distribution of the HFA profiles of non-classifiable patients are shown as a donut chart. B. The association of the complementary HFA profiles with all-cause mortality is shown as Kaplan-Meier plots, the difference between groups was assessed by the log-rank test. The p value is indicated in the plot.



HR – heart rate; SBP – systolic blood pressure; CKD – chronic kidney disease; HK – Hyperkalemia; AF – atrial fibrillation - HR (low: <60; normal: 60-70 and high: >70bpm), BP (low: <90; normal: 90-140 and high: >140mmHg), the presence of CKD (reduced eGFR with <30ml/min/1.73m2 or 30-60ml/min/1.73m2 and or normal eGFR with >60ml/min/1.73m2), the presence of HK (HK: ≥5.5 and no HK: <5.5mmol/l) and the presence of AF (yes/no).Other: comprised from multiple combinations of phenotype characteristics where no statement can be made, all with less than 10 patients

Fig. 1 Non-classifiable patients according to the HFA clinical profiles. Distribution of profiles, characteristics and survival

26-7

Left atrial reservoir strain differentiates cardiac amyloidosis and hypertrophic cardiomyopathy

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Introduction: Availability of mortality-reducing therapies for cardiac amyloidosis (CA) has led to an increase in referral rates to tertiary care centers. Investigations to improve diagnosis rates are urgently needed, as diagnosis of CA requires a multimodal approach and its early diagnosis is crucial due to high mortality in untreated patients. The aim of this study is to evaluate the accuracy of the left atrial reservoir strain (LASr) in differentiating CA patients from patients with hypertrophic cardiomyopathy (HCM).

Methods: This is a cross-sectional analysis from the Graz HCM Registry, a prospective single-center cohort study enrolling consecutive patients with a HCM phenotype. This analysis included HCM and CA patients with valid standardized transthoracic echocardiographic examinations. Blinded investigators performed post-processing echocardiographic analyses in 100 HCM and 95 CA patients.

Results: Compared to HCM patients, CA patients were more frequently male [79 (83%) vs. 54 (54%); $p < 0.001$] and older [78 (73–81) vs. 58 (47–70) years; $p < 0.001$]. Moreover, CA patients had a lower BMI [25.0 (22.8–26.9) vs. 26.5 (24.3–29.7) kg/m^2; $p = 0.002$] as well as lower systolic [134 ± 20 vs. 142 ± 25 mmHg; $p = 0.018$] and diastolic blood pressure [78 ± 12 vs. 84 ± 12 mmHg; $p < 0.001$]. Additionally, CA patients had higher NT-proBNP [2533.0 (1146.0–5016.0) vs. 543.0 (195.0–1381.0) pg/ml; $p < 0.001$] and lower eGFR [58.4 ± 19.1 vs. 80.1 ± 22.2 ml/min/1.73 m^2; $p < 0.001$]. LASr was significantly worse in CA patients compared to HCM patients [9.2 (5.6–13.0) vs. 21.7 (14.8–27.6) %; $p < 0.001$]. Multivariable logistic regression analysis revealed LASr as an independent predictor of CA [OR = 0.936 (95% CI 0.877–0.998)], adjusting for covariates. ROC analysis showed an AUC of 0.80 (95% CI 0.73-0.86) for LASr to discriminate CA from HCM. LASr ≤ 14.3% demonstrated a 80% sensitivity and 79% specificity for the identification of CA patients. Sensitivity analyses involving 74 sex- and age-matched patients yielded materially unchanged results.

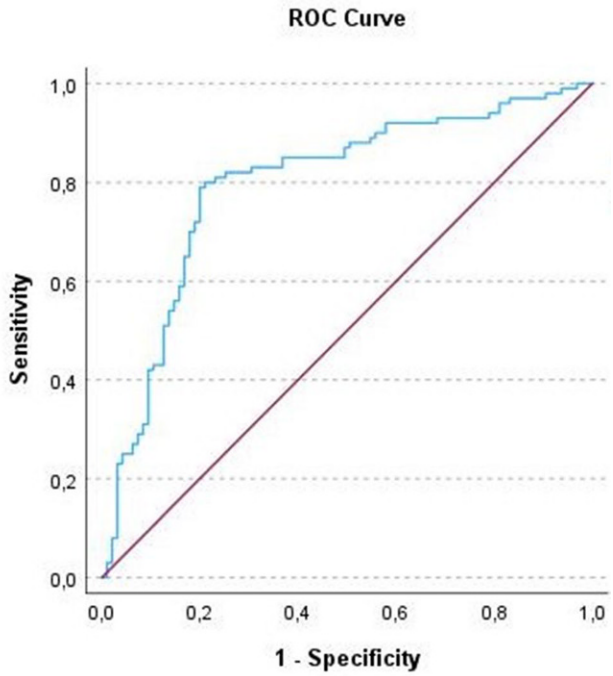

Fig. 1 Receiver-operating characteristic (ROC) curve analysis depicting the diagnostic accuracy of left atrial reservoir strain in differentiating cardiac amyloidosis patients from patients with hypertrophic cardiomyopathy

Conclusion: Compared to HCM patients, LASr was diminished in CA patients and an independent predictor of CA. Moreover, LASr showed high diagnostic accuracy in differentiating CA and HCM patients. Prospective studies are needed to evaluate the added value of left atrial strain in the diagnostic work-up of CA patients.

26-8

Harmonizing Heartbeats: The Mosaic of Cardiac Resynchronization Therapy Responders – A Comprehensive Exploration of Diverse Criteria and Predictors

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Introduction: Heart failure (HF) poses a significant challenge in modern healthcare, necessitating innovative therapeutic strategies. Cardiac resynchronization therapy with defibrillator (CRT-D) has emerged as a pivotal intervention, raising the question of how to define a responder to CRT-D. While the benefits are acknowledged, the criteria for a positive response remain complex and multifaceted, incorporating objective cardiac function metrics, subjective clinical outcomes, advanced imaging modalities, and biomarkers.

Methods: A retrospective single-center study involving 132 consecutive patients receiving CRT-D from 2011 to 2021 scrutinized responder criteria, including NYHA stage, LVEF increase, and proBNP decrease. Statistical analyses, such as Kaplan–Meier curves, Cox hazard regression and logistic regression, were employed to evaluate responder characteristics and survival outcomes.

Results: Responder rates varied across criteria, revealing nuanced patient profiles. CRT-D responders, defined by NYHA decrease, LVEF increase, or proBNP decrease, exhibit improved survival rates after 2 and 3 years ($p < 0.050$). Young age, absence of recent myocardial infarction, and normal right ventricular, echocardiographic parameters emerge as predictors for positive response. In part, drug-based HF therapy correlates with increased responder rates. Cox regression identified LVEF ≥ 5% and proBNP decrease ≥ 25% as independent predictors of extended survival.

Conclusion: This study underscores the lack of a standardized definition for CRT-D responders and the diverse parameters needed for accurate predictions. Right ventricular func-

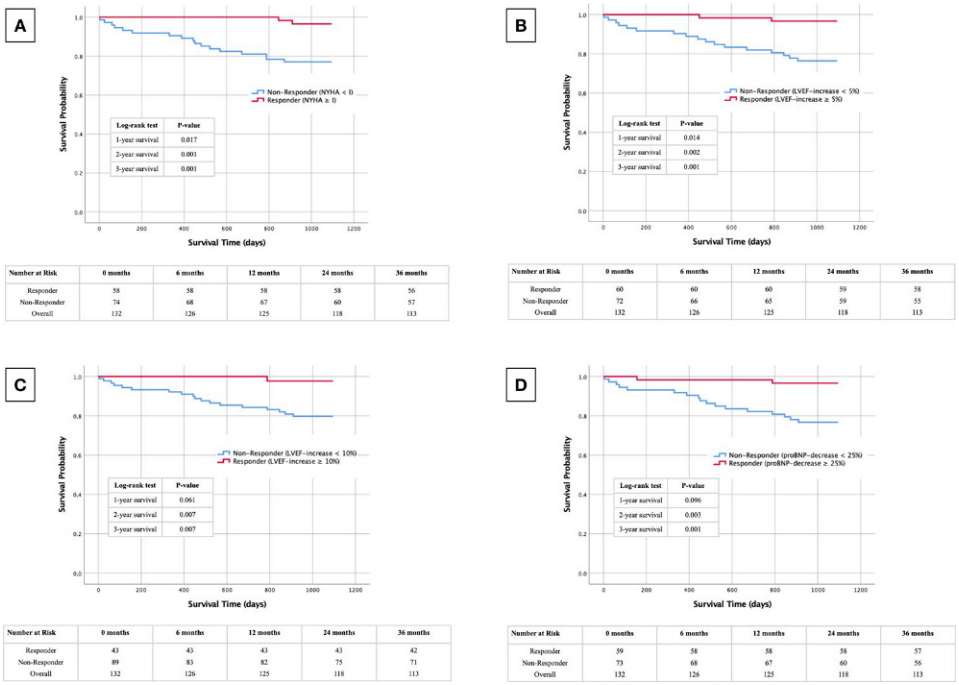

Fig. 1 Kaplan-Meier curves with corresponding numbers at risk and annually log-rank tests for detection of 1- to 3-year survival in CRT-D responders vs. CRT-D non-responders; A: Responder criterion NYHA-improvement ≥ I, B: Responder criterion LVEF-increase ≥5%, C: Responder criterion LVEF-increase ≥10%, D: Responder criterion proBNP-decrease ≥25%

tion, drug-based heart failure therapy, atrial fibrillation, and kidney function emerged as critical factors influencing CRT-D response. The study advocates for a comprehensive evaluation of both ventricles, emphasizes the synergy between pharmacological and device-based therapies, and highlights the challenges posed by atrial fibrillation. Additionally, the inverse correlation between renal function and CRT-D response suggests potential avenues for optimization. The findings call for future research into advanced renal biomarkers, fluid status impact, and interventions targeting renal optimization to refine CRT-D strategies. This study contributes to unraveling the complex tapestry of CRT-D responders, offering insights for personalized HF management and paving the way for evidence-based practices.

POSTERSITZUNG 27 – RISIKOFAKTOREN/ STOFFWECHSEL/LIPIDE 2

27-1

Prognostic Role of Type 2 Diabetes Mellitus in Minor Versus Major Atherosclerosis

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Introduction: The impact of diabetes on major cardiovascular events (MACE) in relation to the extent of pre-existing atherosclerotic disease remains unclear. In this study we compare the impact of T2 DM on MACE in patients with two different states of atherosclerosis: minor coronary atherosclerosis (minAS) and peripheral artery disease, one of the most severe manifestations of major atherosclerosis (majAS).

Methods: We included 1238 patients from two long-term prospective cohort studies. Patients underwent coronary angiography for the allocation to a control group without any lumen irregularities (n = 332) or a minAS group with lumen irregularities but no significant coronary stenoses ≥ 50% at coronary angiography (n = 425). Patients with sonographically proven peripheral artery disease were allocated to the majAS group (n = 481). Over a mean time-period of 7.7 years major cardiovascular events (MACE) were recorded.

Results: Overall, MACE were recorded in 681 (51%) patients. T2 DM significantly increased the risk of MACE both among patients with minAS (22.0% vs. 32.4%; p = 0.023) and majAS (50.6% vs. 67.1%; p < 0.001) but not in the control group (12.0% vs. 12.1%; p = 0.663). In majAS – patients who did not have T2 DM, the risk of MACE was higher than that of T2 DM patients with minAS (p < 0.001). Both T2 DM (adjusted HR = 1.78 [1.45–2.17], p < 0.001) and severity of atherosclerosis (adjusted HR = 2.59 [2.18–3.10], p < 0.001) predicted MACE in a mutually independent manner. An interaction term severity of atherosclerosis x T2 DM was not significant (p = 0.364), indicating that the severity of pre-existing atherosclerosis did not impact the power of T2 DM as a predictor of MACE.

Conclusion: We conclude that T2 DM confers an increased risk for MACE both in early and in advanced atherosclerotic states. The severity of pre-existing atherosclerosis does not impact the power of T2 DM as a predictor of MACE.

27-2

Association Between Abdominal Circumference and Diastolic Dysfunction in Type 1 Diabetes

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Introduction: and Aims: Even with controlled glucose controls, individuals with type 1 diabetes (T1D) face an increased risk of cardiovascular disease. This study aimed to explore the prevalence of diastolic dysfunction and the relationship of abdominal circumference as a marker of insulin resistance with echocardiographic parameters in T1D patient.

Methods: In this prospective study T1 DM patients underwent cardiac function assessment with echocardiography and body composition analysis through bio-electrical impedance.

Results: 58 T1 DM patients were included (57% female, mean age was 45 yrs, mean diabetes duration 26 yrs, mean BMI 27 kg/m2). Diastolic dysfunction was present in 29% of participants. Patients with diastolic dysfunction were significantly older (54.3 vs 42.5 years, P = 0.020), had a larger abdominal circumference (103 vs 90 cm, P = 0.005) and tended to have higher BMI (30.6 vs 26.0; P = 0.066), fat mass percentages (35.6% vs 29.8%; P = 0.091), and extracellular water volumes (20.7 L vs 18.8 L; P = 0.066) than those without. The duration of diabetes did not significantly differ between patients with and without diastolic dysfunction (28.1 vs 25.8 years; P = 0.58).

Conclusion: In patients with T1D, the prevalence of diastolic dysfunction was more strongly associated with metabolic changes indicating insulin resistance, than to the length of time with diabetes. Abdominal circumference could serve as a potential indicator of cardiovascular risk in patients with T1 DM.

27-3

Cardiovascular events in patients treated with bempedoic acid vs. placebo: systematic review and meta-analysis

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Introduction: Reduction of low-density lipoprotein cholesterol (LDL-C) decreases cardiovascular mortality and morbidity. Bempedoic acid represents a promising novel lipid-modifying agent for patients who cannot reach guideline recommended LDL-C goals or statin-intolerant patients, but data on safety and cardiovascular outcomes are limited. We therefore aimed to systematically review randomized controlled trials investigating bempedoic acid vs. placebo in patients with hyperlipidaemia.

Methods: A systematic search on the databases PubMed, Web of Science, and Embase until 20 March 2023 was performed. All randomized trials comparing bempedoic acid (180 mg daily) with placebo in patients with an indication for lipid-lowering therapy were included. As a primary endpoint, we analysed three-point major adverse cardiovascular events (MACEs) consisting of cardiovascular death, non-fatal myocardial infarction (MI), or non-fatal stroke. The analysis was carried out using the odds ratio (OR) as the outcome measure. Due

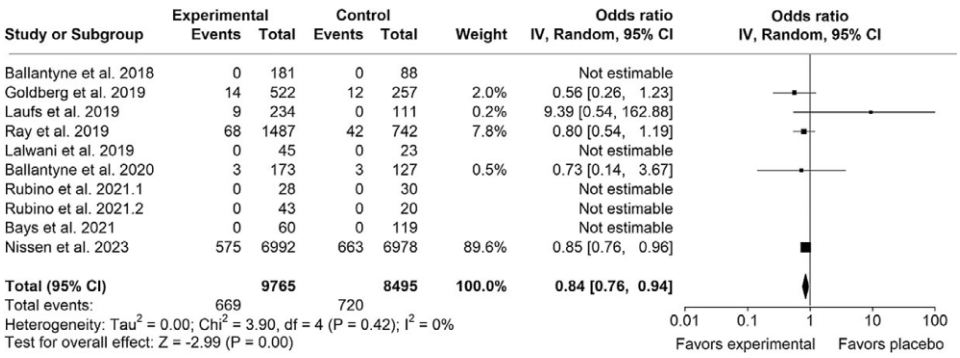

Fig. 1 Forest plot for three-point MACEs including cardiovascular death, non-fatal MI, and non-fatal stroke

to the expected heterogeneity across studies, a random-effects model was fitted to the data.

Results: Out of 258 manuscripts, 10 manuscripts fulfilled the inclusion criteria. In total, these trials included 18 200 patients (9765 on bempedoic acid, 8435 on placebo). Bempedoic acid significantly reduced MACEs compared with placebo (OR 0.84 [95% confidence interval (CI) 0.76-0.96]; P < 0.001; I2 = 0%). The endpoint reduction was driven by a lower rate of non-fatal MI, whereas bempedoic acid had no significant effect on stroke (OR 0.86 [95% CI 0.69–1.08]; P = 0.20, I2 = 0%) and all-cause mortality (OR 1.19 [95% CI 0.73–1.93]; P = 0.49; I2 = 18%).

Conclusion: Bempedoic acid reduced non-fatal MI in patients with hyperlipidaemia, whereas it had no significant effect on stroke and all-cause mortality.

27-4

Risikofaktor Übergewicht – Therapielandschaft für von Übergewicht und Adipositas betroffene Menschen in Österreich

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Einleitung: Schon seit Jahrzehnten stellen Herz-Kreislauf-Erkrankungen die in Österreich häufigste Todesursache dar. Das kardiovaskuläre Risiko wird unter anderem durch zu hohes Körpergewicht signifikant erhöht und steigt dabei mit dem Ausmaß des Übergewichts. Die gesundheitlichen sowie gesellschaftlichen Auswirkungen und die bereits hohen, aber dennoch weiter steigenden Prävalenzzahlen machen Übergewicht und Adipositas zu einem großen Problem unserer Zeit. Bundesweit gut ausgebaute Versorgungsstrukturen mit effizienten Präventionsangeboten und Therapiemöglichkeiten sind daher essenziell. Der vorsorgemedizinische Verein SIPCAN (Special Institute for Preventive Cardiology And Nutrition) analysiert aus diesem Grund in regelmäßigen Abständen die Therapielandschaft in Österreich und bietet von Übergewicht und Adipositas betroffenen Menschen mit dem Adipositas Hilfe-Kompass seit Herbst 2023 ein dynamisches und stetig wachsendes Online-Tool mit möglichen Anlaufstellen.

Methoden: Um die aktuelle Situation sowie Veränderungen und Entwicklungen hinsichtlich vorhandener Therapie- und Präventionsangebote zu beurteilen, wird der Status quo seit dem Jahr 2005 regelmäßig von SIPCAN erhoben und analysiert. Dies geschieht mithilfe einer umfangreichen Online-Umfrage. Die aktuellste Erhebung fand im Zeitraum von März bis Mai 2023 statt. Die Einladung zur Beteiligung an der Umfrage richtete sich an Adipositastherapie anbietende Personen und Institutionen in ganz Österreich und erfolgte über einen E-Mail-Verteiler sowie diverse Fachverbände und fachspezifische Organisationen.

Resultate: An der aktuellen Umfrage beteiligten sich 126 Einrichtungen. Minderjährige wurden in 66,7 % und Erwachsene in 86,5 % dieser Institutionen betreut. In 82,5 % der Fälle wurde Ernährungs-, in 30,2 % Bewegungs- und in 35,7 % Verhaltenstherapie angeboten. Medikamentöse Therapien kamen in 19,8 % der Einrichtungen zum Einsatz, bariatrische Eingriffe wurden in 11,1 % durchgeführt. Hinsichtlich der an den Therapieleistungen aktiv beteiligten Berufsgruppen wurden die Patient*innen am häufigsten von Diätolog*innen (in 68,3 % der Einrichtungen), Ärzt*innen (in 55,6 %) und Psycholog*innen (in 42,9 %) betreut. Der Anteil an interdisziplinär zusammenarbeitenden Therapieanbieter*innen lag bei 60,3 %. In 59,5 % der Fälle wurde nach evidenzbasierten Leitlinien gearbeitet. Für eine fachgerechte Bewertung der Behandlungserfolge wurde in 57,9 % der Einrichtungen eine Prozess- und in 70,6 % eine Ergebnisevaluierung durchgeführt. In 76,2 % der Einrichtungen gab es die Möglichkeit einer Nachbetreuung nach Therapieabschluss. Im zeitlichen Verlauf der Erhebungen ist ein Trend hin zu mehr Einzeltherapie (aktuell: Einzeltherapie in 89,7 %, Gruppentherapie in 36,5 % der Einrichtungen) mit individuell wählbaren Einstiegsterminen (aktuell in 83,3 %) und individueller Dauer (aktuell in 81 %) beobachtbar. In bereits 75,4 % der Fälle müssen die Therapiekosten zumindest teilweise durch private (Zu-)Zahlungen gedeckt werden, während die Finanzierungsquote durch die Krankenkasse, öffentliche Mittel und Fördergeber rückläufig ist.

Schlussfolgerungen: Angesichts der hohen Übergewichtsprävalenz in allen Altersgruppen und der engen Verbindung zu Herz-Kreislauf-Erkrankungen scheint eine fortlaufende Beobachtung und Analyse der Therapiestrukturen in Österreich sinnvoll und wichtig. Die aktuelle Gesamtsituation ist – beispielsweise was die rückläufige Finanzierungsquote durch die Krankenkasse und öffentliche Mittel sowie den zu geringen Anteil an nach evidenzbasierten Leitlinien arbeitenden Therapieanbieter*innen betrifft – verbesserungswürdig. Im Hinblick auf das Ziel, betroffenen Menschen den Zugang zu professioneller Hilfe zu erleichtern, soll der neue Adipositas Hilfe-Kompass zukünftig weiter ausgebaut und auch zur Vernetzung zwischen in der Adipositastherapie tätigen Berufsgruppen genutzt werden.

27-5

Exercise oscillatory ventilation as a predictor of mortality in patients with amyloid cardiomyopathy

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Introduction: Exercise oscillatory ventilation (EOV) signals multiple abnormalities in hemodynamics and ventilatory control which may predict poor outcome in patients with cardiac diseases.[1] We aimed to assess whether EOV (+) patients with amyloid cardiomyopathy show higher mortality rates compared to their counterparts without EOV.

Methods: We analyzed cardiopulmonary exercise testing for EOV, defined by continuous (> 60% of exercise duration) oscillations in minute ventilation (VE), cycling with a frequency of one minute and an amplitude above 15% of resting VE, in patients with amyloid cardiomyopathy.[2]

Results: 156 amyloid cardiomyopathy patients, aged 78 (± 7) years, 87% male with a NYHA functional class of II (49.4%) and median B-type natriuretic peptide levels of 2548 (1374–4703)

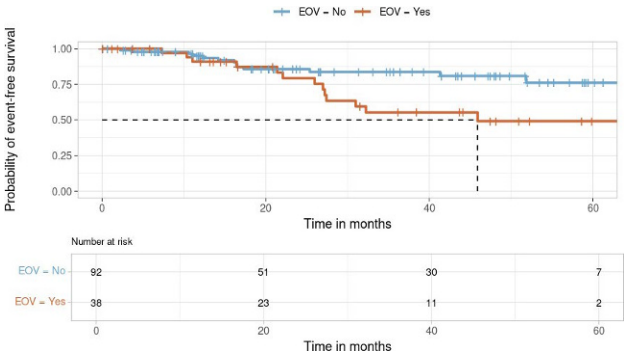

Fig. 1 Kaplan-Meier Curve for EOV – All-Cause Mortality

ng/L, had a mean peak oxygen consumption of 14.8 (± 4.42) ml/kg·min and a VE to carbon dioxide production (VCO2) slope ≥ 40 in 67.9% of cases. EOV was seen in 38 (24.4%), clearly absent in 92 (59.0%) and not clearly differentiable in 26 (16.7%) patients. 33 (21.2%) had a HF-related hospitalization and 31 (19.9%) died. EOV shows a hazard ratio of 2.35 (CI 1.088–5.075, p-value < 0.05) for all-cause mortality. In fact, the log-rank test showed a difference in survival time between patients with and without EOV (p = 0.03) with a median survival time of 46 months.

Conclusion: EOV may improve the prognostic yield of incremental CPET in patients with amyloid cardiomyopathy.

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27-6

Blood pressure behavior during exercise in patients with diastolic dysfunction and a hypertensive response to exercise

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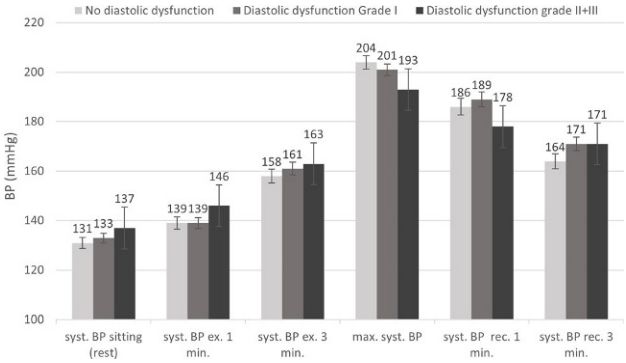

Fig. 1a Systolic BP during an exercise test according to diastolic function Data represent mean with whiskers representing the 95% CI Abbreviations: BP = blood pressure, ex. = exercise, min. = minute, rec. = recovery syst. = systolic

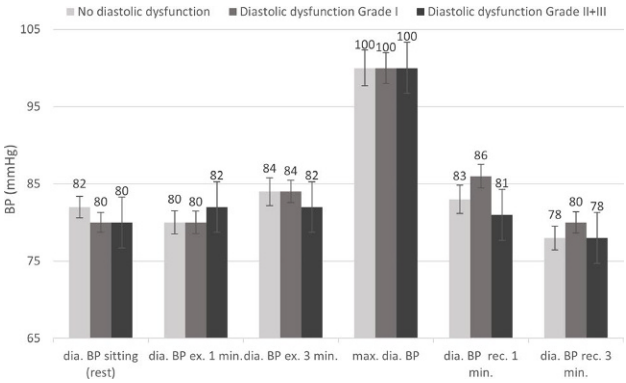

Fig. 1b Diastolic BP during an exercise test according to diastolic function Data represent mean with whiskers representing the 95% CI Abbreviations: BP = blood pressure, dia. = diastolic ex. = exercise, min. = minute, rec. = recovery

Introduction: A hypertensive response to exercise is a precursor leading to hypertension which is a major risk factor for the development of heart failure and diastolic dysfunction. Herein, we aimed to assess blood pressure (BP) in patients with a hypertensive response to exercise and different degrees of diastolic dysfunction.

Methods: Between January 2009 and December 2014, 373 patients with a hypertensive response to exercise (HRE) and echocardiographic data assessing diastolic function were enrolled at the University Hospital of Zurich. ANCOVA was used to assess the changes in BP response during exercise testing in individuals with different degrees of diastolic dysfunction.

Results: Adjusted for baseline systolic BP, normal diastolic dysfunction correlated with significantly greater peak systolic BP than did grades I and II diastolic dysfunction (β (95%) 6.1 (0.8–11.4), p = 0.024 and 15.6 (7.1–24.1), p < 0.001 respectively). Furthermore, normalization of systolic BP was blunted in patients with grade II and III diastolic dysfunction after 3 minutes of recovery in univariable (β (95%) - 9.2 (–13.8- - 4.8) p < 0.001, –16.0 (-23.0–9.0) p < 0.001, respectively) and adjusted models. Patients without diastolic dysfunction achieved higher heart rates (HR) (both in absolute terms (p < 0.001) and as a percentage of the calculated maximum (p = 0.003)) and greater wattage (p < 0.001) at maximum exertion.

Conclusion: The findings of this cross-sectional study suggest that exercise tolerance is compromised in patients with diastolic dysfunction. A hypertensive response to exercise may help identify patients at risk of developing heart failure.

POSTERSITZUNG 28 – KHK UND PULMONALE HYPERTENSION

28-1

Co-incidence of significant coronary calcifications in patients with radiotherapy-associated valvular disease

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Introduction: In cancer survivors, radiotherapy, particularly thoracic radiotherapy, is linked to an increased risk of cardiovascular diseases, including radiotherapy-associated valve disease–a condition damaging heart valves. Radiotherapy is also associated with an increased risk of coronary heart disease. The co-occurrence of radiotherapy associated valve disease and radiotherapy-associated coronary heart disease is underexplored. Given the growing number of long-term cancer survivors, understanding this relationship is valuable in identifying patients that would benefit from coronary imaging or functional testing when radiotherapy-associated valvular disease is detected on echocardiography.

Methods: Patients with radiotherapy-associated valvular disease presenting to our cardio-oncology outpatient clinic were included in this study. This includes patients that have a history of thoracic radiotherapy and valve disease consistent with radiotherapy-associated damage. Available thoracic CT imaging data was analyzed for coronary calcifications according to the guidelines on coronary artery calcium scoring of noncontrast noncardiac chest CT-scans [1]. Briefly, each vessel (LM, LAD, LCX, RCA) was visually scored from 0 (none) to 3 (severe) based on the presence of calcifications in < 1/3 (1), 1/3–2/3 (=2) or > 2/3 (=3) of the vessel. The score was then added up with a maximum score of 12.

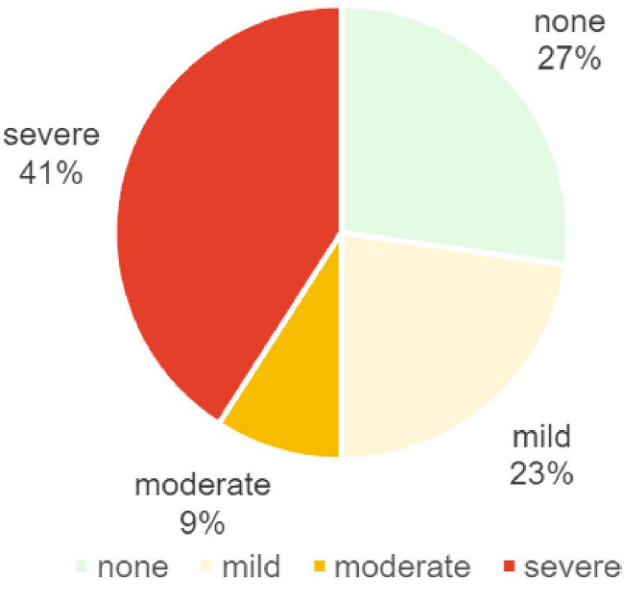

Fig. 1 Coronary Calcification Severity

Tab. 1 CAC

	CAC Score			
	LM	LAD	LCX	RCA
n	44	44	44	44
Sum	52	68	51	47
Mean	1,18	1,55	1,16	1,07
Stdv	1,32	1,23	1,20	1,21
	CAC Severity			
none	12	27%		
mild	10	23%		
moderate	4	9%		
severe	18	41%		

Results: 44 patients with radiotherapy-associated valvular disease and interpretable CT imaging were included in the study (mean age 65 ± 12.4 years, 61% male, 39% female). The total calcium scores were as follows; none in 27% (n = 12), mild in 23% (n = 10), moderate in 9% (n = 4) and severe in 41% (n = 18). Altogether 50% of patients had moderate to severe coronary calcium scores (Table 1).

Conclusion: Half of all patients with radiotherapy-associated valvular disease had moderate to severe coronary artery calcifications according to noncontrast, noncardiac chest CT scans. This increased pre-test probability should be considered when evaluating coronary imaging or functional testing in patients in whom radiotherapy-associated valvular disease is detected during routine echocardiography.

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28-2

Coronary artery disease in cardiac amyloidosis – does it affect the outcome?

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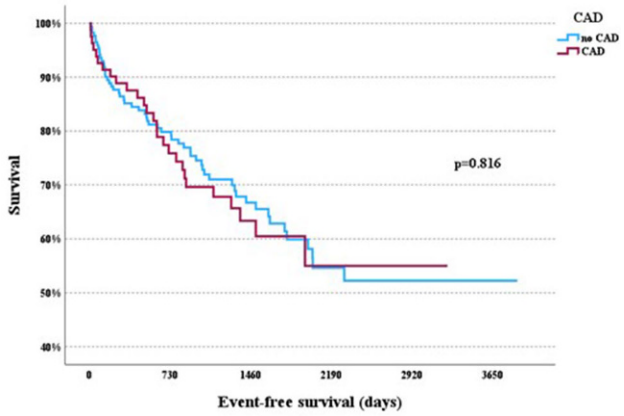

Fig. 1 Kaplan Meier analysis

	Total (n=255)	CAD (n=81)	No CAD (n=174)	p-Value
Age (years)	76.5 ± 9.1	78.7 ± 7.3	75.5 ± 9.7	**0.011**
Female patients (%)	56 (22.0)	9 (11.1)	47 (27.0)	**0.004**
Type of Amyloidosis (%)				0.113
aTTR amyloidosis	216 (84.7)	74 (91.4)	142 (81.6)	
Of those hTTR amyloidosis	17 (6.7)	5 (6.2)	12 (6.9)	
AL amyloidosis	37 (14.0)	7 (8.8)	30 (16.5)	
Combined ATTR and AL amyloidosis	2 (0.8)	0 (0.0)	2 (1.2)	
ATTR-score (%) *				0.227
I	93 (42.7)	30 (40.5)	63 (43.8)	
II	72 (33.0)	21 (28.4)	51 (35.4)	
III	53 (24.3)	23 (31.1)	30 (20.8)	
BMI (kg/m²)	26.0 ± 4.0	25.4 ± 3.4	26.2 ± 4.3	0.109
NYHA class ≥ II (%)	222 (87.1)	68 (84.0)	154 (88.5)	0.678
CCS ≥ II (%)	19 (7.5)	6 (7.4)	13 (7.5)	0.980
CTS (%)	96 (37.6)	30 (37.0)	66 (37.9)	0.996
Current smoker (%)	30 (11.8)	13 (16.0)	17 (9.8)	0.128
Diabetes mellitus (%)	54 (21.2)	23 (28.4)	31 (17.8)	0.054
Atrial fibrillation (%)	148 (58.0)	45 (55.6)	103 (59.2)	0.583
Arterial hypertension (%)	158 (62.0)	63 (77.8)	95 (54.6)	**<0.001**
Hyperlipidemia (%)	112 (43.9)	48 (59.3)	64 (36.8)	**<0.001**
COPD (%)	24 (9.4)	9 (11.1)	15 (8.6)	0.552
Coronary artery disease	81 (31.8)	81 (100.0)	0 (0.0)	**<0.001**
Previous myocardial infarction (%)	21 (8.2)	20 (25.9)	0 (0.0)	**<0.001**
Previous coronary artery bypass graft (%)	14 (5.5)	14 (17.3)	0 (0.0)	**<0.001**
Previous PCI (%)	61 (23.9)	61 (75.3)	0 (0.0)	**<0.001**
proBNP (ng/L)	4732 ± 6272	5540 ± 7751	4347 ± 5412	**0.033**
Troponine T (ng/L)	71 ± 60	69 ± 59	72 ± 62	0.827
Creatine kinase (U/L)	110 ± 90	103 ± 53	113 ± 101	0.419
eGFR (ml/min/m²)	58 ± 27	51 ± 21	61 ± 29	0.074
LDL (mg/dl)	83 ± 38	74 ± 40	87 ± 37	0.863
HbA1c (%)	5.9 ± 0.7	6.1 ± 0.8	5.9 ± 0.7	0.093

Table 1. Baseline characteristics. BMI – body mass index; CCS – Canadian coronary society; COPD – chronic obstructive pulmonary disease; CTS – carpal tunnel syndrome; eGFR – estimated glomerular filtration rate, Cockroft-Gault-formular was used; hTTR – hereditary aTTR amyloidosis ;PCI – percutaneous coronary intervention; wTTR – wild-type TTR amyloidosis

** only in patients with ATTR amyloidosis or combined ATTR and AL amyloidosis*

Fig. 2 Baseline characteristics

Introduction: Background: Cardiac amyloidosis is an important disease causing significant morbidity and mortality. Due to the ageing society as well as better diagnostic tools such as 3,3-diphosphono-1,2-propanodicarboxylic acid scintigraphy (DPD scan), cardiac amyloidosis has increased in prevalence, however, the coexistence, as well as the differences in presentation with coronary artery disease (CAD), has not yet been discovered. Purpose: The purpose of the study is to evaluate the prevalence of CAD in patients with cardiac amyloidosis, to assess differences in late gadolinium enhancement (LGE) in cardiac MRI, and to assess differences in symptoms such as dyspnea.

Methods: We retrospectively assessed all patients with cardiac amyloidosis at our center and screened for an evaluation of coronary artery disease with coronary angiography, coronary CT, or myocardial scintigraphy. In all patients, who underwent cardiac MRI we assessed the pattern of LGE using the cardiac left ventricular segmentation model published by the AHA. All-cause mortality was assessed, uni- and multivariate Cox regression as well as Kaplan Meier analyses were performed.

Results: 455 patients with cardiac amyloidosis were retrospectively assessed for a CAD screening. 255 patients (56.0%) had undergone evaluation, of whom 81 patients (31.7%) had significant CAD. Differences could be found in age (p = 0.011), sex (p = 0.004) and proBNP (p = 0.033). No statistical difference in type of amyloidosis were observed, furthermore, no significant difference in symptoms could be found. In 182 patients (71.4%), cardiac MRI was performed. Differences could only be found in indexed left-ventricular enddiastolic volume (p = 0.031) and left ventricular mass index (p = 0.018). No LGE was found in 9 patients (4.9%), 150 patients (82.9%) presented with subendocardial circular LGE typical for CA and 11 patients (6.1%) showed typical signs of postischemic LGE (17.2% vs 0.8%). No differences in survival could be observed (see Fig. 1), in the multivariate analysis, only type of amyloidosis (AL = 0, aTTR = 1; OR 0.066, 95% CI 0.020-0.216), troponine T (OR 1.010, 95% CI 1.005–1.015) and eGFR (OR 0.969, 95% CI 0.950-0.988) were associated with the outcome.

Conclusion: With 31.7%, CAD is highly prevalent in patients with cardiac amyloidosis. In case of CAD, a coronary intervention (surgical or interventional) was performed in 92.8%, making coronary interventions in patients with cardiac amyloidosis a feasible option. Furthermore, we could show that the presence of CAD does not change the outcome in patients with CA. Cardiac MRI in patients with concomitant CAD and cardiac amyloidosis often shows the typical diffuse LGE, therefore, visualization of postischemic changes in these patients is difficult. Furthermore, symptoms do not differ between patients with CAD and no CAD.

28-3

Telemedizinisch-assistiertes Bewegungsprogramm (TAB) bei Koronarer Herzkrankheit

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Einleitung: Herz-Kreislauf-Erkrankungen (HKE) sind eine häufige Ursache für die Abnahme der körperlichen Leistungsfähigkeit und Lebensqualität. Viele Studien konnten zeigen, dass durch gezielten und dosierten Einsatz von Bewegung in der kardiologischen Rehabilitation, die Lebensqualität, die körperliche Leistungsfähigkeit und deren Auswirkung auf die psychosoziale Ebene verbessert werden und Morbidität und Mortalität reduziert werden. Trotz nachgewiesener positiver Effekte und einer Klasse 1 A Empfehlung der Leitlinien seit 2016 werden Rehabilitationsprogramme nach einem akuten kardialen Ereignis oder nach einem herzchirurgischen Eingriff nur selten genutzt. Die Gründe dafür sind vielfältig: neben niedrigen Zuweisungsraten, langen Anfahrtswegen und sozialen/beruflichen Umständen spielen auch lange Wartezeiten auf einen Rehabilitationsplatz eine Rolle. Das Ziel der vorliegenden Arbeit ist die Implemen-

tierung eines telemedizinisch-assistierten Bewegungsprogramms (TAB) in das HerzMobil Tirol (HMT) Projekt Koronare Herzerkrankung (KHK) und eine daraus resultierende Verbesserung der Sekundärprävention bei Patient:innen nach einem akutem Koronarereignis und nach elektiver perkutaner koronarer Intervention.

Methoden: Patient:innen, die die Einschlusskriterien erfüllten, wurden in das Versorgungsprogramm HMT KHK für drei Monate aufgenommen und hatten somit die Möglichkeit zusätzlich am TAB teilzunehmen. Als zusätzliches Ausschlusskriterium galt lediglich eine Ejection Fraction (EF) von unter 40 %. Anhand der therapeutischen Eingangsuntersuchungen wurden die Patient:innen in ihrer körperlichen Leistungsfähigkeit in unterschiedliche Bewegungsstufen klassifiziert. Die therapeutischen Eingangs- und Abschlussuntersuchungen beinhalteten den 1-Minuten Sit-To-Stand Test (STS) und den 6-Minuten Gehtest (6 MWT), sowie ein Anamnesegespräch. Zur Erhebung der Lebensqualität wurde der standardisierte EQ-5D-5L Fragebogen herangezogen. Zunächst erhielten die Patient:innen eine Bewegungsberatung und eine Schulung zum Thema Bewegung mit dem Fokus, zuhause selbständig ein individualisiertes Bewegungsprogramm ausführen zu können. Ziel war die Steigerung der Adhärenz und die Initiierung eines nachhaltigen Bewegungsverhaltens. Das individualisierte Bewegungsprogramm beinhaltete alle wichtigen Komponenten (Ausdauer-, Kraft-, Beweglichkeits- und Koordinationstraining), Bewegungsvideos und ein Bewegungstagebuch. Die Trainingssteuerung erfolgte durch eine Trainingstherapeutin über die BORG Skala im telemedizinischen Setting, wobei die Kontaktaufnahme wöchentlich und bei Bedarf stattfand.

Resultate: Für die statistische Analyse wurden die 15 Personen herangezogen, die das TAB bereits abgeschlossen haben. Von diesen waren drei weiblich und zwölf männlich. Das durchschnittliche Alter lag im Median bei 61 Jahren. Die Erkrankungen unter den Patient:innen waren mit 47 % der NSTEMI, mit 20 % der STEMI, mit 27 % die stabile Angina pectoris (AP) und mit 7 % die instabile AP. Die körperliche Aktivität betreffend gaben 53 % der Patient:innen an, vor ihrem kardialen Ereignis regelmäßig körperlich aktiv gewesen zu sein, wobei die Mehrheit auf ausdauerorientierte Bewegung wie Spaziergänge verwies. Der Interventionszeitraum betrug zwölf Wochen, in denen die Patient:innen im Median 298 Minuten pro Woche (IQR 198–454) ausdauerorientierte Bewegung (z. B. Gehen, Radfahren, Wandern) absolvierten und im Median zweimal pro Woche (IQR 1–2) ein videoangeleitetes Krafttraining durchführten. Die Teilnehmer:innen des TAB zeigten im STS eine signifikante Steigerung von 25 (IQA 20–32) auf 40 (IQA 25–44) ($p = 0{,}002$). Parallel dazu zeigte sich eine signifikante Verbesserung der Lebensqualität – Verbesserung im EQ-5D-5L von 70 (IQA 55–85) auf 80 (IQA 70–90) ($p = 0{,}003$).

Schlussfolgerungen: Der Prozessverlauf zeigt, dass die Adhärenz der Patient:innen die grundlegende Voraussetzung für eine erfolgreiche Implementierung der „Bewegung als Therapiesäule" ist. Der erste Schritt hierfür erfolgt durch die Empfehlung der betreuenden Ärzt:innen hinsichtlich der Bedeutung der Bewegung im Therapieplan. Im Betreuungsverlauf ist der persönliche Kontakt zwischen Patient:in und Therapeutin der entscheidende Faktor für die Stabilisierung der Adhärenz. Daher wird dieser einerseits als wichtiges Instrument in der Umsetzung des Konzeptes „Bewegung ist Therapie" und andererseits als der Schritt auf dem Weg in die Autonomie bewertet. Unabhängig von der Altersstufe zeigte sich, dass Onlineschulungen telemedizinisch umgesetzt werden konnten. Der STS als Assessment und die BORG Skala zur Trainingssteuerung haben sich in der Evaluierung als valide Instrumente herausgestellt und waren in der Umsetzung der Bewegungsprogramme erfolgreich. Durch diese Maßnahme können Zeit-, Personal- und finanzielle Ressourcen eingespart werden ohne eine wichtige Therapiesäule zu vernachlässigen. Zusammenfassend ergibt sich aus der vorliegenden Evidenz eine Notwendigkeit für innovative Rehabilitationskonzepte, wie z. B. die Implementierung eines telemedizinisch-assistierten Bewegungsprogramms (TAB) bei KHK. Die Digitalisierung könnte die Implementierung aller Elemente einer kardiologischen Rehabilitation auch für Menschen in entlegenen Einzugsgebieten ermöglichen.

28-4

SGLT2-Inhibitors and cardiovascular outcomes in patients treated for complex coronary artery disease

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Introduction: Growing evidence has confirmed the protective role of SGLT2-Inhibitors in patients with type II diabetes mellitus and those with heart failure regardless of left ventricular ejection fraction (LVEF). But due to reported SGLT2-receptor implications in atherosclerosis, SGLT2 inhibitors may play a role in preventing the development of atheroma and facilitate secondary prevention in cardiovascular disease. In particular, the effect may be enhanced in patients with complex coronary artery disease such as chronic total occlusions (CTO), who have an increased prevalence of heart failure, cardiovascular events,

Variable	OMT (n = 111)	PCI (n = 92)	Total (n = 203)	P value
Age	67±10	61±10		**<0.001**
Female	14 (12.6)	14 (15.2)	28 (13.8)	0.592
CTO				
LAD	19 (17.1)	23 (25)	42 (20.7)	
CX	20 (18.0)	16 (17.4)	36 (17.7)	
RCA	71 (64.0)	53 (57.6)	124 (61.1)	
Branch	1 (0.9)	0 (0)	1 (0.5)	
St.p. MCI	68 (61.3)	50 (54.3)	118 (58.1)	0.320
St.p. STEMI	28 (25.2)	14 (15.2)	42 (27.7)	0.080
St.p. CABG	25 (22.5)	12 (13.2)	37 (18.3)	0.088
PAD	43 (38.7)	18 (19.6)	61 (30)	**0.003**
Atrial fibrillation	18 (16.2)	9 (9.8)	27 (13.3)	0.179
COPD	22 (19.8)	11 (12.0)	33 (16.3)	0.131
CKD	25 (22.5)	17 (18.5)	42 (20.7)	0.479
Hypertension	93 (83.8)	80 (87.9)	173 (85.6)	0.405
Diabetes mellitus	57 (51.4)	37 (40.2)	94 (46.3)	0.113
SGLT2i	43 (38.7)	29 (31.5)	72 (35.5)	0.285
Antianginous therapy	23 (20.7)	21 (22.8)	44 (21.7)	0.717
HFrEF	40 (36.0)	26 (28.3)	66 (32.5)	0.239

Fig. 1 Baseline characteristics and CTO treatment strategy

Variable	No SGLT2i (n = 131)	SGLT2i (n = 72)	Total (n = 203)	P Value
Age	63±11	65±10	64±10	0.160
Female	19 (14.5)	9 (12.5)	28 (13.8)	0.692
CTO				
LAD	25 (19.1)	17 (23.6)	42 (20.7)	
CX	27 (20.6)	9 (12.5)	36 (17.7)	
RCA	78 (59.5)	46 (63.9)	124 (61.1)	
Branch	1 (0.8)	0 (0)	1 (0.5)	
St.p. MCI	69 (52.7)	49 (68.1)	118 (58.1)	**0.034**
St.p. STEMI	28 (21.4)	14 (19.4)	42 (20.7)	0.745
St.p. CABG	15 (11.5)	22 (30.6)	37 (18.3)	**<0.001**
PAD	32 (24.4)	29 (40.3)	61 (30.0)	**0.018**
Atrial fibrillation	14 (10.7)	13 (18.1)	27 (13.3)	0.139
COPD	19 (14.5)	14 (19.4)	33 (16.3)	0.361
CKD	26 (19.8)	16 (22.2)	42 (20.7)	0.689
Hypertension	113 (86.9)	60 (83.3)	173 (85.6)	0.486
Diabetes mellitus	44 (33.6)	50 (69.4)	94 (46.3)	**<0.001**
PCI	63 (48.1)	29 (40.3)	92 (45.3)	0.285
Antianginous therapy	25 (19.1)	19 (26.4)	44 (21.7)	0.227
HFrEF	32 (24.4)	34 (47.2)	66 (32.5)	**<0.001**

Fig. 2 Baseline characteristics and SGLT2i

Event	OMT	PCI	Total	p-Value
Any event	23 (20.7)	19 (20.7)	42 (20.7)	0.990
Death	15 (13.6)	4 (4.3)	19 (9.4)	**0.024**
Target lesion revascularization	2 (1.8)	11 (12.1)	13 (6.5)	**0.003**
Myocardial infarction	3 (2.7)	4 (4.3)	7 (3.5)	0.531
Cardiovascular hospitalization	14 (12.7)	13 (14.3)	27 (13.4)	0.747
Heart failure hospitalization	5 (4.5)	4 (4.3)	9 (4.4)	0.957

Fig. 3 Clinical events and CTO treatment strategy

Event	No SGLT2i	SGLT2i	Total	p-Value
Any event	25 (19.1)	17 (23.6)	42 (20.7)	0.446
Death	13 (9.9)	6 (8.5)	19 (9.4)	0.732
Target lesion revascularization	8 (6.2)	5 (7.0)	13 (6.5)	0.807
Myocardial infarction	2 (1.5)	5 (7.0)	7 (3.5)	0.053
Cardiovascular hospitalization	15 (11.5)	12 (16.9)	27 (13.4)	0.287
Heart failure hospitalization	6 (4.6)	3 (4.2)	9 (4.4)	0.891

Fig. 4 Clinical events and SGLT2i

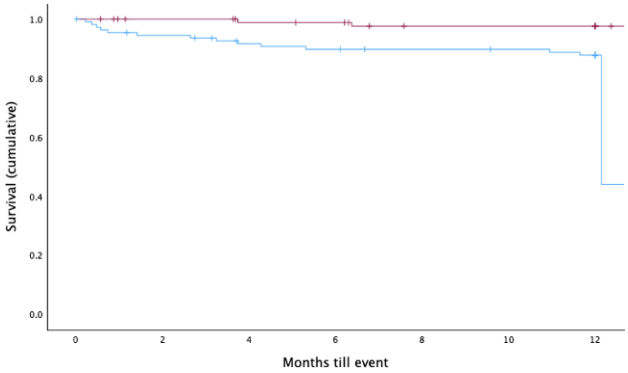

Fig. 5 Treatment strategy and death

and stent restenosis after percutaneous coronary intervention (PCI). We aimed to elucidate the impact of SGLT2-Inhibitor baseline prescription on cardiovascular outcomes in our prospective cohort of patients with CTO undergoing evaluation for PCI and receiving revascularization or optimal medical therapy (OMT) alone.

Methods: We prospectively enrolled consecutive patients with a recently documented CTO presenting to our special outpatient clinic as part of a university-affiliated tertiary care center between the years 2019 and 2022. Patients were evaluated for PCI based on current guidelines and clinical practice and suitable candidates underwent revascularization. Baseline documentation of demographics, clinical data and medication including SGLT2i was performed. Patients were analyzed in two groups (PCI vs OMT alone) and correlations were tested for our composite clinical endpoint consisting of death, major adverse cardiac events (MACCE), cardiovascular hospitalization and hospitalization for heart failure. Use of SGLT2i in the baseline was described and correlations were tested for the clinical primary endpoint for the whole cohort and the two study groups separately.

Results: In this study were enrolled 203 patients with chronic total occlusion undergoing PCI evaluation. In a median follow-up of 12 months, 42 (20.7%) patients had at least one of the clinical endpoints. Revascularization with PCI was performed in 92 patients (42.3%) and the rest received OMT alone. Patients receiving PCI were younger (67 ± 10 vs 61 ± 10 years old, $p < 0.001$) and had more LAD CTO, while those on OMT alone had more often peripheral artery disease (38.7% vs 19.6%, $p = 0.003$). Type II diabetes mellitus was present in 46.3% of patients, and 32.5% of patients were diagnosed with heart failure with reduced ejection fraction (< 50%) at the baseline. SGLT2i were equally prescribed at the baseline in the two patient groups (38.7% vs 31.5%). The composite endpoint was comparable between groups, with the patients receiving OMT alone having more deaths (13.6% vs 4.3%, $p = 0.024$), and the PCI group having more target lesion revascularization (12.1% vs 1.8%, $p = 0.003$). The main indication for SGLT2i is diabetes mellitus (69.4% vs 33.6%, $p < 0.001$) followed by heart failure. Patients receiving SGLT2i alone had a comparable occurrence of the clinical endpoints, although being more prescribed in patients with diabetes mellitus, heart failure with reduced ejection fraction, peripheral artery disease and prior coronary artery bypass grafting (CABG).

Conclusion: In patients with chronic total occlusion, SGLT2i prescription is independent of treatment strategy and does not impact clinical outcomes in one year follow-up. Treatment strategy alone exhibits differences in occurrence of death and target lesion revascularization. Interestingly, patients with prior myocardial infarction and those with advanced atherosclerotic lesions, such as prior CABG and peripheral artery disease tend to have SGLT2i on their baseline medical therapy, despite a low prescription rate for heart failure with reduced ejection fraction and a higher prescription rate for diabetes mellitus. SGLT2i do not impact clinical outcomes in a complex coronary artery disease cohort despite low prescription rates for heart failure with reduced ejection fraction. Efforts for implementation of SGLT2i should be additionally encouraged to comply with heart failure recommendations in other high-risk patient cohorts.

28-5

The optimal cut-off value for the one-minute sit-to-stand test to determine functional impairment in patients with pulmonary hypertension

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Introduction: Pulmonary hypertension (PH) often leads to reduced functional capacity, commonly assessed by the six-minute walk test (6 MWT). The 1-min sit-to-stand test (1-min STST) is a shorter test with smaller space requirements. Despite its potential utility, to our knowledge no studies have determined the optimal cut-off value for the 1-min STST in patients with PH. This study aimed to assess the optimal cut-off value for the 1-min STST by utilizing three established 6 MWT thresholds (165 m, 320 m, and 440 m) recommended in current European PH guidelines published by Humbert et al. (1).

Methods: A receiver operating characteristics (ROC) curve analysis was conducted to identify a threshold for the 1-min STST, aligning with the three 6 MWT cut-offs. Clinical parameters and health-related quality of life (HRQoL) assessed through the Cambridge Pulmonary Hypertension Outcome Review (CAMPHOR) questionnaire were evaluated.

Results: A total number of 114 patients with PH (mean age 66 ± 14 years, 57% female) were included in the analysis. Patients performed a mean number of 17 ± 7 repetitions in the 1-min STST and achieved a mean 6 MWT distance of 351 ± 137 m. The < 165 m 6 MWT threshold revealed the highest area under the

Variables	Entire study cohort (n = 114)	1-min STST ≤ 15 repetitions (n = 45)	1-min STST > 15 repetitions (n = 69)	p-value
Demographic and clinical data				
Age (years), mean (SD)	66 ± 14	70 ± 10	64 ± 16	**0.013**
Female sex, n (%)	65 (57)	29 (64)	36 (52)	0.196
Body mass index (kg/m²), mean (SD)	28 ± 7	29 ± 7	27 ± 6	0.127
NT-proBNP level, pg/mL, median (IQR)	1028 [232-2207]	1587 [460-3955]	499 [193-1623]	**0.001**
WHO functional class, n (%)				**<0.001**
Class I	11 (10)	0 (0)	11 (16)	
Class II	41 (36)	9 (0)	32 (46)	
Class III	56 (49)	31 (69)	25 (36)	
Class IV	6 (5)	5 (11)	1 (0)	
LTOT, n (%)	31 (27)	18 (40)	13 (19)	**0.013**
Right heart catheterization, mean (SD)				
mPAP (mmHg)	41 ± 13	45 ± 14	38 ± 12	**0.006**
mPCWP (mmHg)	15 ± 8	17 ± 9	14 ± 8	**0.042**
PVR (Wood units)	6 ± 4	6 ± 4	5 ± 4	0.218
Pulmonary function, mean (SD), n = 58		***n = 23***	***n = 35***	
FVC (% of pred.)	81 ± 18	73 ± 19	87 ± 16	**0.002**
FEV_1 (% of pred.)	76 ± 20	67 ± 20	83 ± 17	**<0.001**
D_{LCO} (% of pred.)	50 ± 20	36 ± 13	60 ± 17	**<0.001**
CAMPHOR questionnaire, median (IQR)				
Symptom score	8 [5-14]	12 [7-16]	7 [3-10]	**<0.001**
Activity limitation score	8 [4-14]	11 [6-19]	6 [3-9]	**<0.001**
Quality of life score	5 [1-10]	8 [4-13]	3 [1-7]	**<0.001**
Vital parameters regarding the 1-min STST, mean (SD)				
Resting HR (beats/min)	77 ± 15	77 ± 14	77 ± 17	0.849
Effort HR (beats/min)	98 ± 21	94 ± 19	102 ± 22	**0.044**
Resting SpO_2 (%)	94 ± 7	91 ± 9	95 ± 4	**0.014**
Effort SpO_2 (%)	89 ± 9	85 ± 12	92 ± 6	**<0.001**
Effort BDS (0 to 10)	5 ± 2	6 ± 2	4 ± 2	**0.003**

Abbreviations. SD, standard deviation; IQR, interquartile range; NT-proBNP, N-terminal prohormone of brain natriuretic peptide; WHO, World Health Organization; LTOT, long-term oxygen therapy; CAMPHOR, Cambridge Pulmonary Hypertension Outcome Review; mPAP, mean pulmonary artery pressure; PCWP, mean pulmonary capillary wedge pressure; PVR, pulmonary vascular resistance; RAP, mean right atrial pressure; 6MWT, six-minute walk test; 1-min STST, one-minute sit-to-stand test; HR, heart rate; SpO_2, peripheral oxygen saturation; BDS, Borg Dyspnea Score.

Fig. 1 Summary of baseline characteristics of the entire study cohort and comparison of patients who performed ≤15 repetitions (n = 45) and those who performed >15 repetitions (n = 69) in the 1-min STST

curve (AUC = 0.90; 95%-CI 0.84-0.97). The optimal cut-off for the 1-min STST was 14.5 repetitions, exhibiting 69% sensitivity and 100% specificity. Patients below this threshold demonstrated significantly worse clinical parameters and reported worse HRQoL ($p < 0.001$), as shown in Table 1.

Conclusion: A 1-min STST cut-off of 14.5 repetitions identified PH patients with functional impairment, suggesting its potential utility for risk stratification.

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28-6

Cleavage of circulating VWF – a high shear stress-induced anti-thrombotic mechanism in pulmonary hypertension

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Introduction: Acquired von Willebrand syndrome (AvWFS) is a bleeding disorder characterized by reduced high molecular weight (HMW) VWF multimers and is observed in diseases with high shear stress like aortic stenosis. Because precapillary pulmonary hypertension is characterized by high shear stress in the pulmonary vasculature, we studied VWF biology in the two most common subsets of disease, pulmonary arterial hypertension (PAH) and chronic thromboembolic pulmonary hypertension (CTEPH). Because the pro-thrombotic ability of VWF is highly dependent on HMW multimers we assessed VWF concentration, associated co-factors, the vWF cleaving protease ADAMTS13, as well as VWF multimeric composition in patients with CTEPH, PAH and age and gender-matched controls, and monitored bleeding.

Methods: We enrolled 85 patients with CTEPH, 52 patients with PAH, and 30 age and gender matched controls. ADAMTS13 plasma antigen concentration was measured by ELISA, and ADAMTS13 activity was analyzed using a fluorescence resonance energy transfer assay. VWF multimer analysis was performed using low-resolution horizontal SDS-agarose gel electrophoresis for calculation of the retardation factor (RF). VWF multimer analysis was performed in a blinded fashion. Data on laboratory parameters including VWF:Ag, VWF:RCo, and FVIII were documented. Data on medication, comorbidities at study inclusion, a history of bleeding events as well as bleeding events during follow-up were collected.

Results: PVR was 643.7 ± 289.5 dyn/s/cm-5 in CTEPH patients and 705.0 ± 372.6 dyn/s/cm-5 in PAH patients. VWF Antigen was significantly higher in patients with CTEPH and PAH than in controls ($p = 0.0235$). Factor VIII activity was elevated in both patient groups, but significantly higher in patients with CTEPH ($p = 0.0031$). In both patient cohorts the VWF:RCo/VWF:Ag ratio was low and 8 CTEPH and 6 PAH patients were below the diagnostic threshold defining AvWFS. Levels of ADAMTS13 plasma antigen were highest in PAH patients ($p = 0.0467$) while ADAMTS13 specific activity did not differ between groups. Patients with CTEPH and PAH had significantly higher VWF multimeric RF than controls ($p = 0.0003$), indicating a reduction of long VWF multimers. In a Subgroup analysis of VWF multimeric composition, 33.3% of CTEPH and 58.8% of iPAH patients showed few or no long VWF multimers indicating the presence of AvWFS. 18.8% of CTEPH patients and 57.7% of PAH patients had a history of bleeding at the time of study inclusion ($p < 0.0001$). During a follow-up period of 5.38 (2.26–7.80) years 56 bleeding events occurred. The rate of bleeding events was significantly higher in PAH patients with 0.09 bleeding events per patient year compared to CTEPH patients with 0.06 per patient year ($p = 0.0001$). Gastro-intestinal bleeding and minor bleeds (nose or gum bleeding) were more common in PAH patients than CTEPH patients ($p = 0.0014$ and

p = 0.0029 respectively). No differences in intracranial bleeding were observed.

Conclusion: Our study demonstrates an AvWFS phenotype in 16% of patients with precapillary PH. Our observation may serve as an explanation for the lack of clear evidence of a benefit of anticoagulation in PAH, while in CTEPH strong procoagulatory mechanisms may counterbalance the increased bleeding risk due to AvWFS.

28-7

CTEPH and ATTR amyloidosis – Is there a link?

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Introduction: At the cardiology department of Ordensklinikum Linz Elisabethinen, among others, patients with pulmonary hypertension or chronic thromboembolic pulmonary hypertension (CTEPH), are treated. In this abstract we would like to present a small case series of; patients who, in addition to CTEPH, were subsequently diagnosed with cardiac ATTR amyloidosis.

Methods: As part of the case report, the medical history of 3 patients with findings of CTEPH and cardiac ATTR amyloidosis was retrospectively evaluated and literature was searched on known co-incidences or a possible link between CTEPH and cardiac ATTR amyloidosis.

Results: We report a total of two men and one woman aged 78 to 81 years who were diagnosed with CTEPH in the years 2018 and 2019 (for patients' characteristics see Table 1). Diagnosis with CTEPH was made according to current guidelines at that time with persisting mismatching defects in V/Q lung scan after at least three months of adequate anticoagulation, a CT-angiography of the pulmonary arteries and a right heart catheterization with a mean pulmonary arterial pressure (mPAP) > 20 mmHg at rest. Patients received specific therapy with Riociguat, a stimulator of soluble guanylate cyclase, after diagnosis with CTEPH was made. During follow-up a significant increase in thickness of the IVS was noticed over a period of 3–6 years. Subsequently diagnosis with cardiac ATTR amyloidosis was made with 99mTc-DPD scintigraphy and after laboratory rule out of AL amyloidosis. Additionally, two patients underwent a cardiac MRI for verification. After reviewing the current literature in PubMed®, no publications were found that describe a link or increased co-incidences of CTEPH and ATTR amyloidosis. A retrospective analysis from 52 patients with diagnosed cardiac amyloidosis (either AL or ATTR) showed that there is – even at the time of diagnosis – a high prevalence of pulmonary hypertension without going into detail about CTEPH. Most common forms of PH were isolated and combined postcapillary PH (IpcPH and CpcPH) with rates of 55% and 29%, respectively, while precapillary PH was found in 6%.

	Patient #1	Patient #2	Patient #3
Diagnosis of CTEPH			
Age	78	81	79
mPAP (mmHg)	26	32	37
PCWP (mmHg)	20	22	18
NT-proBNP (pg/ml)	1252	2518	1866
Thickness of IVS (mm)	13	11	11
Diagnosis of cardiac ATTR amyloidosis			
Age	84 (Δ6)	85 (Δ4)	82 (Δ3)
NT-proBNP (pg/ml)	3470	5144	1936
Thickness of IVS (mm)	16 (Δ3)	14 (Δ3)	16 (Δ5)

Fig. 1 Patients' characteristics

Conclusion: While pulmonary hypertension (PH) per se is quite common, affecting around 1% of global population with most forms associated with left heart and lung disease, CTEPH is a rare disease with an incidence of 2–6/million adults and a prevalence of 26–38/million adults. The overall prevalence of cardiac ATTR amyloidosis in unknown, although studies in which patients were systematically screened for cardiac wild type ATTR amyloidosis suggest that it is relatively common in patients > 60 years with HFpEF and severe aortic stenosis with a prevalence from 6 to 16%. While there are no data on the occurrence of ATTR amyloidosis in the course of CTEPH, retrospective analyses show a frequent occurrence of IpcPH and CpcPH in patients with previously diagnosed cardiac amyloidosis. In our small case series three patients were subsequently diagnosed with cardiac ATTR amyloidosis after 3 to 6 years after diagnosis of CTEPH. As cardiac amyloidosis occurs frequently in older patients, our patients were also between 82 and 85 years old at time of diagnosis. Overall, it can be assumed that ATTR amyloidosis is often still underdiagnosed and therefore could probably be found more frequently in older patients, regardless of the presence of CTEPH. In addition, the number of patients diagnosed with CTEPH is also increasing due to more active screening in patients with PH. Based on current literature, it is unclear whether there is a link between these two diseases and further investigation is need

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