ACTA CARDIOLOGICA
https://doi.org/10.1080/00015385.2022.2064122

ABSTRACTS

Belgian Society of Cardiology

41st Annual Congress

12th & 13th May 2022

President: Prof. Michel De Pauw

Abstracts are identified as follows: Best Abstracts by (#) and abstracts of papers short-listed for the Young Investigator Award by (*). All other accepted abstracts have been invited for poster display.

Abstracts are printed in alphabetical order of the first author's name within the following categories:

- Arrhythmias/Device
- Basic science
- Cardio-prevention
- Heart failure
- Imaging
- Invasive/Interventional cardiology
- Other

ARRYTHMIAS/DEVICE

Ambulatory PV isolation workflow using suture-mediated vascular closure devices

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Background/Introduction: Pulmonary vein isolation (PVI) used for the treatment of atrial fibrillation (AF) is an increasingly performed procedure worldwide and the possibility to be performed in a day care setting represents an attractive prospect in the electrophysiology field [1]. The main reason for delayed discharge is vascular complications [2–5].
Purpose: To evaluate the feasibility, safety, and efficacy of suture-mediated vascular closure devices in ambulatory management after PVI.
Methods: Prospective single-centre cohort study on 50 patients admitted for PVI from January 2020 to May 2021. The feasibility of an ambulatory PVI strategy was assessed as the number of patients discharged on the same day of the procedure. Outcomes were post-procedural time to reach haemostasis, time to ambulate, and time to discharge. Vascular complications were analysed during the 30-days follow-up.
Results: A total of 48/50 (96%) patients were discharged on the same day of the procedure. During the post-operative stay, two patients had minor bleeding without the necessity of interventions, and one patient was kept in a laying position until an ultrasound evaluation resulted in negative. The median time for deambulation, possibility of discharge, and discharge were 3:11, 4:48, and 5:51 (hh:mm). No major vascular complications were observed in the 30-days follow-up. Three minor haematomas (>6 cm) and one transient access site-related nerve injury occurred.
Conclusion(s): The use of the closure device for femoral venous accesses after PVI led to safely discharge of patients within 6 h from the intervention in 96% of the population. The ambulatory management described in the article could be useful for minimizing the post-operative recovery time and management. Further randomised trials are needed for further assessment of this useful approach.

MADIT-ICD benefit score aids in selecting implantable cardioverter-defibrillator in cardiac resynchronisation therapy

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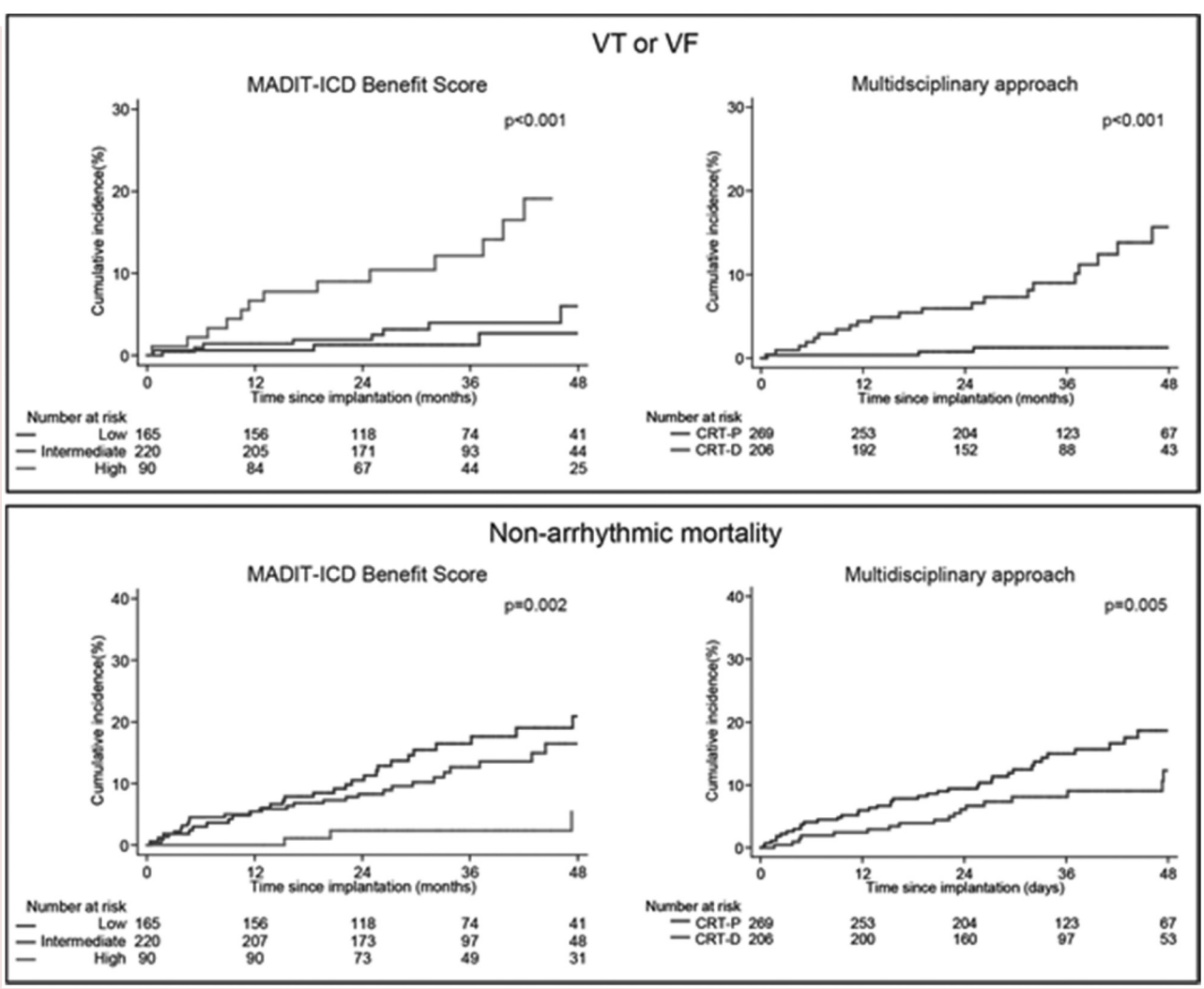
Background/Introduction: In cardiac resynchronisation therapy (CRT) treatment for heart failure (HF), selection between CRT-pacemaker (CRT-P) and CRT-defibrillator (CRT-D) is challenging. Recently, the MADIT-ICD Benefit score was introduced to help select ICD in primary prevention, but it is unclear if this score is useful in CRT.
Purpose: To evaluate if the MADIT-ICD Benefit score can predict who benefits most from CRT-D *vs.* CRT-P in real-world patients with a guideline indication for CRT and to compare this with a multidisciplinary expert centre approach.
Methods: HFrEF patients that received a CRT for a guideline indication at a tertiary care hospital between October 2008 and September 2016, were retrospectively enrolled. The MADIT-ICD Benefit groups (low, intermediate, high) were compared with the current multidisciplinary expert centre approach. Endpoints were (i) sustained ventricular tachycardia (VT) or ventricular fibrillation (VF) and (ii) non-arrhythmic mortality.
Results: Of the 475 included patients, 165 (34.7%) were in the lowest, 220 (46.3%) were in the intermediate, and 90 (19.0%) were in the highest benefit group. After a median follow-up of 34 months, VT/VF occurred in 3 (1.8%) patients in the lowest, 9 (4.1%) in the intermediate, and 13 (14.4%) in the highest benefit group ($p < 0.001$) (Figure 1). Vice versa, non-arrhythmic death occurred in 32 (19.4%) in the lowest, 32 (14.6%) in the intermediate, and 3 (3.3%) in the highest benefit group ($p = 0.002$). The predictive power for ICD benefit was comparable between expert multidisciplinary judgement and the MADIT-ICD Benefit score for the prediction of VT/VF (UNO's C index 0.69 *vs.* 0.69; $p = 0.936$) as well as for the prediction of non-arrhythmic mortality (UNO's C-index 0.59 *vs.* 0.62; $p = 0.767$).
Conclusion(s): The MADIT-ICD Benefit score can identify who benefits most from CRT-D, comparable to multidisciplinary judgement in a CRT expert centre.



How to improve patient knowledge in atrial fibrillation?

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Background/Introduction: Untreated atrial fibrillation (AF) is responsible for one-fifth of all strokes and increases the risk of stroke by 4–5 times compared to sinus rhythm. Furthermore, strokes due to AF are more serious and more deadly than strokes due to other causes.
Purpose: This paper aims to describe the impact of a general information booklet for patients about AF, stroke, and anticoagulation (eight pages), and to identify some of the factors that may affect the knowledge regarding this pathology. With such data, we hope to be able to target patients who need more information.
Methods: From February 2021 until April 2021, all patients known to have a history of AF and who were hospitalized in our cardiology department were randomized (1:1) to receive this booklet or not. After, they were asked to answer a quiz (scored up to 10) questioning their awareness regarding AF, stroke, and anticoagulation.
Results: One hundred and twenty patients were enrolled in two equal groups (60 patients each) similar regarding age (71% > 50 years *vs.* 80%), male sex (55 *vs.* 63%), profession (40% unemployed, 51% workers, 9% independent *vs.* 31, 55, 15%), history of stroke (33 *vs.* 34%). Two-thirds of both groups had at least one risk factor and three out of four knew their anticoagulation prescription. Patients who received the booklet had a significantly higher quiz score than those who did not (8.25 ± 1.70 *vs.* 6.08 ± 2.10, $p < 0.001$). In both groups, a high score was related to older age (>50 years) or being an independent worker ($p < 0.05$). There was no impact of sex, medication, history of stroke, or cardiovascular risk factors on the performance.
Conclusion(s): In patients with AF, providing an informative brochure helped them better understand their disease. Our study points out the particular need to intensify the information given among the youngest patients (<50 years) and/or unemployed.

#Feasibility and intermediate-term outcomes of left bundle branch area pacing: 2-year results from a single centre prospective cohort

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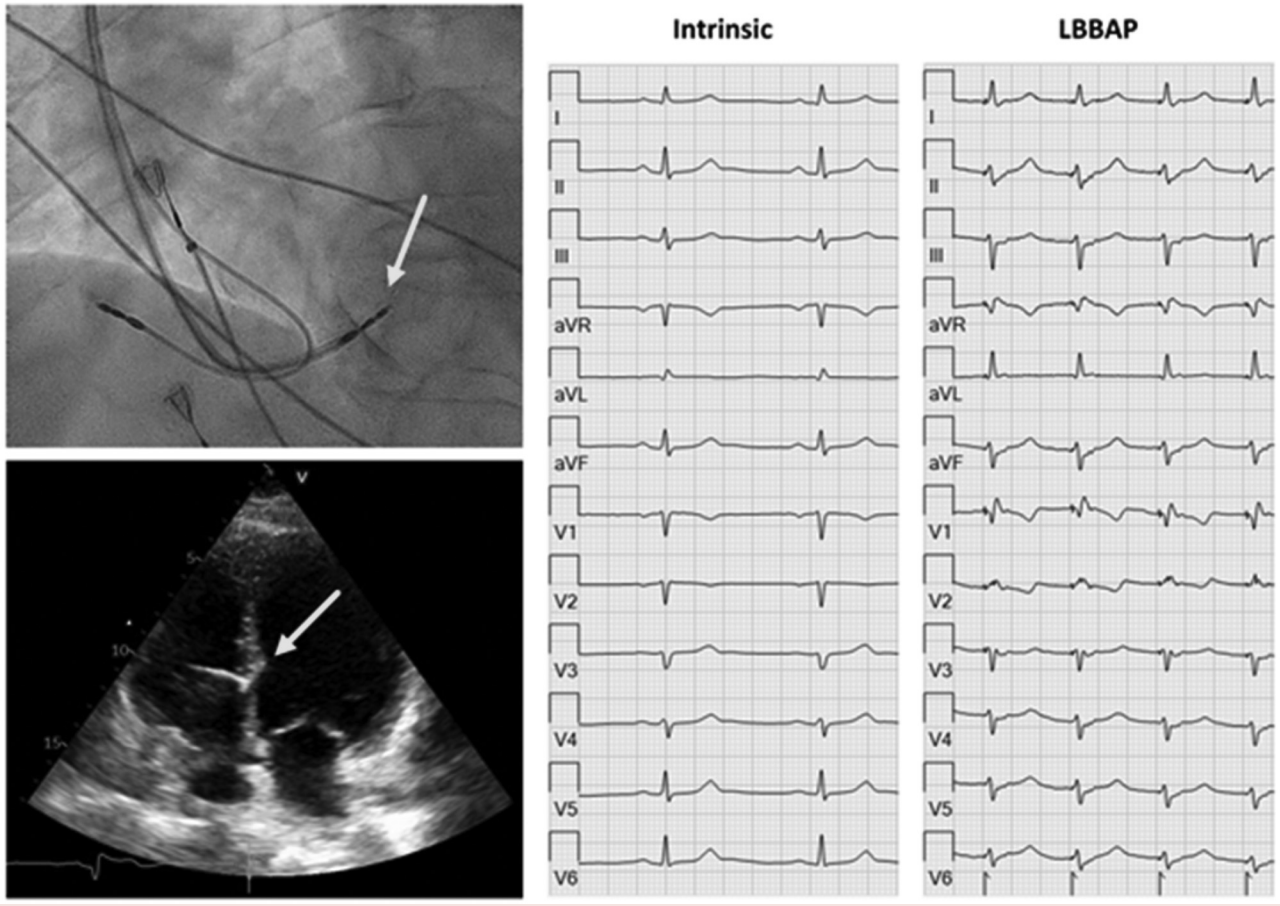
University Hospital Ghent, Ghent, Belgium

Background/Introduction: Left bundle branch area pacing (LBBAP) achieves physiological pacing by capturing the conduction system in the direct area of the left bundle branch.
Purpose: This study explores the feasibility, safety, and pacing characteristics of LBBAP in a large Belgian cohort.
Methods: Adult patients requiring permanent pacing for bradycardia or heart failure in whom LBBAP was attempted between November 2019 and September 2021 were prospectively enrolled. LBBAP was performed with a lumen-less pacing lead (SelectSecure 3830) or a stylet-driven pacing lead (Solia S60).
Results: The study enrolled 195 patients (age 70 ± 15 years, 64% male). LBBAP was successful in 175 (90%) patients. Low LV ejection fraction (EF) ($p = 0.001$), LV mass ($p = 0.015$), renal impairment ($p = 0.001$) and diabetes ($p = 0.029$) were associated with LBBAP implant failure. Acute LBBAP thresholds were low (0.5 ± 0.2 V at 0.4 ms). In patients with narrow QRS, QRSD increased from 94 ± 12 to 119 ± 14 ms ($p < 0.001$). In patients with left bundle branch block (LBBB), a more prominent QRSD decrease was observed (156 ± 17 to 125 ± 18 ms, $p < 0.001$) compared to patients with right BBB (146 ± 13 to 130 ± 14 ms, $p = 0.001$). Post-procedural echocardiography revealed 4 (2%) septal coronary fistulas which healed spontaneously. During 8 [5;13] months follow-up, 3 (1.7%) LBBAP lead revisions were necessary. Pacing thresholds marginally increased during follow-up to 0.7 ± 0.3 V ($p < 0.001$). In bradycardia patients, LVEF remained stable at 6 months follow-up compared to pre-implant (52 ± 9 to $52 \pm 10\%$, $p = 0.240$). In contrast, in LBBB patients with reduced LV function, LVEF significantly increased from 40 ± 7 to $47 \pm 6\%$ ($p = 0.028$).



Conclusion(s): LBBAP is a novel pacing modality with high implant success, low complication rate, and correction of LBBB-induced LV dysfunction.

BASIC SCIENCE

Development of 'home-made' oxLDL to study the interplay between atherosclerosis and cancer: characterization of their effects on head and neck cancer cells

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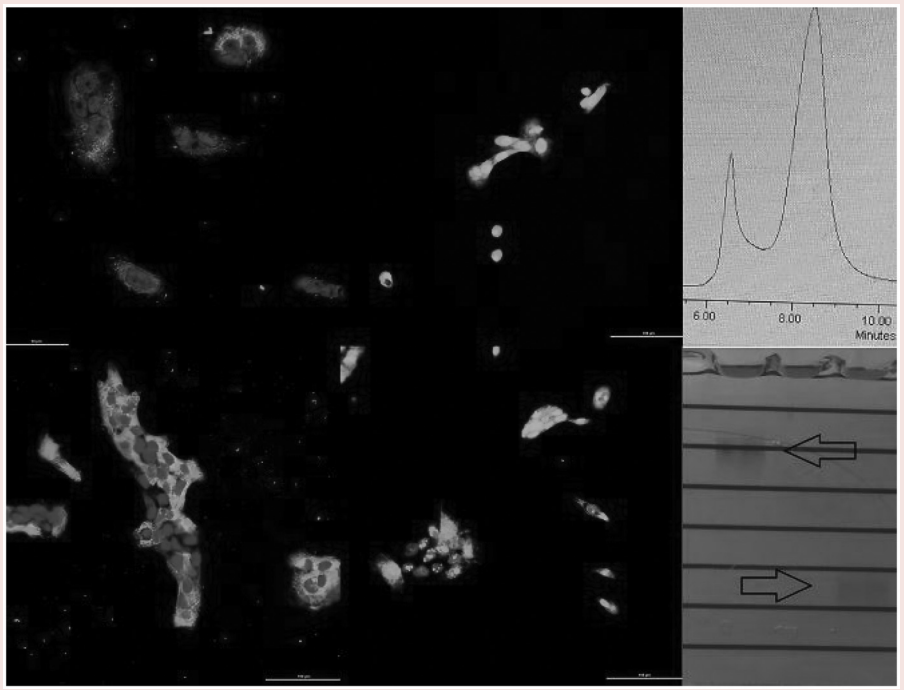
Background/Introduction: Cardiovascular diseases (CVD) and cancers are the two main causes of death worldwide, sharing many comorbidities and risk factors. A pro-inflammatory state with neoangiogenesis and oxidative stress seems to be the cornerstone linking them, while initiation and progression of atherosclerotic plaque are mainly caused by oxidized low-density lipoproteins (oxLDL).
Purpose: We sought to produce in our laboratory well-characterized oxLDL to control and standardize their production for further studies on cancer cells lines. We wanted to characterize our 'home-made' oxLDL, comparing with commercially available oxLDL, and study their influence on the proliferation and migration of head and neck cancer cells (HNCC), both human papilloma virus (HPV)-positive and negative.
Methods: We applied a commercial purification kit based on serial precipitation and centrifugation to isolate LDL and VLDL from human plasma. LDL was isolated by gel permeation chromatography. LDL was oxidized by incubation with 5 μM $CuSO_4$ for 20 h, the reaction is stopped with 0.2 mM EDTA. The quality of the oxidation was assessed by agarose gel electrophoresis. The expression of two oxLDL receptors, CD36 and LOX-1, was investigated by immunofluorescence on one HPV-positive HNCC (93VU-147T) and three HPV-negative HNCC (FaDu, Detroit-562, and UPCI-SCC-131) treated or not with oxLDL (30 μg/mL) over

48 h. The impact of oxLDL on cells migration was assessed in Boyden chambers while their proliferation was estimated upon staining with Crystal Violet.
Results: Electrophoresis showed oxLDL migrating farther than native LDL (25 against 11 mm) due to their increased electronegativity. The proliferation of HNCC increased with oxLDL exposition from 5 to 30 μg/mL, similar to the four HNCC lines. Beyond 30μg/mL, the proliferation decreased, probably due to oxLDL toxicity. Both CD36 and LOX-1 expression increased in all HNCC after oxLDL exposition, in comparison with control. Migration decreased after oxLDL exposition, principally when oxLDL were in direct contact with HNCC. No difference was highlighted between 'home-made' oxLDL and commercial oxLDL.



Conclusion(s): We successfully produced oxLDL comparable to commercially available ones to assess their involvement in cancer progression. Our results demonstrate increased HNCC proliferation under oxLDL exposition and a decrease in their migration. Further studies of the interplay between atherosclerosis and cancer cells are required to refine our understanding of the underlying mechanisms.

#*In vivo* calcium and voltage mapping of the zebrafish heart

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Background/Introduction: Inherited cardiac arrhythmias are characterised by a disturbance in the electrical functioning of the heart due to a dysfunction of cardiac ion channels, accessory proteins, and/or structural components. This complex process is difficult to model *in vitro,* while *in vivo* mouse models differ from humans with regard to cardiac electrophysiology. Thus, there is a need for alternative disease models in cardiac arrhythmia research. The zebrafish heart shows remarkable similarity to humans in its action potential (AP) morphology. Due to the optical translucency of zebrafish larvae, it is possible to visualize the cardiac calcium and voltage dynamics across their entire hearts *in vivo* by use of fluorescent genetically encoded calcium and voltage indicators (GECI and GEVI).
Purpose: The combination of the fast kinetics of a next-generation voltage reporter (Ace2N-mNeon) and the ability to measure calcium transients *in vivo* would create an extremely sensitive method for studying the mechanisms of calcium-mediated cardiac arrhythmia. A stable transgenic zebrafish line with a dual voltage and calcium sensor would be extremely useful for clarifying the mechanism of arrhythmia in inherited and acquired arrhythmia syndromes.
Methods: We report the generation of a transgenic zebrafish line expressing dual voltage and calcium reporters (Ace2N-mNeon and R-GECO, respectively), under the control of a myocardial-specific promoter (*myl7*).
Results: By examining the Ace2N-mNeon and R-GECP sensors with light-sheet microscopy, we were able to generate 3D optical maps of AP characteristics across the entire zebrafish heart at 2 days post-fertilization (Figure 1). The ability of the model to

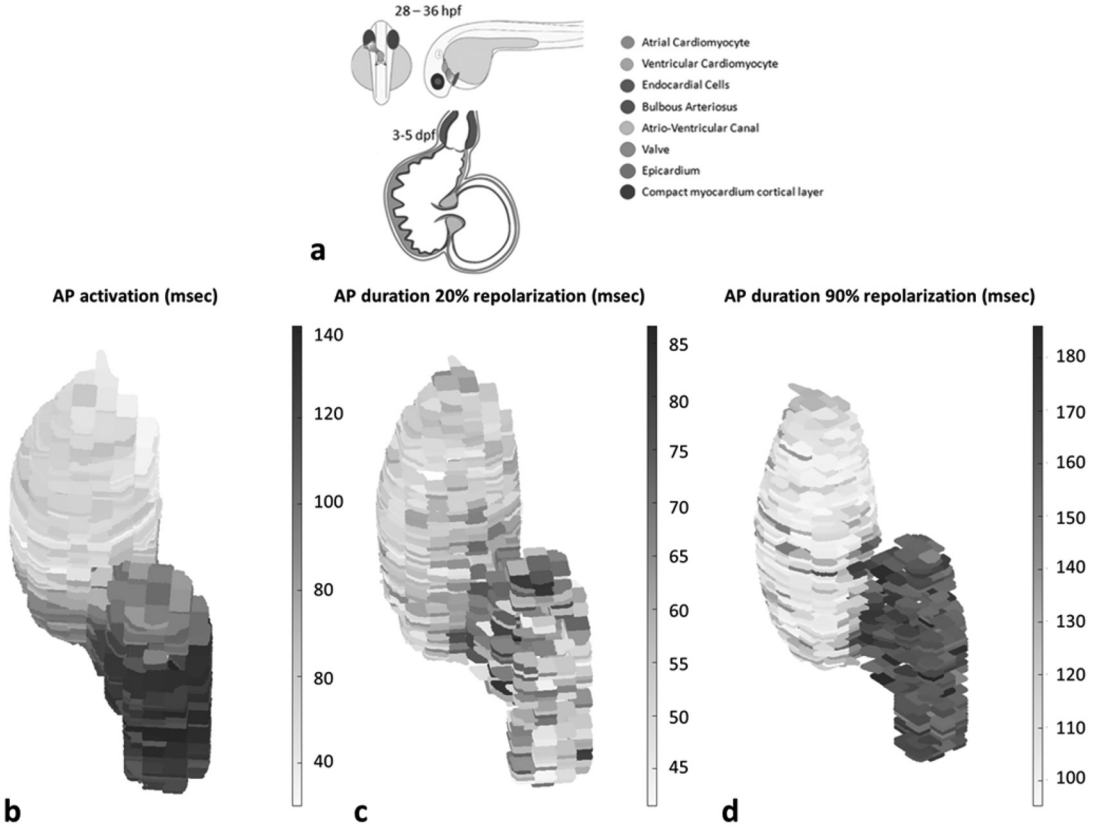

Figure 1. Schematic reconstruction of the developing zebrafish heart, adapted from Brown et al., and 3D maps.

render changes in normal electrophysiology and arrhythmia was validated by drug tests with the class I antiarrhythmic agent quinidine and the adenylate cyclase activator forskolin.
Conclusion(s): In the next step, we intend to use this line for *in vivo* modelling of cardiac arrhythmia in mutant zebrafish carrying variants in known and suspected inherited arrhythmia genes.

Induced pluripotent stem cell-derived cardiac myocytes to assess susceptibility to anthracycline cardiotoxicity

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Background/Introduction: New oncological treatments improved survival but also increased awareness of cardiovascular side-effects following cancer therapy. Recent scientific advances and more specifically the advent of induced pluripotent stem cell-derived cardiac myocytes (iPSC-CMs) offer the ability to predict cardiovascular diseases on an individual level.
Purpose: Currently we have no tools to predict which cancer patients will develop cardiomyopathy upon exposure to anti-cancer drugs and which patients will remain unharmed. The aim of this project is to set up an *in vitro* assay using iPSC-CMs to assess the inter-individual susceptibility to the cytotoxic effect of anthracyclines.
Methods: We used polymerase chain reaction (PCR) and immunofluorescent stainings (IF) to confirm the cardiomyocyte-like profile of our iPSC-CMs. For quantitative analysis of the cytotoxic effect (effect on survival), we performed Flow Cytometry (FC) analysis to create a dose-response curve.
Results: We produced iPSC-CMs from established iPSC cell lines with confirmed differentiation towards cardiomyocyte-like cells using PCR for myosin light chain (*MYL 2* and *7*), myosin heavy chain (*MYH 6* and *7*), troponin T (*TNNT2*). Furthermore, IF for iPSC-CM clearly showed a cardiac myocyte phenotype and the detrimental effect of increasing concentrations of doxorubicin on the cellular ultrastructure. Using FC, the detrimental effect of increasing concentrations of doxorubicin could be quantified (Figure 3).

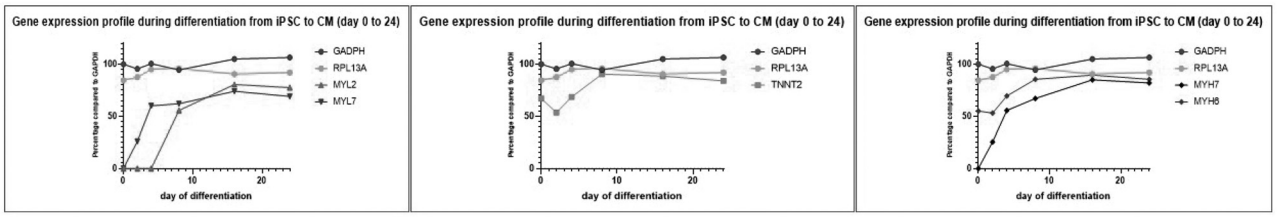

FIGURE 1: Gene expression profile during differentiation from induced pluripotent stem cells to cardiomyocytes

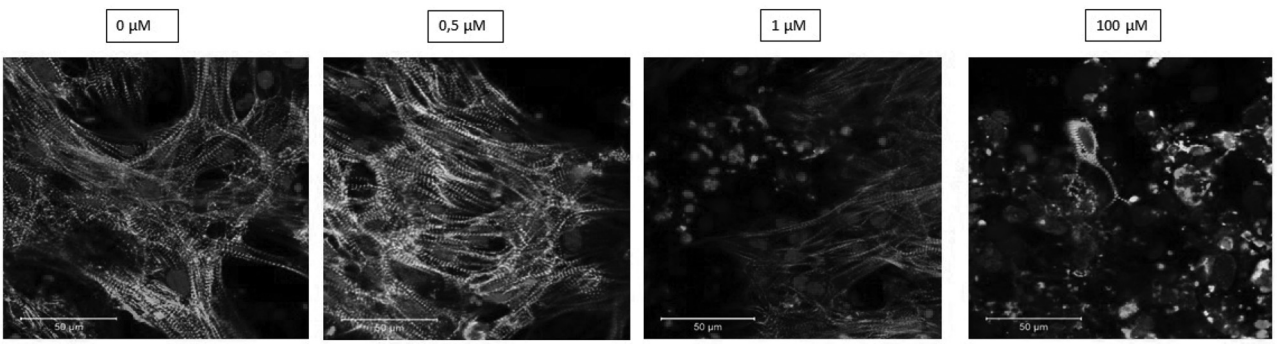

FIGURE 2: Effect of doxorubicin on iPSC-derived cardiomyocytes (40x) after 6h exposure, 48h read-out.
Human iPSC-derived cardiomyocytes from healthy controls at day 26 of differentiation. Red=Phalloidin (Rhodamine), green=Actinin (DAM-Alexa488), blue=TOPRO3. Scale bar = 50 µm.
From left to right: no doxorubicin, 0,5 µM doxorubicin, 1 µM doxorubicin, 100 µM doxorubicin

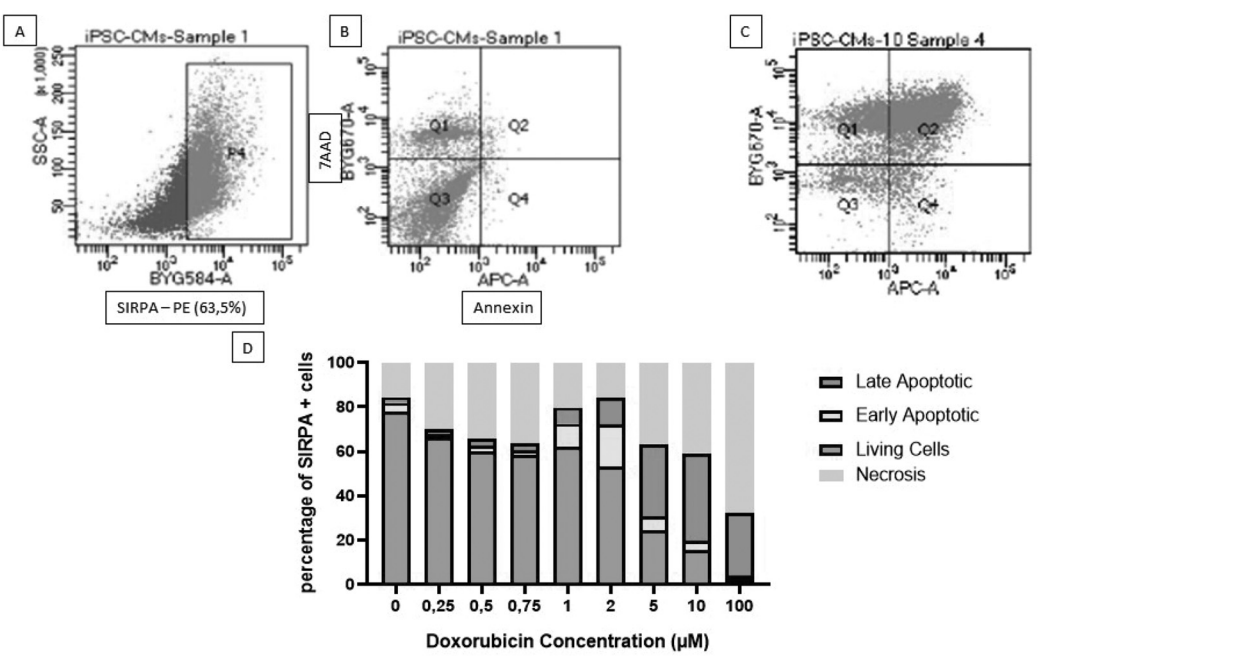

FIGURE 3: Quantitative analysis of the cytotoxic effect of anthracyclines on iPSC-derived cardiomyocytes using flow cytometry.

Panel A: Following cell culture in a dish, signal-regulatory protein alpha (SIRPA) was used to isolate all iPSC-CM using a predefined threshold of SIRPA expression.
Panel B: Following isolation using SIRPA expression, the two dyes 7 aminoacindomycin D (7AAD) and annexin V allows assessment of its vital status: necrotic cell (Q1, upper left quadrant), late apoptotic cell (Q2, upper right quadrant), living cell (Q3, lower left panel) or early apoptotic cell (Q4, lower right quadrant). These are cell that were not exposed to doxorubicin
Panel C: The same quadrants after exposure to 10 µM doxorubicin during 6h, 48h read-out
Panel D: Percentage of living cells, early apoptosis, late apoptosis and necrosis depending on dosage ranging from 0 to 100 µM

Conclusion(s): iPSC-CMs were used to predict the cytotoxic effect of doxorubicin using FC analysis. Our approach can be further developed to examine the inter-individual susceptibility of patients to cytotoxicity following anthracycline exposure.

Role of platelet GARP in TGF-B activation

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[a]Université Catholique de Louvain, Brussels, Belgium; [b]Université de Strasbourg, Strasbourg, France; [c]University of Würzburg, Würzburg, Germany; [d]Cliniques Universitaires Saint-Luc, Brussels, Belgium

Background/Introduction: Transforming growth factor (TGF)β is known to be a central player in the control of cardiac fibroblast properties and fibrosis. However, cellular and molecular mechanisms that trigger its activation remain poorly understood. Platelets are considered as a major source of TGFβ and recent evidence suggests that they are involved in TGFβ activation via Glycoprotein A Repetitions Predominant (GARP) present on their surface.
Purpose: The present study sought to evaluate the role of platelet GARP in TGFβ activation using platelet-specific GARP knockout mice.
Methods: We generated a new Cre transgenic mouse strain that allowed Megakaryocyte/platelet specific invalidation of GARP (Gp1ba-Cre x GARPfl/fl). The impact of GARP deficiency on platelet function was measured *in vitro* by flow cytometry using thrombin and CRP. Serum production of total and active TGFβ was assessed by ELISA.
Results: Platelet count and other haematological parameters were normal in platelet-specific GARP knockout mice, except platelet volume, which was increased by 10.3%, as compared to wild-type platelets. Stimulation by thrombin and CRP increased GARP exposure at the platelet surface. However, platelets without GARP displayed normal agonist-induced activation, as reflected by CD62P and aIIb3 exposure. Interestingly, the generation of active TGFβ was drastically impaired in the serum of platelet-specific GARP knockout mice, while the amount of total TGFβ was not affected.
Conclusion(s): We provided evidence that platelet GARP is a crucial contributor to the systemic activation of TGFβ. Future work will aim to determine its role in cardiac fibroblast myodifferentiation and fibrosis.

Progressive left ventricular electro-mechanical remodelling in presence of left bundle branch block

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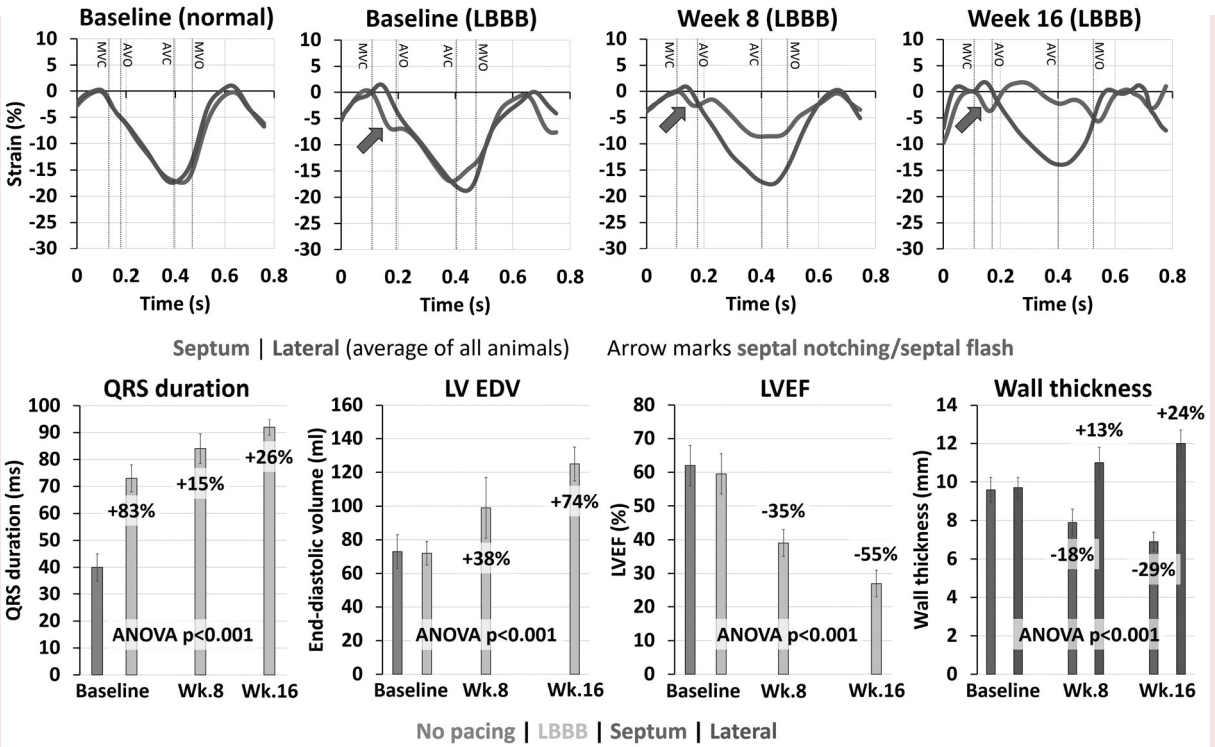
Background/Introduction: Recent cross-sectional studies suggest a relationship between persisting LBBB and the extent of LV electro-mechanical-remodelling over-time. A longitudinal study using an animal model could enlighten the relationship between the onset of LBBB and electro-mechanical-remodelling.
Purpose: To investigate the progressive remodelling that develops over time in an animal model of LBBB.
Methods: Fifteen sheep were subjected to DDD-pacing, inducing an LBBB-like-conduction-delay. All animals underwent an 8-week pacing protocol, whereas five of them underwent 16 weeks. Septal and lateral strain and end-diastolic wall-thickness were assessed. Cardiac-magnetic-resonance-imaging was used to determine LV volumes and LVEF.
Results: At baseline, DDD-pacing increased QRS-duration (+83%; $p < 0.0001$) and induced LBBB-like-mechanical-dyssynchrony, with mild early-systolic septal-notching and preserved systolic-shortening. Lateral pre-stretch was followed by increasing systolic shortening. After 8 weeks of DDD-pacing, mechanical dyssynchrony worsened: septal-notching increased, with reduced systolic shortening. After 16 weeks, early septal shortening was followed by profound stretching throughout systole. Lateral shortening was reduced ($p < 0.05$). QRS-duration progressively increased by +15% (week 8) and +26% (week 16) (all $p < 0.001$). End-diastolic-volumes increased by +38% (week 8) and +74% (week 16), whereas LVEF decreased by –35% (week 8) and –55% (week 16) (all $p < 0.001$). Septal thickness reduced by –18% (week 8) and –29% (week 16), while lateral thickness increased by +13% (week 8) and +24% (week 16) (all $p < 0.05$).



Conclusion(s): A persisting LBBB induces progressive changes in LV deformation-patterns, and triggers morphological- and electrical-remodelling, strengthening the concept of LBBB-induced-cardiomyopathy. In the clinic, patients with mild dysfunction should be closely monitored for potential disease progression to treat dyssynchrony as soon as guideline indications are reached. Further studies need to show if earlier CRT implantation might prevent further LV deterioration.

Acetyl-CoA carboxylase inhibition alters tubulin acetylation and aggregation in thrombin-stimulated platelets

Laurence Pirotton[a], Marie Octave[a], Audrey Ginion[a], Valentine Robaux[a], Sophie Lepropre[a], Victor Darley-Usmar[b], Jérôme Ambroise[c], Bruno Guigas[d], Martin Giera[d], Marc Foretz[e], Luc Bertrand[a], Christophe Beauloye[a] and Sandrine Horman[a]

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Background/Introduction: Acetyl-CoA carboxylase (ACC) is the first enzyme regulating de novo lipogenesis via the carboxylation of acetyl-coA into malonyl-coA. ACC inhibition decreases lipogenesis but increases the content of acetyl-CoA which can serve as a substrate for protein acetylation. Several findings support the role of acetylation in the coordination of signalling pathways driving platelet cytoskeletal remodelling and aggregation.
Purpose: To demonstrate that ACC inhibition may affect tubulin acetylation and platelet functions.
Methods: Human platelets were treated for 2 h with CP640.186, a pharmacological ACC inhibitor, before thrombin stimulation. Platelet functions were assessed by aggregometry and flow cytometry. Lipogenesis was measured *via* ^{14}C-acetate incorporation into lipids. Lipidomics analysis was carried out on the commercial Lipidyzer platform. Protein phosphorylation and acetylation were evaluated by western blot.
Results: Short-term ACC inhibition with CP640.186 drastically decreased platelet lipogenesis without affecting the global platelet lipid content but it was sufficient to increase the level of tubulin acetylation, at the basal state and after thrombin stimulation. This increase was associated with an impaired platelet aggregation which was not due to alterations in platelet secretion processes. Similar results were obtained when human platelets were pre-treated with tubacin, a tubulin deacetylase HDAC6 inhibitor. Both ACC and HDAC6 inhibition blocked key platelet signalling events, such as Rac1 GTPase activation and phosphorylation of its downstream effector, the p21-activated kinase 2 (PAK2). Surprisingly, neither CP640.186 nor tubacin affected the actin cytoskeleton remodelling but both treatments significantly decreased ROS production in response to thrombin.

Conclusion(s): In human platelets, ACC inhibition limits tubulin deacetylation which impairs platelet aggregation with subsequent downregulation of the Rac1/PAK2 pathway and a decrease in ROS generation.

Platelet-specific acetyl-CoA carboxylase 1 deletion decreases phospholipid content and impairs platelet functions

Marie Octave[a], Laurence Pirotton[a], Audrey Ginion[a], Valentine Robaux[a], Yotis Senis[b], Zoltan Nagy[c], Jérome Ambroise[d], Bruno Guigas[e], Martin Giera[f], Luc Bertrand[a], Christophe Beauloye[a] and Sandrine Horman[a]

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Background/Introduction: Acetyl-CoA carboxylase (ACC) catalyzes the first step of de novo lipogenesis (DNL). Pharmacological inhibition of ACC has been of interest for therapeutic intervention in a wide range of diseases, including cardiovascular diseases and cancers. However, the impact of its inhibition on haemostasis remains under-investigated.
Purpose: We previously demonstrated that ACC1 activation promotes thrombus formation by increasing platelet phospholipid content and thromboxane A2 generation. Here, we sought to evaluate the impact of its platelet-specific deletion on platelet lipid content and functions.
Methods: We generated a new Cre transgenic mouse strain that allows megakaryocyte/platelet specific ACC1 deletion (GpIbCre$^{+/-}$ x ACC1 flx/flx mouse). *In vitro*, platelet functions were assessed by aggregometry and flow cytometry. Lipidomics analysis was carried out on the commercial Lipidyzer platform. Thromboxane A2 secretion was evaluated by ELISA.
Results: As expected, ACC1 deletion was restricted to the megakaryocytic lineage. Haematological parameters in platelet-specific ACC1 knockout mice (ACC1 pKO) showed a decrease in platelet count by 30% and an increase in platelet volume by 31%, compared to ACC1 floxed platelets. *In vitro*, ACC1 pKO platelets displayed impaired thrombin- and CRP-induced platelet aggregation, associated with reduced dense granules secretion. In contrast, ADP-induced platelet aggregation was higher in absence of ACC1. In agreement with our previous studies, lipidomics analyses showed that ACC1 deletion in platelets was associated with a significant decrease in arachidonic acid-containing phosphatidylethanolamine plasmalogen, and subsequently with reduced production of thromboxane A2 upon thrombin or CRP stimulation.
Conclusion(s): Together, these findings indicate that ACC1 inhibition affects platelet lipidome with consequences on platelet formation and functions. This suggests clinical implications for DNL inhibitors as a new class of therapeutics.

Gender differences in risk factor management and pharmacological treatment among CHD patients: Belgian results of the EUROASPIRE IV and EUROASPIRE V surveys

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Background/Introduction: Although the prevalence of coronary heart disease (CHD) is slowly declining in Belgium, it remains one of the leading causes of mortality and morbidity for both men and women.
Purpose: Little is known about the implementation of the regularly updated European guidelines on CVD prevention in Belgium in comparison to other European high-income countries. We evaluated to what extent Belgian CHD patients were managed in line with the 2016 JES European guidelines on cardiovascular disease prevention in daily clinical practice with a particular focus on gender and the comparison with other high-income countries.
Methods: Analyses were based on the ESC-EORP EUROASPIRE IV and EUROASPIRE V surveys. Information was available on patients from 19 high-income countries. They had been admitted to the hospital for a coronary event 6 months to 2 years before the study visit. Findings were compared between Belgium and other high-income EUROASPIRE countries (World Bank Atlas definition).
Results: Patient information was available for 10,519 patients of which 23.8% were women. Overall, women were significantly older compared to men (66.8 *vs.* 64.4 years). Regarding risk factor levels, women were significantly more inactive (OR = 1.31, 95% CI = 1.19–1.44), were more obese (OR = 1.37, 95% CI = 1.25–1.50), and had a worse LDL-C control (OR = 1.52, 95% CI =1.36–1.70). Interaction testing demonstrated that the findings in Belgium were however fully in line with the observations

made in other high-income EUROASPIRE countries. Similar results were found for pharmacological treatment at the time of the study visit. Women were less likely to use ACE-I/ARBs (OR =0.84, 95% CI =0.76–0.94) and statins (OR =0.79, 95%CI =0.70–0.90) but these results did not differ significantly between Belgium and the other high-income countries.
Conclusion(s): Compared to other high-income EUROASPIRE countries, gender differences in risk factor control and pharmacological treatment in CHD patients from Belgium do not seem to be significantly different.

Different left ventricular pressure-volume area and stroke work in different ventricular afterload between descending thoracic compares to ascending aortic stenosis associated for ventricular arrhythmia

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Background/Introduction: The difference between intraventricular coupling in the early stage of chronic HF and its relation to ventricular arrhythmia occurrence are inconclusive in left ventricular hypertrophic remodelling.
Purpose: To assess left ventricular stroke work, effective work, and pressure-volume loops area in descending thoracic compares to ascending aortic stenosis resulting with chronic late *vs.* early systolic LV load in HFPEF and its association to ventricular arrhythmia occurrence on 4th and 8th week, using pressure-volume assessment loops plane analysis.
Methods: Fourteen domestic male pigs (28 ± 3 kg) having mild to moderate descending thoracic or ascending aortic stenosis underwent cMRI and invasive left ventricular P-V loops measurements (Millar 5Fr pig-tailed conductance catheter) on 4th and 8th week of aorta banding. LV stroke work and PVA were analysed for MVO2 demand in hypertrophic remodelling resulting from different LV afterload (late *vs.* early LV afterload) and in ventricular arrhythmia occurrence to define early adverse LV hypertrophic remodelling. Data were compared with two-way repeated-measures ANOVA, considering significant $p < 0.05$.
Results: Left ventricular SW was different, so were bPVA and $bMVO_2$ demand (Figure 1), being greater in hypertrophic LV remodelling associated with chronic late LV afterload in descending thoracic aortic stenosis compared to ascending aortic stenosis creating early systolic LV load on 8th week, for the Burkoff method of analysis (*post-hoc* $p = 0.02$). Effective LV work was associated with a difference in aorta banding in LL *vs.* EL ($p = 0.027$). In an analysis for ventricular arrhythmia presence, MVO_2b was different significantly between DB *vs.* AB ($p = 0.027$) and compared to normal rhythm ($p = 0.044$). Indexed MVO_2 was different between groups ($p = 0.008$), in arrhythmia ($p = 0.012$) and compares to normal rhythm ($p = 0.029$), associating for difference in LV afterload in descending thoracic *vs.* ascending aortic stenosis ($p = 0.04$). The difference in LV afterload associated with linear MVO_2 and effective LV work in LL *vs.* EL associated hypertrophic LV remodelling in presence of arrhythmia *vs.* normal rhythm ($p = 0.02$).
Conclusion(s): MVO_2 is affected earlier in hypertrophic remodelling in DB compared to AB being associated with ventricular arrhythmia occurrence in the porcine HFpEF model of different LV afterload, and effective LV work in presence of higher left ventricular stroke work.

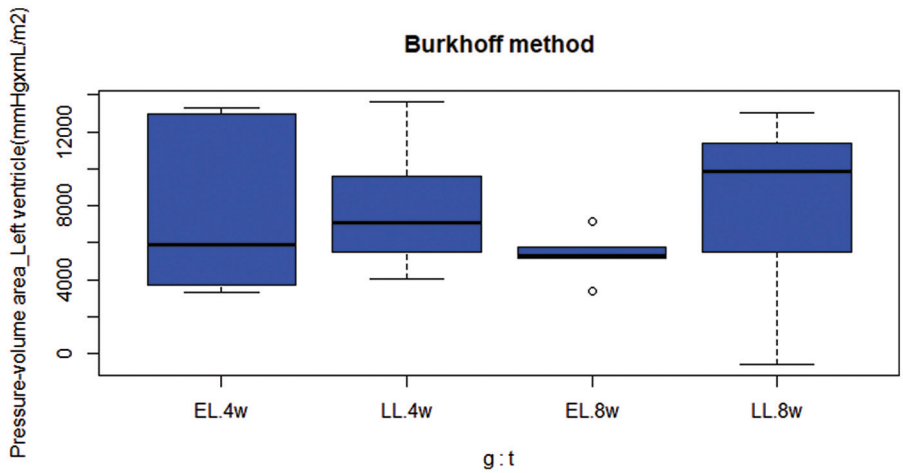

Figure 1.

#Pericyte loss results in the development of heart failure with preserved ejection fraction

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Background/Introduction: Heart failure with preserved ejection fraction (HFpEF) is a complex heterogeneous disease for which we have limited pathological understanding. Microvascular dysfunction has been proposed to drive HFpEF progression, however, the onset and triggers remain unknown.
Purpose: We aimed to investigate the pathophysiological progression of HFpEF in a rodent model of the disease.
Methods: We used the obese ZSF1 rat to investigate cardiac microvascular changes in relation to key pathological features of HFpEF. Additionally, $PDGF^{ret/ret}$ mice, with a mutation in the platelet-derived growth factor (PDGF) retention sequence leading to a loss in pericyte coverage, were used to investigate the effect of the loss of pericytes on the development of HFpEF.
Results: HFpEF-associated risk factors developed early (6 and 14 weeks) triggering capillary endothelial abnormalities (activation and junctional remodelling), pericyte loss, and cardiomyocyte hypertrophy as early as 14 weeks. Though rarefaction was not observed until 21 weeks, active capillary regression was present at 14 weeks, indicated by the presence of empty collagen sleeves. Stimulation of endothelial cells and pericytes with the same metabolic stressors (either high glucose, low-density lipoprotein, or H_2O_2) indicated that pericytes were more sensitive to these stresses. Since the loss of pericytes can cause endothelial activation and vessel regression, we investigated the effect of pericyte loss on cardiac function. $PDGF^{ret/ret}$ animals developed diastolic dysfunction without exposure to any comorbidities. Cardiac hypertrophy and fibrosis were also present similar to the phenotype in the ZSF1 rats.
Conclusion(s): Overall, our findings show that microvascular dysfunction occurs before the onset of other pathological processes. We propose that pericytes are more susceptible to metabolic stressors and that loss of pericytes leads to HFpEF.

CARDIO PREVENTION

Correlation between the Belgian SCORE table and the new SCORE2 table

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Background/Introduction: The use of the Belgian SCORE table is recommended by the Belgian Society of Cardiology (BSC) as the reference table for categorizing cardiovascular risk in primary prevention. The latest cardiovascular prevention guidelines (ESC 2021) recommend the use of a new SCORE2 risk table.
Purpose: The purpose of this study is to compare risk categorization using these two risk tables and the objective is to observe changes in risk categorization in a population of primary prevention patients seen in cardiology consultations.
Methods: We assessed the cardiovascular risk of primary prevention patients. The low and moderate risk categorization of the Belgian SCORE table was combined as in the SCORE2 table.
Results: Two hundred and two patients were included in the analysis. Comparing the changes between the Belgian SCORE table and the SCORE2 table, out of 170 low/moderate risk patients, 66 patients (38.8%) remained in the same category, and 103 (60.6%) moved to high risk, and 1 moved to very high risk. None of the 22 high-risk patients were downgraded, 16 patients (72.7%) remained at high risk, and 6 patients (27.3%) were upgraded to very high risk. Of the 10 very high-risk patients, 3 (30%) moved to high risk, and the other 7 (70%) did not change category. Overall, there is 44% agreement in the risk categories between the 2 tables.
Conclusion(s): The concordance between the Belgian SCORE table and the new SCORE2 table is poor. More than half of the patients change the category, the majority of whom go from low/moderate risk to high risk, which could imply different therapeutic attitudes depending on the table used. According to the published study, the SCORE2 table more adequately assesses cardiovascular risk, and given this poor agreement, we should opt to use it in our daily clinical practice.

Determinants of participation in cardiac telerehabilitation during the first surge of the COVID-19 pandemic

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Background/Introduction: Cardiac rehabilitation (CR) is considered a Class IA recommendation for secondary prevention of ischemic heart disease and heart failure. Participation rates are low, however. Telerehabilitation (TR) is widely studied to overcome known barriers. During the first surge of the COVID-19 pandemic, the shutdown of CR facilities in Belgium led to the first real-life implementation of cardiac TR.
Purpose: This study aimed to characterise the patient population that had for the first time the opportunity to participate in cardiac TR and to analyse if there were determining factors for participation or non-participation in TR.
Methods: This retrospective study examined all patients with cardiovascular disease enrolled in CR at the Jessa Hospital in Hasselt during the first wave of the COVID-19 pandemic in Belgium between 17th of March and 30th of April 2020. Baseline characteristics were collected. *t*-Tests, Pearson chi-square tests, and logistic regression were used to determine the correlation of certain variables with participation in TR.
Results: Two hundred and eight (69%) patients participated in TR. No correlation was found between participation or non-participation in TR and the analysed baseline characteristics (age, gender, BMI, index event, starting rehabilitation before or during the COVID lockdown, device telemonitoring, or comorbidities).
Conclusion(s): This study is the first study to analyse real-life data about TR participation rates. In a population of conventional CR participants, and if TR is the only option offered, participation rates are high (69%). No correlation was found between willingness to participate and baseline characteristics. Further research is needed to assess determinants, barriers, and facilitators of TR.

The Walk Hop program: a French innovative multicentric telerehabilitation initiative

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Background/Introduction: About 80,000 patients are hospitalised in France each year with the acute coronary syndrome. Thanks to pharmacological and revascularisation progress, the major challenge now is to ensure a sustained improvement in the health condition and avoid severe complications. Cardiac rehabilitation has demonstrated high scientific evidence, however only one patient in three benefits from centre-based cardiac rehabilitation (CBCR).
Purpose: The objective of the 'Walk Hop' program is to demonstrate that home-based cardiac telerehabilitation (HBCT) is a complementary approach to CBCR and can increase the proportion of patients gaining benefit from a rehabilitation program.
Methods: The study design is a multicentre implementation program. Three thousand two hundred coronary patients with a RARE score below 4 will be recruited in eight participating cardiac rehabilitation centres (CRC). The total duration of the experimentation is 42 months. The study is supported financially by the French authorities. Based on an initial evaluation performed at the CRC, the cardiologist will propose the telerehabilitation solution developed by Ensweet to patients who are eligible for HBCT. This multidisciplinary platform consists of a secured portal and an application allowing the patient to exchange with the CRC. Patients will be equipped with a cycloergometer and a heart rate monitor. The patient application will provide personalised rehabilitation sessions and therapeutic education selected by the CRC and will collect data from the performed sessions, adherence to the programme, medication compliance, symptoms, and quality of life.
Results: Final results of this implementation program are expected in 2024.
Conclusion(s): The Walk Hop program will investigate the implementation of a smartphone supported telemonitoring and digital support intervention. Expected impacts are an improved cost-effective access to rehabilitation programmes and development of an ambulatory healthcare organisation in cardiology.

HEART FAILURE

HELIOS-A: 9-month subgroup analyses and exploratory efficacy results from the phase 3 study of vutrisiran in patients with hereditary transthyretin-mediated amyloidosis with polyneuropathy

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Background/Introduction: Hereditary transthyretin-mediated (hATTR) amyloidosis, also known as ATTRv amyloidosis, is a progressive, life-threatening, multisystem disease. Vutrisiran is an investigational RNA interference (RNAi) therapeutic targeting variant and wild-type *TTR* for the treatment of ATTR amyloidosis.
Purpose: The 9-month HELIOS-A subgroup analyses and exploratory efficacy results are presented.
Methods: HELIOS-A is a Phase 3, global, open-label study of vutrisiran 25 mg subcutaneous injection once every 3 months in patients with ATTRv amyloidosis with polyneuropathy (NCT03759379). Patients were randomized (3:1) to vutrisiran or patisiran, a reference comparator approved for hATTR amyloidosis with polyneuropathy based on the APOLLO study. External control for most endpoints is the APOLLO placebo group ($n = 77$). Month 9 endpoints include change from baseline in neuropathy impairment (mNIS +7 [primary]) quality of life (QOL; Norfolk QOL-DN [secondary]) and gait speed (10-MWT [secondary]) *vs.* external placebo. Exploratory endpoints at month 9 include nutritional status (mBMI), disability (R-ODS), QOL (EQ-VAS), neuropathy impairment (NIS), and cardiac biomarker (NT-proBNP). The primary population was the modified intention-to-treat (all randomized patients who received $\geq$1 dose of vutrisiran or placebo [mITT]). A prespecified cardiac subpopulation was included (baseline left ventricular wall thickness $\geq$1.3 cm and no medical history of aortic valve disease or hypertension).
Results: HELIOS-A enrolled 164 patients (vutrisiran, $n = 122$; patisiran, $n = 42$). As previously reported, month 9 primary and secondary endpoints were met. mNIS +7 and Norfolk QOL-DN were consistently improved with vutrisiran across all patient subgroups and subcomponents *vs.* external placebo. mBMI (LS mean difference 67.8; $p = 8.5 \times 10^{-8}$), R-ODS (4.3; $p = 3.3 \times 10^{-7}$), EQ-VAS (9.8; $p = 0.0001$), and NIS (−13.7; $p = 1.1 \times 10^{-13}$) were improved *vs.* external placebo. NT-proBNP was reduced *vs.* external placebo in both the mITT population (adjusted geometric fold change ratio: 0.6; $p = 9.2 \times 10^{-7}$) and the cardiac subpopulation (0.6; $p = 0.0016$).
Conclusion(s): At 9 months vutrisiran significantly improved multiple endpoints compared with external placebo, indicating benefit across various areas of patient health and function.

Metabolic syndrome in rats as a cause of HFpEF

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Background/Introduction: Heart failure with preserved ejection fraction (HFpEF) is triggered by metabolic risk factors, such as obesity, *diabetes mellitus*, and hypertension. The prevalence of HFpEF is increasing and there are currently little evidence-based therapies. A key obstacle to testing new drugs is the availability of animal models for HFpEF.
Purpose: As patients with HFpEF very often present with comorbidities comprising the metabolic syndrome, we hypothesized, that metabolic syndrome in aging animals could lead to the development of diastolic dysfunction and HFpEF. In this context, the aim of the present study was to characterize the overtime development of HFpEF in rats with a polygenic predisposition to develop obesity fed with high-fat diet (HFD).
Methods: Obese prone (OP) and obese resistant (OR) Sprague Dawley rats were respectively fed with an HFD or a standard rat chow (Std) for 4 months or for 12 months ($n = 10$ rats in each group; four groups). Abdominal obesity, glucose tolerance test,

and lipidemia were evaluated. Echocardiography and invasive left ventricular pressure measurement were performed. Before euthanasia of the animals, blood was sampled. Myocardial tissue was collected for histological and RNA-sequencing analysis.
Results: After 4- and 12-month HFD, OP rats presented increased body and abdominal fat weights, altered glucose tolerance test, and dyslipidaemia. In OP rats, left ventricular systolic (164 ± 6 *vs.* 120 ± 5 mmHg, $p < 0.001$) and end-diastolic pressures (1.9 ± 0.3 *vs.* 9.2 ± 1.9 mmHg, $p < 0.05$) were increased after 12-month HFD. Echocardiography showed increased left ventricular mass and relative surface area in 12-month HFD fed OP rats, with preserved ejection fraction. In 12-month HFD fed OP rats, circulating NT-proBNP levels were decreased while ST2 levels increased. Clusters of genes implicated in fatty acid metabolism and calcium-dependent contraction were identified as the most disrupted pathways in 12-month HFD fed OP rats.
Conclusion(s): HFH during 12 months in OP rats led to the development of an HFpEF animal model, suitable for investigating novel therapeutic interventions.

Assessment of the interest in current practice of the algorithm HeartLogic

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Background/Introduction: The HeartLogic algorithm combining the data of multiple sensors integrated into ICD (Implantable Cardioverter Defibrillator) and CRT-D (Cardiac Resynchronization Therapy Defibrillator) has demonstrated the capacity to alert before the occurrence of the majority of heart failure events. The test sensitivity is 70% with an average time between the alert and the event of 34 days and an unexplained alert rate of 1.47 alerts per patient-year.
Purpose: We analysed in a retrospective evaluation the algorithm's efficacy in our centre. We evaluated patients with heart failure with reduced ejection fraction implanted with ICD or CRT-D. The algorithm was present from the time of implantation but data were unknown to the cardiologist.
Methods: Algorithm sensitivity: Number of heart failure events that occurred within 2 months of alert (alert threshold of 16), compared to the total number of heart failure events (with or without alert). **Unexplained alert rate:** number of alerts per patient-year not followed by a heart failure event within 2 months.
Results: Forty alerts were reported in 22 patients (January 2018 to July 2021) including 7 followed by a heart failure event (unexplained alert rate of 0,70 per patient-year). Ten heart failure events were recorded including 7 preceded by an alert (sensitivity of 70%).
Conclusion(s): Our retrospective analysis, describing one experiment of the HeartLogic algorithm in clinical practice, indicated that it is useful in the early detection of heart failure events.

#Ambulatory haemodynamic-guided management reduces heart failure hospitalisations in a multicentre European heart failure cohort

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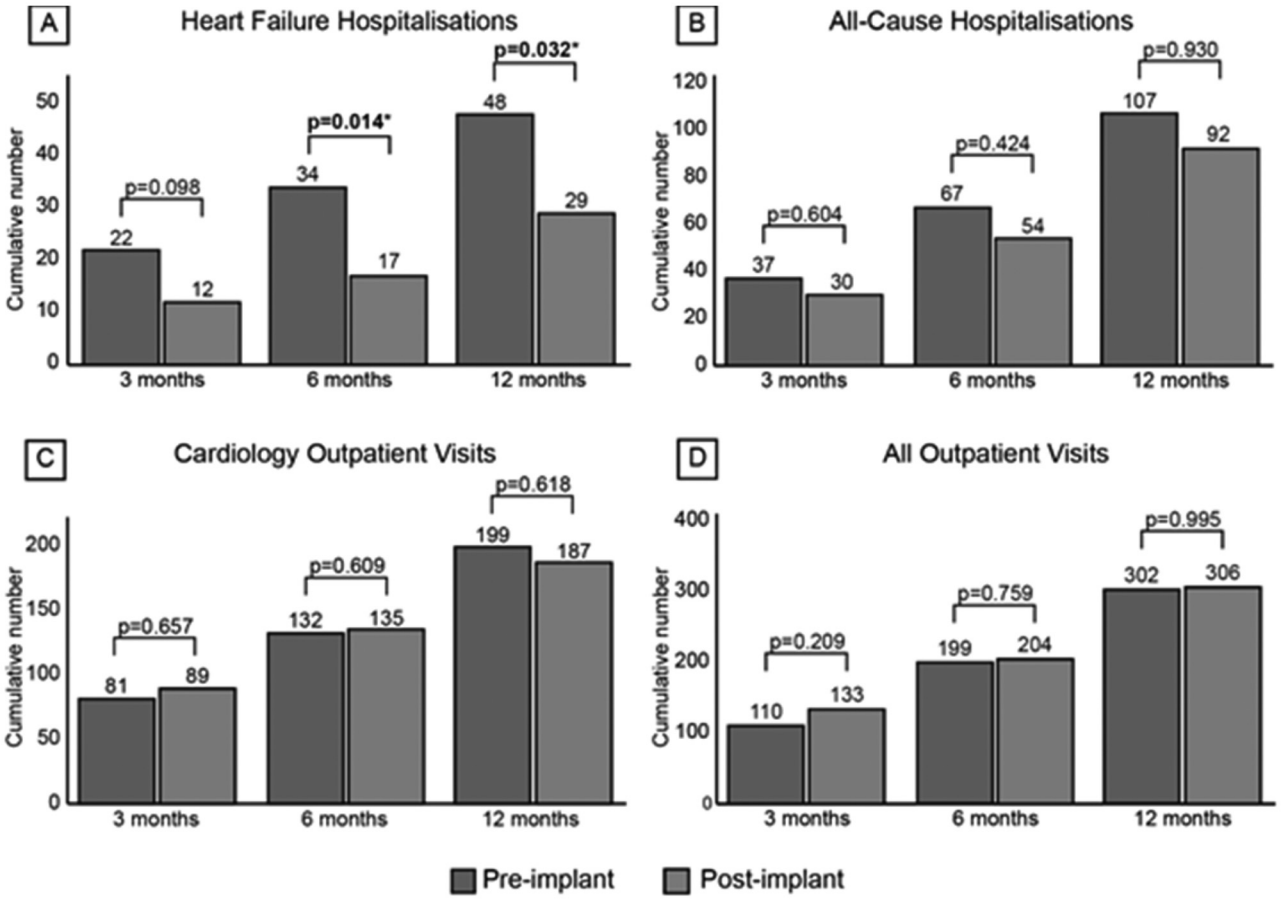
Background/Introduction: European experience with haemodynamic-guided ambulatory heart failure (HF) management using a pulmonary artery pressure (PAP) sensor is limited.
Purpose: To study the efficacy of PAP sensor guided therapy in a multinational real-world European population.
Methods: Data were retrospectively collected from three tertiary care centres. The study endpoints were a total number of diuretic changes, HF hospitalisations, all-cause hospitalisations, cardiology outpatient visits, and all outpatient hospital visits. The endpoints were compared between the pre- and post-implant period at 3, 6, and 12 months with every patient serving as its own control. HF-related health care costs were compared at 6 and 12 months.
Results: A PAP sensor was implanted in 48 consecutive HF patients (30 CardioMEMS devices and 18 Cordella devices), between April 2015 and January 2021 with a median follow-up of 19 (13–30) months. Patients were 71 years old, 25.0% were female, 68.8% had HF with reduced or mildly reduced ejection fraction, NTpro-BNP was 1801 pg/mL and baseline mPAP was 26 mmHg. There was a significant increase in the number of diuretic changes after 1 year (118 *vs.* 195; $p = 0.005$). The number of HF hospitalisations was significantly reduced after 6 months (Figure 1). There was no difference in the number of all-cause hospitalisations, cardiology outpatient visits, and all outpatient visits. The heart failure related health care costs per patient dropped from € 6286 to € 3761 at 6 months ($p = 0.012$) and from €8960 to €6167 at 12 months ($p = 0.032$).



Conclusion(s): Ambulatory haemodynamic-guided HF management led to a reduction in HF hospitalisations already after 6 months and reduced HF-related health care costs.

*AMPK and O-GlcNAcylation: a new paradigm to protect the failing hypertrophic heart

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Background/Introduction: Cardiac hypertrophy is initially an adaptive response that allows the heart to maintain cardiac output but can become maladaptive and lead to heart failure (HF). We have previously shown that AMP-activated protein kinase (AMPK) activation prevents cardiac hypertrophy development by decreasing O-GlcNAcylation, a post-translational modification of proteins increased during cardiac hypertrophy and HF.
Purpose: The purpose of this study is to see if AMPK activation can also reverse cardiac hypertrophy when already developed, potentially preventing its evolution to HF.
Methods: *In vitro* hypertrophy is induced in neonatal rat cardiomyocytes using the pro-hypertrophic agent phenylephrine (PE) before AMPK activation using different AMPK activators (991, A769662, AICAr, Phenformin). *In vivo* hypertrophy is induced by trans-aortic constriction (TAC) and AMPK is activated by metformin 3 weeks post-operation. To see the implication of O-GlcNAcylation in this process, we used pharmacological O-GlcNAc inducers (ThiametG, PUGNAc, or NButGT). Cardiac hypertrophy is evaluated by measurement of cell surface area and expression of pro-hypertrophic markers (ANP, BNP, β-MHC) and cardiac functions by echocardiography. O-GlcNAc levels are evaluated by western blotting.

Results: We showed that PE-induced hypertrophy is accompanied by an increase in O-GlcNAc level. Both cardiomyocyte hypertrophy and O-GlcNAc levels are reversed by AMPK activators, such inhibition disappearing when AMPK is knocked-down using siRNA. *In vivo*, cardiac hypertrophy is also accompanied by an increase in O-GlcNAc levels. Interestingly, metformin-mediated AMPK activation reduces O-GlcNAc levels and improves cardiac function in WT mice, those effects being absent in AMPK deficient mice. Finally, treatment with O-GlcNAc inducers counteracts the beneficial action of AMPK activators both in *vitro* and *in vivo*.
Conclusion(s): AMPK activation improves cardiac function by reducing O-GlcNAc levels, underling new potential therapeutic possibilities in the prevention of hypertrophy-mediated HF.

*SARS-CoV-2 infection causes cardiomyocyte swelling, cardiac pericyte loss, increased permeability, and diastolic dysfunction in a hamster model

Margo Daems

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Background/Introduction: Recovered COVID-19 patients often display cardiac dysfunction, even after a relatively mild infection.
Purpose: We present an in-depth physiological and histological timeline of the cardiac consequences of SARS-CoV-2 infection using a hamster model.
Methods: We used several methods, including transthoracic echocardiography, RNA sequencing on *in vitro* cultures, and *in-situ* hybridization techniques, complemented with histological analysis.
Results: We analysed cardiac function by echocardiography over a period of 35 dpi. Already by 14 dpi and continuing at 35 dpi, infected hamsters presented with an increased E/E', decreased MV deceleration time, and an increased isovolumetric contraction time as compared to control, indicating the presence of diastolic dysfunction. Histologically, cardiomyocytes were enlarged already by 4 dpi and remained enlarged over 5 weeks. We observed the presence of fibrin-rich microthrombi at 4 dpi, which were resolved by 14 dpi. SARS-CoV-2 RNA was present in cardiac pericytes, accompanied by reduced pericyte coverage of capillaries at 4 dpi and 14 dpi, which mostly recovered by 35 dpi. At 14 dpi, the reduced pericyte coverage coincided with increased vascular permeability, suggesting that SARS-CoV-2 infection of pericytes affects microvascular integrity. SARS-CoV-2 infection of pericytes *in vitro* induced the expression of genes involved in viral defence, and affected genes involved in pericyte contractility and extracellular matrix proteins. Loss of cardiac pericytes was observed in cardiac biopsies from patients recovered from SARS-CoV-2 infection.
Conclusion(s): Overall, our results demonstrate that SARS-CoV-2 infection causes a phenotype similar to ischemia-reperfusion, without overt ischemia. We propose that partial occlusion by microthrombi and microvascular dilation caused by pericyte loss induces regional variations in blood flow, and results in a stiffer 'swollen' heart that shows diastolic dysfunction.

Combined lenalidomide/bortezomib for multiple myeloma complicated by fulminant myocarditis: a rare case report of widely used chemotherapy

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Background/Introduction: Drug-induced myocarditis is a rare complication of certain cancer treatments, characterized by the development of myocardial inflammation shortly after initiation of treatment, potentially leading to heart failure and/or malignant arrhythmias. The development of eosinophilic myocarditis after administration of lenalidomide has been described and bortezomib has been associated with the development of cardiomyopathies and atherosclerosis.
Purpose: We report a case of therapy-induced myocarditis in a patient treated with the combination of radiotherapy and bortezomib-lenalidomide-dexamethasone (VRd) for multiple myeloma. To our knowledge, this is the first case presenting with myocarditis as part of a reactive hypersensitivity syndrome without cardiac symptoms, highlighting the importance of screening for this rare but potentially fatal complication even in the absence of cardiac symptoms.
Methods: We report the case of a patient who presented at our hospital and discusses relevant literature.
Results: A 69-year-old woman was diagnosed with Multiple Myeloma, underwent local radiotherapy for a pathological fracture of the fourth lumbar vertebra, and was treated with bortezomib-lenalidomide-dexamethasone. Within 19 days after therapy initiation, she presented with gastro-intestinal symptoms, an erythematous pruritic rash, and general fatigue. Surprisingly, routine ECG showed upwardly concave ST-elevation in I and aVL and ST-depressions in II, III, and aVF. Troponin levels were markedly elevated. A complete blood count revealed eosinophilia. Based on further cardiac work-up, she was diagnosed with drug-induced myocarditis. Endomyocardial heart biopsy did not reveal any abnormalities, probably due to sampling error. After discontinuation of chemotherapy and prompt treatment with high doses of corticosteroids, the patient recovered.

Conclusion(s): Diagnosis of drug-induced myocarditis can be challenging. Early diagnosis and treatment are crucial, warranting alertness for suggestive symptoms. Cardiac biomarkers, ECG monitoring, and cardiac MRI are key to confirm the diagnosis. Every patient presenting with eosinophilia and/or acute onset of auto-immune symptoms after initiation of therapy with lenalidomide/bortezomib deserves a prompt cardiac screening. The golden standard remains an endomyocardial biopsy, although sampling error may occur.

Survival analysis of a large Belgian heart failure cohort with reduced ejection fraction

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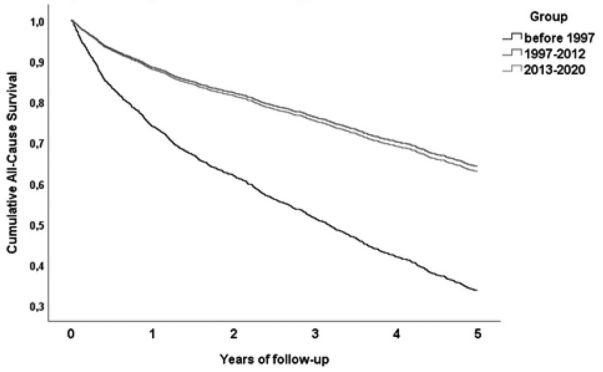
Background/Introduction: The therapeutic management of heart failure has evolved over the past 20 years. Indeed, before 1997, patients with heart failure with reduced ejection fraction (HFrEF) were mainly treated with angiotensin-converting enzyme inhibitors (ACEi). After 1997, several clinical trials demonstrated the benefit of beta-blockers and from 2012, the use of mineralocorticoid receptor antagonists (MRAs) was recommended by AHA guidelines.
Purpose: Our aim is to evaluate and analyse clinical characteristics, treatment evolution, and long-term outcomes in a large cohort of HFrEF patients.
Methods: Between 1994 and 2020, 2512 patients were included at the time of diagnosis of HFrEF and prospectively followed for a primary endpoint of all-cause mortality at 5 years. Patients were classified according to the time of enrolment (group 1: before 1997, group 2: 1997–2012, group 3: 2013–2020). All-cause mortality was analysed using univariate Cox regression analysis.
Results: Of the 2512 patients, 67 patients were included in group 1, 1805 in group 2, and 640 in group 3. Patients in groups 2 and 3 were significantly older and had more comorbidities, such as hypertension and chronic obstructive pulmonary disease than patients in group 1 (Table 1). Over time, the prevalence of ischemic heart disease decreased and the use of beta-blockers and MRAs increased. A total of 925 (37%) patients died after five years. After adjustment for age and ischaemic aetiology, all-cause mortality was lower in group 2 (HR 0.41, CI95% 0.29–0.58, $p \leq 0.001$) and group 3 (HR 0.43, CI95% 0.30–0.61, $p \leq 0.001$) compared to group 1 (Figure 1).
Conclusion(s): In heart failure with reduced ejection fraction, a significant improvement in survival was observed over the last 20 years, clearly related to better therapeutic management.

Table 1. Baseline characteristics of patients with HFrEF according to time of enrolment.

	All	Group 1 Before 1997	Group 2 1997-2012	Group 3 2013-2020	P-value
	N=2512	N=67	N= 1805	N=640	
Age, years, mean (SD)	64 (13)	61 (11)	64 (4)	65 (13)	P=0.01
Women, n (%)	590 (24)	11 (16)	431 (24)	148 (23)	P=0.4
BMI,kg/m2, mean (SD)	26.8 (5)	26.4 (4.2)	26.8 (4.9)	26.8 (5.1)	P=0.8
Diabetes, n (%)	718 (28.6)	15 (22)	532 (30)	171 (27)	P=0.2
Hypertension, n (%)	1317 (52)	20 (30)	954 (53)	343 (54)	P=0.001
COPD, n (%)	294 (11.7)	0 (0)	213 (12)	81 (13)	P=0.01
Smoking, n (%)	1431 (57)	37 (55)	1015 (56)	379 (59)	P=0.4
History of AF, n (%)	391 (16)	7 (10)	282 (16)	102 (16)	P=0.5
Ischemic etiology , n (%)	1676 (66.7)	46 (69)	1257 (70)	373 (58)	P<0.001
ACEi, ARBs or ARNi, n (%)	2441 (97)	65 (97)	1780 (99)	616 (96)	P=0.001
β −blockers, n (%)	2027 (81)	31 (46)	1432 (79)	564 (88)	P<0.001
MRAs, n (%)	1658 (66)	21 (31)	1146 (64)	491 (77)	P<0.001
Diuretics, n (%)	1849 (74)	49 (73)	1341 (74)	459 (72)	P=0.5

Continuous variables are expressed as mean ± 1 standard deviation (SD) and categorical variables as count and proportion. p-values are derived from one-way ANOVA, the Bonferroni test or Chi square test when appropriate, BMI: Body mass index, COPD: Chronic obstructive pulmonary disease, AF: Atrial fibrillation, ARBs: Angiotensin receptor blockers, ARNi: Angiotensin receptor neprysilin inhibitor

Figure 1. Univariate cox-regression survival analysis for 5-year all-cause mortality adjusted for age and ischemic etiology.



Performance of non-invasive myocardial work to predict the first hospitalization for de novo heart failure with preserved ejection fraction (HFpEF)

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Background/Introduction: Non-invasive myocardial work (MW) is a validated index of left ventricular (LV) systolic performance, incorporating afterload and myocardial metabolism. The role of MW in predicting the first hospitalization for de novo heart failure with preserved ejection fraction (HFpEF) is still unknown.
Purpose: We aim to investigate the diagnostic performance of MW to predict the first de novo HFpEF hospitalization in ambulatory individuals with preserved LVEF.
Methods: Twenty-nine patients with transthoracic echocardiography performed at least 6 months before the first HFpEF hospitalization were compared with 29 matched controls. MW was derived as the area of the pressure-strain loop using speckle-tracking and brachial artery blood pressure. Global work index (GWI), global constructive work (GCW), global wasted work (GWW), and global work efficiency (GWE) were collected. First HFpEF hospitalization and its combination with cardiovascular death (MACE) and all-cause of death (MAE) were assessed.
Results: At baseline, future HFpEF patients showed lower GWI, GCW, GWE, and higher GWW than controls (all $p < 0.05$). At admission *vs.* baseline, GWE significantly decreased, and GWW increased in the HFpEF group ($p < 0.05$), whereas no significant difference was observed in the controls over time. GWW, with a cut-off of 170 mmHg%, showed the largest AUC to predict first HFpEF hospitalization (AUC =0.80, 95% CI 0.69–0.91, $p < 0.001$), MACE (AUC =0.80, 95% CI 0.66–0.90, $p < 0.001$) and MAE (AUC =0.79, 95% CI 0.62–0.88, $p = 0.001$). GWW >170 mmHg% was associated with a 4-fold increase of MACE (HR =4.5, 95% CI 1.59–13.12, $p = 0.005$) and a 3-fold higher risk of MAE (HR =2.9, 95% CI 1.24–6.6, $p = 0.014$).
Conclusion(s): In ambulatory patients with preserved-EF and risk factors, GWW showed high accuracy to predict HFpEF hospitalization and combination with mortality. The GWW routine assessment might help in patients with dyspnoea.

#Performance of the MAGGIC score to predict 1- and 3-years mortality in a real life cohort of patients with HFrEF

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Background/Introduction: The Meta-analysis Global Group in Chronic Heart Failure (MAGGIC) score is derived from 13 routinely available characteristics and evaluates the 1- and 3-years mortality risk of heart failure (HF) patients.

Fig 1. Observed survival (in red) compared with survival predicted by the MAGGIC score (in green)

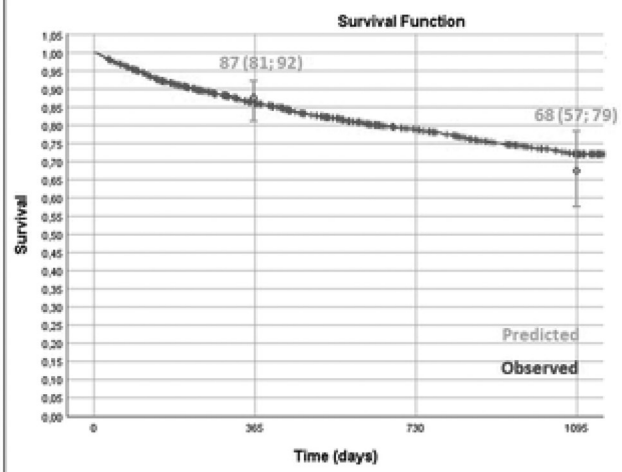
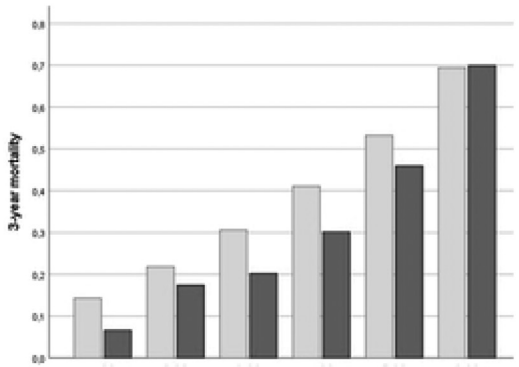


Fig 2. Observed versus predicted 3-years mortality among 6 different risk groups defined by the MAGGIC score



MAGGIC	0–16	17–20	21-24	25–28	29-32	33+
Predicted (%)	14.3	21.9	30.6	41.0	53.2	69.4
Observed(%)	6.6	17.4	20.2	30.2	45.9	69.9
Δ	7.7	4.5	10.4	10.8	7.3	-0.5

Purpose: To validate the performance of this score to predict mortality in a real-life cohort of HF and reduced ejection fraction (HFrEF).
Methods: Between 1994 and 2020, we included 2512 patients with HFrEF followed at CUSL and calculated their MAGGIC scores. Patients were followed up prospectively and the outcome measures were 1 and 3-years mortality. The predicted probability of death from the calculated risk score was compared with the observed 3-years mortality, and model discrimination was assessed by formal tests (C-index) and graphical means (Kaplan Meier curves and bar charts).
Results: In our patients (64 ± 13 years, 76.5% male, FEVG 23.7 ± 6.8%), the mean MAGGIC score was 22.9 ± 6.3. We observed 352 (14%) deaths at 1 year and 659 (26%) at 3 years. The 1- and 3-years mortality predicted by the MAGGIC score were 13 and 32%, respectively. The Kaplan Meier curve (Figure 1) shows observed *vs.* predicted survival at 1- and 3-years. Discrimination was excellent overall (C-index for 3 years mortality =0.726). Figure 2 shows observed *vs.* model predicted 3-years mortality among six risk groups. The difference between predicted and observed mortality varied between −0.5 and 10.8%, with slight over-prediction in all but the highest risk group.
Conclusion(s): The MAGGIC score performed well to predict 1- and 3-years mortality in HFrEF patients. Although the predicted 3-years mortality was slightly higher than the observed mortality, the MAGGIC score demonstrated an excellent ability to categorize patients into separate risk strata.

Performance of SHFM and MAGGIC risk scores to predict 1-year mortality in patients on the waiting list for heart transplantation

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Background/Introduction: Currently, the decision to transplant patients with end-stage heart failure (HF) is based on expert consensus and the measure of exercise capacity. In the context of heart graft shortage, the selection of patients for transplantation is critical. Risk scores have been established to predict the prognosis of HF patients and may be useful to prioritize patients on the transplant list.
Purpose: To evaluate the performance of the Seattle Heart Failure Model (SHFM) and the Meta-analysis Global Group in Chronic Heart Failure (MAGGIC) score to predict 1-year mortality in HF patients on the transplant list.
Methods: Patients enrolled on the transplant list in our centre from 2007 to 2017 were included. Exclusion criteria were: high urgency transplant, left ventricular assistance device, and previous heart transplant. The endpoint was 1-year mortality. The performance of the scores was assessed using the area under receiver operator curves (ROC AUC).
Results: In the final population of 121 patients (51 ± 12 years, 78% men, LVEF 22 ± 11%), 10 (8%) patients died during the first year after their inscription on the list, before reaching transplant. The SHFM score had adequate discrimination regarding 1-year

Figure 1. Receiver operator characteristic curves of risk scores for 1-year mortality

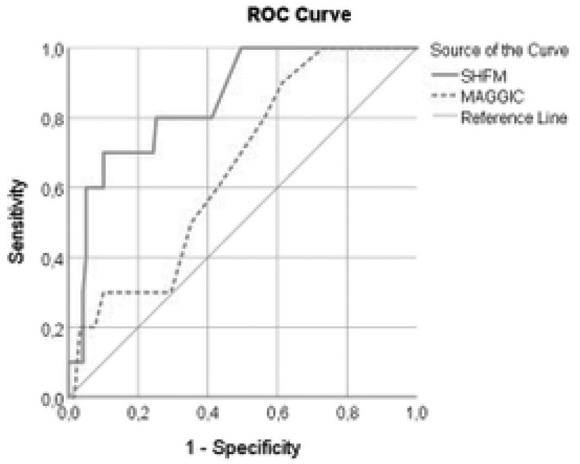
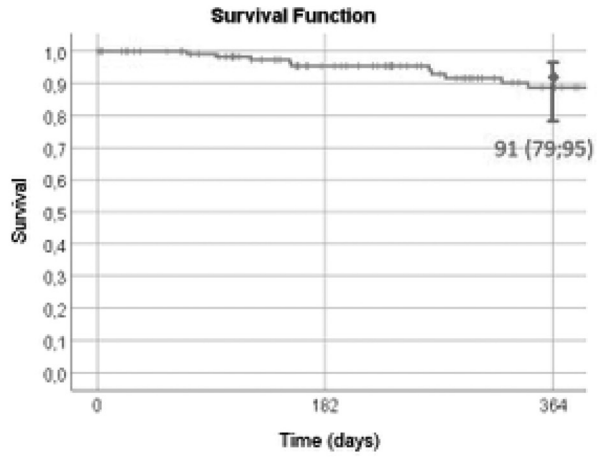


Figure 2 . Observed 1-year survival (in blue) compared with survival predicted by the SHFM score (in red)



mortality (ROC AUC =0.87, $p < 0.001$). The MAGGIC score, however, performed poorly in this specific population of advanced HF patients (ROC AUC 0.64, $p = 0.14$) (Figure 1). Figure 2 shows the SHFM predicted 1-year survival plotted against the Kaplan Meier curve of observed survival.

Conclusion(s): The SHFM score performs well to predict 1-year mortality in patients on the waiting list for heart transplantation and may be valuable for patient selection. Although easier to compute and validated in large cohorts of HF patients, the MAGGIC score does not seem appropriate to predict 1-year mortality in advanced HF patients waiting for heart transplantation.

The evaluation of three murine comorbidity models of diastolic dysfunction and HFpEF

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Background/Introduction: Heart failure (HF) is one of the biggest causes of hospitalisation and mortality worldwide, resulting in an enormous socioeconomic burden. More than half of heart failure patients are diagnosed with Heart Failure with diastolic dysfunction or HFpEF.

Purpose: As a consequence of the aging population, and increased survival of patients with metabolic comorbidities the incidence of HFpEF is increasing even further. The exact pathogenesis of HFpEF remains unelucidated, and our understanding of the disease is further impeded by the absence of appropriate animal models. A preclinical HFpEF model must accurately reflect the heterogenous patient comorbidity profile, and replicate diastolic dysfunction which does not progress to systolic HF and the key histological features. Moreover, we need genetic models in which we can alter signalling pathways, limiting the background to C57BL/6J mouse models, the most common background for genetic manipulation. The development of appropriate pre-clinical models that accurately mimic the pathophysiological onset of the condition in humans will advance the pathological understanding, identification of early diagnostic markers, and development of effective treatment and prevention strategies. Here, we investigate the known clinical features of HFpEF in three murine comorbidity models: (1) 8-week-old male C57BL/6J mice on a high-fat diet and L-NAME (an NO synthase inhibitor) for 5 weeks, to obtain a model of metabolic hyperlipidaemic and hypertensive stress, (2) 13-month-old female C57BL/6J mice on a high-fat diet and L-NAME for 2 months to obtain an aged model of hyperlipidaemia and hypertension, and (3) 6-week-old *db/db* mice with 1% salt. Therefore, this project is the first necessary step to reach the growing clinical demand for heart failure.

Methods: Cardiac function was characterized using echocardiography. Key histological features were assessed using immunohistological stainings for cardiac inflammation, fibrosis, cardiomyocyte hypertrophy, and vessel density.

Results: All models showed some degree of diastolic dysfunction, with increased *E/E'*. The E/A was increased in C57BL6J males on HFD + L-NAME and in *db/db* mice, but not in 21-month-old females on HFD + L-NAME. The fold-change, however, was consistently higher in the *db/db* mice fed with 1% salt. This was also the only model to show cardiomyocyte hypertrophy and

capillary density loss. The C57BL6J males, were the only model to show interstitial fibrosis and leukocyte ($CD45^+$) recruitment, although the latter was much more pronounced in the aged females.
Conclusion(s): In conclusion, all models have advantages and disadvantages, highlighting the complexity of modelling HFpEF in the lab. The lack of a perfect HFpEF animal model attenuates the understanding of its complex pathophysiology and the development of new therapies. Therefore, the model choice should be based on the studied clinical feature since different patient cohorts also present with a subset of those features. The best approach, however, is to use multiple models and identify consistent behaviours present in all of them, which strengthens the robustness of preclinical data and increases the applicability of results to clinical settings.

IMAGING

*Echocardiographic assessment of mechanical dyssynchrony: are the new parameters better?

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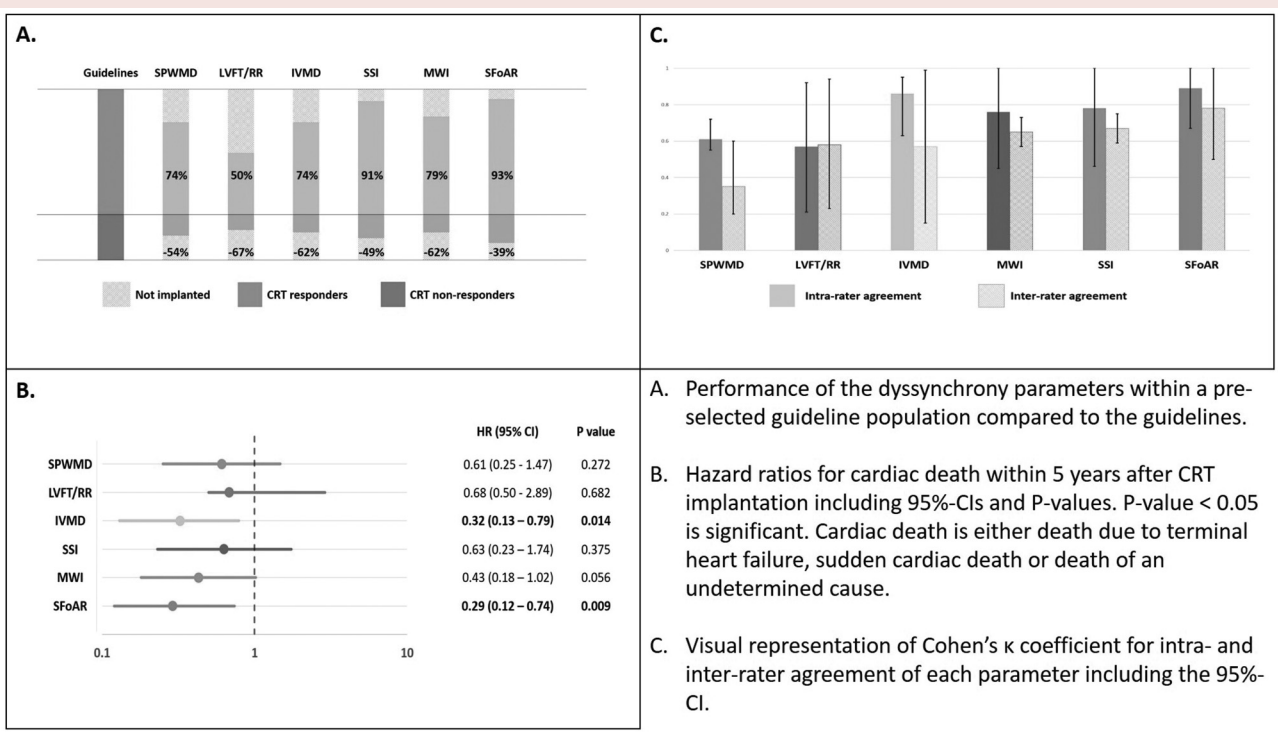
Background/Introduction: In 2008 the PROSPECT study compared several parameters of mechanical dyssynchrony (MD) for predicting CRT-response. The parameters performed poorly and echocardiography became discredited. Promising new parameters have been developed, but a comparison of old and new is missing.
Purpose: To compare old- and new-parameters of MD for (I) identifying volume responders 1 year post-CRT, (II) predicting cardiac death within 5 years post-CRT, and (III) reproducibility in a population of guideline CRT candidates.
Methods: One hundred and forty-six CRT-patients were analysed retrospectively in a multicentre setting. MD was assessed using three old-parameters: septal-to-posterior-wall-motion-delay (SPWMD), left-ventricular-filling-time/cardiac-cycle-ratio (LVFT/RR), and intra-ventricular-mechanical-delay (IVMD); and three new-parameters: systolic-stretch-index (SSI), myocardial-work-index (MWI), and presence of septal-flash or apical-rocking (SFoAR). CRT-response was defined as a $\geq$15% decrease in LV-end-systolic volume 1 year post-CRT. For each parameter patients were categorized using previously published cut-offs as 'eligible' or 'non-eligible' for CRT. For a given parameter the 'non-eligible' were considered as not-implanted. Results were compared to guidelines. The hazard ratio (HR) for cardiac death within 5 years after implantation was computed for all patients, and intra-and-interrater-agreement was determined.
Results: Seventy-three percent ($n = 107$) of patients were responders. All old-parameters identified <75% of the original responders. SFoAR preserved the highest proportion of responders (93%) and reduced non-response rate by 39%. Cardiac death was predicted by SFoAR (HR =0.29; $p = 0.009$) and IVMD (HR =0.32; $p = 0.014$). Intra-and-interrater-agreement was best for SFoAR ($\kappa = 0.89$ and $\kappa = 0.78$, respectively). Interrater-agreement was poor for all old-parameters ($\kappa < 0.6$).



A. Performance of the dyssynchrony parameters within a pre-selected guideline population compared to the guidelines.

B. Hazard ratios for cardiac death within 5 years after CRT implantation including 95%-CIs and P-values. P-value < 0.05 is significant. Cardiac death is either death due to terminal heart failure, sudden cardiac death or death of an undetermined cause.

C. Visual representation of Cohen's κ coefficient for intra- and inter-rater agreement of each parameter including the 95%-CI.

Conclusion(s): The new parameters for dyssynchrony outperform the old. The visual presence of apical-rocking or septal-flash provided the most CRT responders, predicted favourable long-term outcomes, and was highly reproducible. Our results suggest the new parameters of mechanical dyssynchrony should be tested in prospective randomized trials and could be used for the selection of CRT candidates.

Relationship between right and left ventricle function in subjects free of cardiovascular diseases

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Background/Introduction: The volumetric assessment of cardiac function determines diastolic and systolic function for the right (RV) and left ventricles (LV), and whether the lung volumes interfere with the function of the LV, and/or modify LV properties remains unknown.
Purpose: The aim was to investigate the relationship between RV, lung volumes, and LV function in the KORA-MRI study.
Methods: From the KORA-MRI cohort study, 361 subjects (mean age 56.1 ± 9.1 years; 43% women) underwent a whole-body 3T MRI scan. Cardiac functional parameters were measured from a cine-steady-state free precession sequence using cvi42. Lung volumes were derived semi-automatically using an in-house algorithm. Linear regression analyses were performed to assess the relationships between lung volumes and RV and LV function adjusted for age, sex, and cardiovascular risk factors.
Results: RV end-diastole was positively associated with LV end-diastolic ($\beta = 28.1$, $p = <0.001$), end-systolic ($\beta = 11.0$, $p = <0.001$), stroke volume ($\beta = 17.0$, $p = <0.001$), and inversely with ejection fraction ($\beta = -1.4$, $p = 0.001$). RV end-systole was positively associated with LV end-diastolic ($\beta = 21.2$, $p = <0.001$), end-systolic ($\beta = 11.5$, $p = <0.001$), stroke volume ($\beta = 9.7$, $p = <0.001$), and inversely with ejection fraction ($\beta = -3.3$, $p = <0.001$). When adjusting for lung volumes, the association between RV and LV did not attenuate, and no effect modification was observed. Interestingly, in women and men, despite their different lung volumes, we did not observe any gender difference for the association between RV and LV parameters.
Conclusion(s): In subjects free of cardiovascular diseases RV and LV were strongly associated, suggesting that RV function is crucial for LV function, independent of lung volumes.

A hybrid approach using multi-slice computed tomography and echocardiography for grading aortic valve stenosis severity

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Background/Introduction: Studies in aortic valve stenosis (AS) have used multi-slice computed tomography (MSCT)-derived left ventricular outflow tract (LVOT) dimensions to calculate a 'hybrid' aortic valve area (AVA) in combination with TTE-derived Doppler measurements.
Purpose: The purpose of this study was to compare TTE and MSCT for AS classification and to investigate the impact of different measurement levels of the LVOT using MSCT.
Methods: Two hundred and ten patients with severe native AS planned for transcatheter aortic valve replacement were included. LVOT dimensions were assessed with TTE and MSCT at the aortic annulus ($LVOT_{TTE}$ and $LVOT_{CT\text{-}Annulus}$) and for MSCT at additional positions 5 and 10 mm below the annulus ($LVOT_{CT\text{-}5mm}$ and $LVOT_{CT\text{-}10mm}$). Based on MSCT-derived LVOT areas, 'hybrid' AVA_{CT}'s were calculated.
Results: $LVOT_{CT\text{-}Annulus}$ was on average 2.8 mm greater than $LVOT_{TTE}$ ($p < 0.001$). $LVOT_{CT\text{-}Annulus}$ and $LVOT_{CT\text{-}5mm}$ showed similar correlations with $LVOT_{TTE}$ ($r = 0.76$ and 0.73, respectively, both $p < 0.001$). $LVOT_{CT\text{-}10mm}$ showed a weaker correlation with $LVOT_{TTE}$ ($r = 0.59$, $p < 0.001$). Intra- and inter-observer correlation coefficients were significantly higher for MSCT compared with TTE. All AVAs had significant and similar correlations with transvalvular mean pressure gradient. Using each of the AVA_{CT}'s led to a reclassification of a significant number of patients from discordant low AVA ($<1.00\,cm^2$) low gradient (LG) to the non-severe-AVA LG category in comparison with AVA_{TTE}. Using adapted MSCT-AVA cut-offs, no such reclassification occurred for $AVA_{CT\text{-}Annulus}$ and $AVA_{CT\text{-}5mm}$.
Conclusion(s): Calculating a 'hybrid' AVA leads to larger AVAs. This results in a reclassification towards non-severe AS at an AVA cut-off of $1.00\,cm^2$, but not when considering MSCT-specific AVA cut-offs. $LVOT_{CT\text{-}Annulus}$ has a superior intra- and inter-observer variability. However, AVA_{CT} does not lead to more concordance between pressure gradient and AVA in comparison with AVA_{TTE}.

Subclinical thrombosis in bioprosthetic aortic valves: a prospective study

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Background/Introduction: Subclinical bioprosthetic aortic valve thrombosis (BPVT) is a potential underreported cause of early bioprosthetic valve failure. Data about BPVT are scarce.
Purpose: The objective of this study was to detect the incidence of BPVT in the first 2 years after bioprosthetic aortic valve implantation (BPAV) and investigate the effectiveness of antiplatelet/anticoagulant therapy in preventing/treating BPVT.
Methods: Therefore we prospectively included 74 patients following implantation of a BPAV, with or without CABG, from January 2016 until January 2019 with follow-up at UZ Leuven hospital.
Results: In this study, 74 patients with BPAV were prospectively recruited. All patients underwent transthoracic echocardiography (TTE) 1 week, 6 weeks, 6 months, 12 months, and 2 years after BPAV. One of 74 patients (1.3%) treated with NOAC experienced BPVT. No patients with antiplatelet therapy with aspirin did BPVT within the first two years after BPAV. The two-years mortality of patients with BPAV was 3% (2/74 patients).
Conclusion(s): Our results suggest that there is no increased risk of BPVT with antiplatelet therapy alone compared to patients treated with anticoagulation with NOAC or Coumadin. Our study supports evidence that therapy with aspirin after BPAV implantation is effective in preventing BPVT. In the case of BPVT, treatment with Coumadin induced a complete recovery of the function of the BPAV.

Myocardial stiffness is significantly increased at mitral valve closure during dyssynchronous contraction

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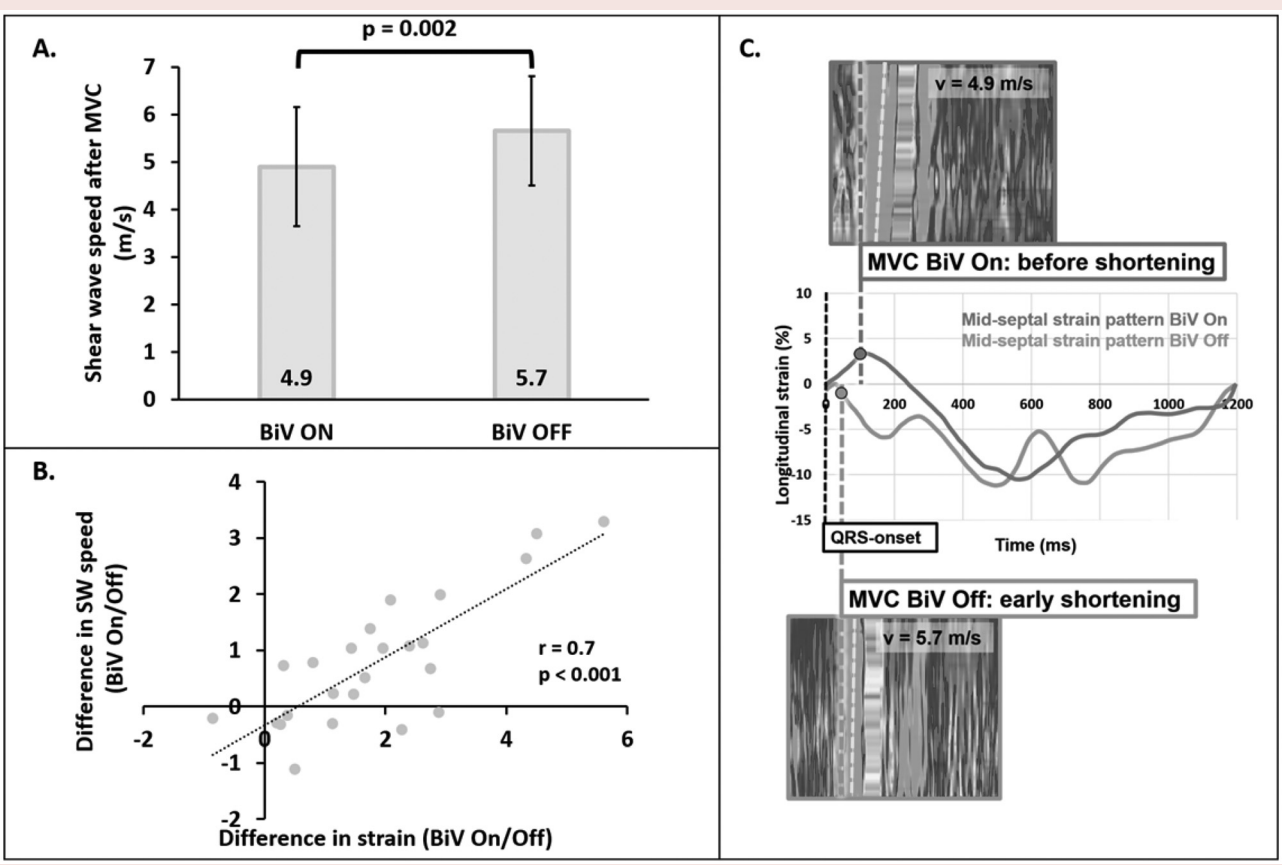
Background/Introduction: Shear-wave-elastography (SWE) has emerged as a non-invasive technique to determine myocardial tissue stiffness. SWE is based on the detection of shear waves (SW), e.g. induced by mitral-valve-closure (MVC). SW speed is directly dependent on myocardial stiffness. However, the effect of dyssynchrony—as it occurs in LBBB—on SW speed is unknown.



Purpose: To investigate the effect of the dyssynchronous contraction pattern caused by LBBB on SW speed.
Methods: Twenty-six non-ischemic CRT-patients with LBBB were included (age: 68 ± 15 years; 50% males). Dyssynchrony was reintroduced by turning biventricular (BiV) pacing off. Echocardiographic images were taken during BiV-pacing on/off, with a conventional and high frame-rate scanner (932 ± 32 Hz). SW was visualized in septal M-modes, colour-coded for tissue acceleration. Their slope represents SW propagation speed. The mid-septal longitudinal strain was assessed. To investigate how dyssynchrony affects SW speed, the onset of QRS, MVC, and onset of septal contraction were measured.
Results: Switching BiV-pacing on/off did not affect LVEF or volumes (all $p > 0.05$). SW speed was significantly higher during BiV-off *vs.* on (5.7 ± 1.5 *vs.* 4.9 ± 1.3 m/s; $p = 0.002$; Figure A). Septal contraction onset was significantly earlier during BiV-off (14 ± 20 *vs.* 103 ± 58 ms; $p < 0.0001$). MVC occurred before the onset of septal contraction during BiV-on and after during BiV-off (−12 ± 60 *vs.* 40 ± 26 ms; $p = 0.001$). Change in SW speed correlated well with change in the septal longitudinal strain at MVC when turning BiV-pacing off ($r = 0.70$; $p < 0.001$; Figure B).
Conclusion(s): Dyssynchrony significantly increases SW speed at MVC, possibly due to the early-systolic contraction of the septum (Figure C). This indicates that changes in contraction patterns caused by LBBB significantly influence myocardial stiffness at MVC.

Functional and structural cardiac abnormalities by cardiac MRI in women after contemporary adjuvant breast cancer radiotherapy

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Background/Introduction: Radiation therapy (RXT) is a keystone in breast cancer (BC) treatment, which reduces the risk of local recurrence and mortality. Prior works in a patient treated for BC, suggest that RXT can cause ischemic heart disease and myocardial fibrosis.
Purpose: To evaluate the effects of late radiation-induced cardiotoxicity after contemporary BC-RXT, with exposure to a lower cardiac dose, we sought to estimate the prevalence of cardiac functional and structural myocardial changes in BC survivors treated by RXT 10 years earlier, in relation to measured radiation dose exposure (MHD, mean heart dose).
Methods: In a prospective cross-sectional study, we studied 62 women (mean age 62 ± 7 years) treated with adjuvant RXT but without chemotherapy for a first left ($n = 28$) or right-sided ($n = 34$) BC, compared to 20 age-matched (64 ± 10 years) female controls. All subjects underwent 3T cMR to measure LV volumes, function, global longitudinal (GLS), extracellular volume (ECV), and late gadolinium enhancement (LGE).
Results: MHD in BC survivors was 1.6 ± 1.5 Gy (range 0–8.0 Gy). Indexed LV mass (44 ± 11 *vs.* 51 ± 9 g/m^2, $p = 0.005$), LV ejection fraction (62 ± 6 *vs.* 65 ± 6, $p = 0.009$) and GLS (−14.6 ± 1.8 *vs.* −15.5 ± 1.8, $p = 0.05$) were significantly lower in BC patients than in controls. Indexed EDV (66 ± 11 *vs.* 65 ± 12 ml/m^2, $p =$ NS) and ESV (26 ± 7 *vs.* 24 ± 7 ml/m^2, $p =$ NS) were similar. ECV fraction (30 ± 6 *vs.* 28 ± 3%, $p = 0.05$), was significantly higher in irradiated patients. No correlation with the MHD ($r = 0.01$, $p =$ NS), nor LGE, was observed.
Conclusion(s): In this work, patients with BC treated by RXT 10 years ago, presented significantly lower LV mass, reduction of LV systolic function, and increased ECV, reflecting increased myocardium fibrosis relative to healthy controls. This suggests that exposure to low radiation doses may cause subclinical alterations in cardiac structure and function.

Shear wave propagation speed after aortic valve closure is related to myocardial contractility

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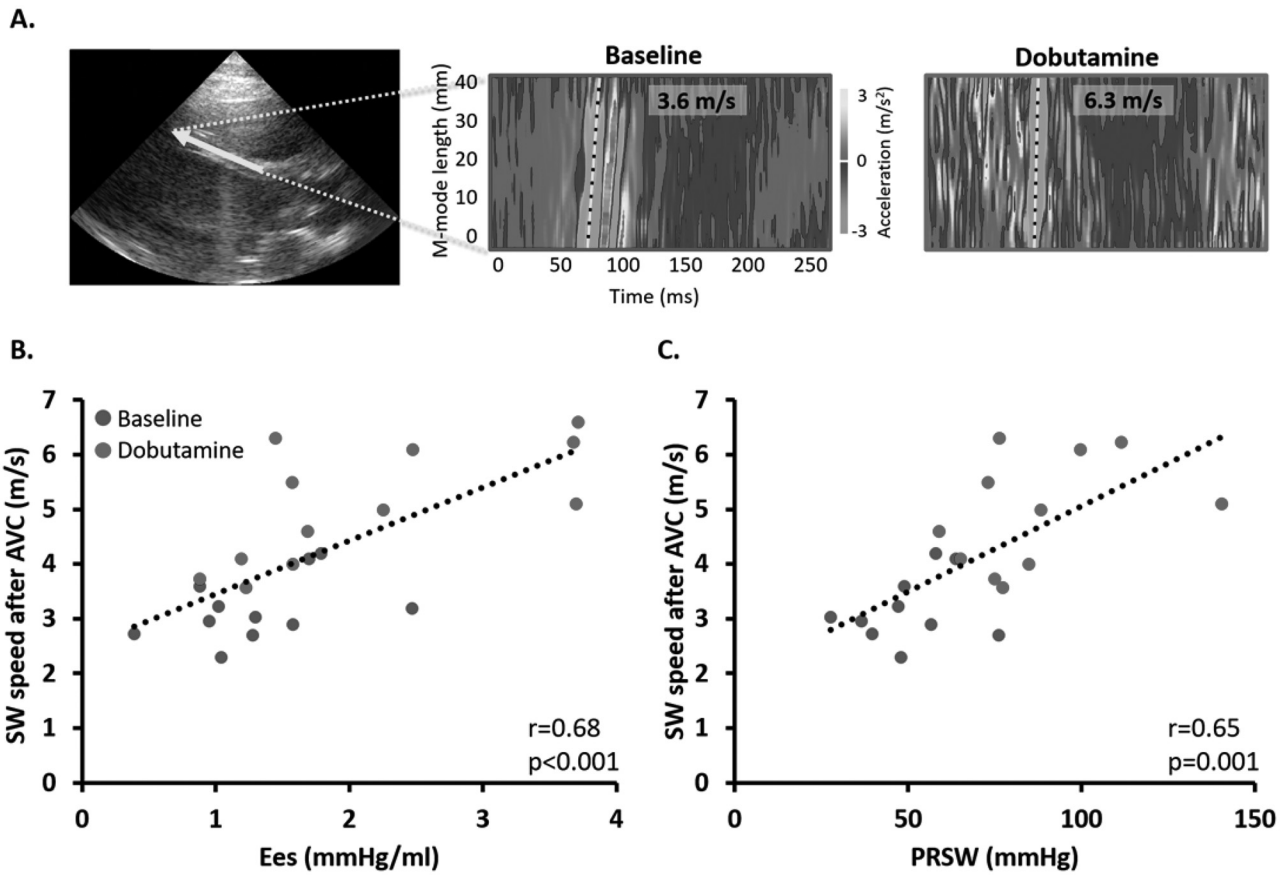
Background/Introduction: Shear wave elastography is a novel method that tracks shear wave (SW) propagation in the myocardium using high-frame-rate (HFR) ultrasound. SWs can be induced by e.g. aortic valve closure (AVC). Previous work has suggested that systolic SW speed is related to contractility. The gold standard for evaluating LV contractility is invasive pressure-volume (PV)-loop analysis. However, its invasive nature limits clinical applicability.
Purpose: To compare SW speed after AVC to invasive PV-loop-derived measurements of contractility.
Methods: In 12 pigs (31.9 ± 4.3 kg), dobutamine was administered intravenously. Conventional and HFR echocardiographic images were acquired simultaneously with PV-loops before and after administration of dobutamine. HFR echocardiographic datasets were acquired with an experimental ultrasound scanner (average frame rate: 1304 ± 15 Hz). SWs were visualized on M-mode displays along the septum; colour coded for tissue acceleration (Figure 1(A)). SW speed was calculated by measuring the



spatiotemporal slope. The end-systolic elastance (Ees) of the ESPVR and preload recruitable stroke work (PRSW) were used as measures of contractility.
Results: Heart rate (72 ± 20 *vs.* 105 ± 25 bpm; $p < 0.05$) and LVEF (61 ± 4 *vs.* 74 ± 7%; $p < 0.001$) significantly increased after dobutamine administration. Ees (1.3 ± 0.5 *vs.* 2.1 ± 1.0 mmHg/ml; $p < 0.01$), PRSW (41 ± 25 *vs.* 86 ± 23 mmHg; $p < 0.01$), as well as SW speed after AVC (3.1 ± 0.6 *vs.* 5.3 ± 1.1 m/s; $p < 0.001$) increased during dobutamine infusion. SW speed after AVC correlated strongly with Ees ($r = 0.68$; $p < 0.001$) (Figure 1(B)) and PRSW ($r = 0.65$; $p = 0.001$) (Figure 1(C)).
Conclusion(s): Systolic SW speed is related to invasively determined measurements of LV contractility. The results indicate the potential of SW speed after AVC as a novel non-invasive parameter for the assessment of LV contractility.

Effects of left coronary artery bifurcation angle on computed tomography derived fractional flow reserve in normal coronary artery disease

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Background/Introduction: Computed-tomography (CT) derived fractional-flow-reserve (FFR_{CT}) decreases from proximal to the distal part of the vessel due to the influence of various factors. The energy loss due to the bifurcation angle may contribute to progressive FFR_{CT} decline. However, the association of bifurcation angle with FFR_{CT} is unclear.
Purpose: This study aimed to identify the inappropriate bifurcation angle of an FFR_{CT} decline below the pathological value of 0.80 in normal coronary arteries.
Methods: A total of 83 consecutive patients who underwent both CT angiography including FFR_{CT} and invasive coronary angiography, resulting in normal coronary arteries were evaluated. ΔFFR_{CT} was defined as the magnitude of the change in FFR_{CT} from proximal to the distal vessel of the left anterior descending (LAD) and left circumflex (LCX). Bifurcation angle was

measured from three-dimensional volume-rendered images. Vessel length, lumen volume, non-calcified plaque volume, and calcified plaque volume were assessed.
Results: ΔFFR_{CT} was significantly correlated with each bifurcation angle (LAD angle, $r = 0.35$, $p = 0.001$; LCX angle, $r = 0.26$, $p = 0.02$) and vessel length (LAD angle, $r = 0.30$, $p = 0.005$; LCX angle, $r = 0.49$, $p < 0.0001$). In LAD angle, vessel length was the strongest predictor for distal FFR_{CT} of ≤ 0.80 (β-coefficient $= 0.56$, $p = 0.0002$), followed by bifurcation angle (β-coefficient $= 0.24$, $p = 0.02$). Bifurcation angle predicted for distal of FFR_{CT} ≤ 0.80 (LAD angle, cut-off 31.0°, AUC 0.70, sensitivity 74%, specificity 68%; LCX angle, cut-off 52.6°, AUC 0.86, 95%, sensitivity 88%, specificity 85%).
Conclusion(s): The magnitude of the change in FFR_{CT} depended on each bifurcation angle. In normal coronary arteries, vessel length was the most influential factor on FFR_{CT}, followed by bifurcation angle.

Impact of ramus coronary artery on computed tomography derived fractional flow reserve in normal coronary artery disease

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Background/Introduction: The ramus artery contributes to the development of turbulence and may have the potential to decrease computed-tomography (CT) derived fractional-flow-reserve (FFR_{CT}) even without coronary artery disease. The relationship between ramus-induced turbulence and FFR_{CT} is unclear.
Purpose: To investigate the effect of the ramus artery on FFR_{CT} in normal coronary arteries.
Methods: A total of 120 consecutive patients who underwent both CT angiography including FFR_{CT} and invasive coronary angiography, resulting in normal coronary arteries were evaluated. The patients were divided into three groups: no-ramus ($n = 72$), small-ramus that could not be analysed by FFR_{CT} ($n = 18$), and large-ramus that could be analysed by FFR_{CT} ($n = 30$). FFR_{CT} was measured at proximal and distal portions of the left-anterior-descending artery (LAD), left-circumflex-artery (LCX), and ramus artery (in no-ramus and small-ramus group FFR_{CT} was measured at just above the bifurcation between LAD and LCX) were measured. Vessel diameter, bifurcation angle, and left ventricular mass were assessed.
Results: In no-ramus group, proximal FFR_{CT} showed no significant difference (LAD, 0.96 ± 0.02; MID, 0.97 ± 0.02; LCX, 0.97 ± 0.02, $p > 0.05$, respectively). However, in small- and large-ramus groups, proximal FFR_{CT} was significantly higher in ramus artery than LAD and LCX (small-ramus, LAD, 0.95 ± 0.03; Ramus, 0.97 ± 0.02; LCX, 0.95 ± 0.03; large-ramus, LAD, 0.95 ± 0.03; Ramus, 0.98 ± 0.01; LCX, 0.96 ± 0.03, $p < 0.05$ for ramus, respectively). In LAD, proximal ramus artery diameter was the strongest predictor for distal FFR_{CT} ≤ 0.80 (β-coefficient $= -0.37$, $p = 0.03$), followed by lumen volume (β-coefficient $= -0.60$, $p = 0.04$). Proximal ramus artery diameter predicted distal FFR_{CT} ≤ 0.80 (cut-off 2.10 mm, AUC 0.76, sensitivity 100%, specificity 52%, 95%CI 0.58–0.88).
Conclusion(s): The presence of a large ramus artery may cause an unexpected FFR_{CT} decline.

Left ventricular mass index predicts underestimation of computed tomography derived fractional flow reserve in significant obstructive coronary artery disease

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Background/Introduction: In significant obstructive coronary artery disease (SOCAD), a mismatched assessment of the severity of coronary artery stenosis may occur between invasive coronary angiography and computed tomography (CT) derived fractional flow reserve (FFR_{CT}).
Purpose: To identify the predictive factors of underestimation of FFR_{CT} values above the value of 0.80 in SOCAD vessels.
Methods: A total of 141 consecutive patients who had both CT angiography coupled to FFR_{CT} analysis and invasive angiogram showing >75% coronary stenosis were evaluated. Vessels were divided into two groups according to FFR_{CT} at the distal vessel: FFR_{CT} >0.80 ($n = 12$) and FFR_{CT} ≤ 0.80 ($n = 153$). Vessel-related parameters (vessel length, lumen volume, non-calcified plaque volume, and calcified plaque volume) and left ventricular (LV) myocardial-related parameters (LV wall thickness and LV mass) were evaluated.
Results: Vessel morphology and plaque components did not differ between FFR_{CT} >0.80 and ≤ 0.80, whereas LV wall thickness, LV mass, and LV mass index were significantly higher in FFR_{CT} >0.80. Of all, vessel morphology and plaque components were not related to FFR_{CT}, whereas maximal LV wall thickness, LV mass, and LV mass index correlated with FFR_{CT}. In the vessels

showing FFR_{CT} >0.80, only LV mass and LV mass index correlated with FFR_{CT}. LV mass index of 66.5 g/m^2 was the strongest predictor of a distal FFR_{CT} of >0.80.
Conclusion(s): The presence of an excessive LV mass is a major predictor of underestimation of FFR_{CT} in SOCAD vessels. LV myocardial-related parameters should be considered when interpreting numerical values of FFR_{CT} to avoid the possibility of overlooked SOCAD.

Significance of vascular morphology and plaque characteristics assessment for computed tomography derived fractional flow reserve in early stage coronary artery disease

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Background/Introduction: Computed-tomography (CT) derived fractional-flow-reserve (FFR_{CT}) gradually decreases from proximal to distal vessel even in no-apparent coronary artery disease (NACAD). The FFR_{CT} value at the distal coronary artery below 0.80 may be difficult to interpret whether the FFR_{CT} decline is physiological or pathological.
Purpose: To identify the predictive factors of FFR_{CT} decline below the pathological value of 0.80 in NACAD.
Methods: A total of 150 consecutive patients who had both CT angiography coupled to FFR_{CT} analysis and invasive angiogram showing <20% coronary stenosis were evaluated. Vessels were divided into two groups according to FFR_{CT} at the distal vessel: FFR_{CT} >0.80 ($n = 317$) and FFR_{CT} ≤0.80 ($n = 114$). ΔFFR_{CT} was defined as the magnitude of the change in FFR_{CT} from proximal to the distal vessel. Vessel morphology (vessel length and lumen volume) and plaque characteristics [non-calcified plaque (NCP) volume and calcified plaque volume] were evaluated.
Results: FFR_{CT} decreased continuously from proximal to distal across the three major vessels in both FFR_{CT} >0.80 and FFR_{CT} ≤0.80. Compared to FFR_{CT} >0.80, NCP volume was significantly higher in all three major vessels in FFR_{CT} ≤0.80. ΔFFR_{CT} was correlated with vessel length and lumen volume in FFR_{CT} >0.80, whereas ΔFFR_{CT} was correlated with NCP volume in FFR_{CT} ≤0.80. NCP volume above 44.8 mm^3 was the strongest predictor of distal FFR_{CT} of ≤0.80.
Conclusion(s): The presence of NCP is a major predictor of a gradual decrease of FFR_{CT} below 0.80 in NACAD vessels. Vessel morphology and plaque characteristics should be both considered when interpreting numerical values of FFR_{CT}.

#Outcome penalty of guidelines surgical triggers in severe aortic regurgitation

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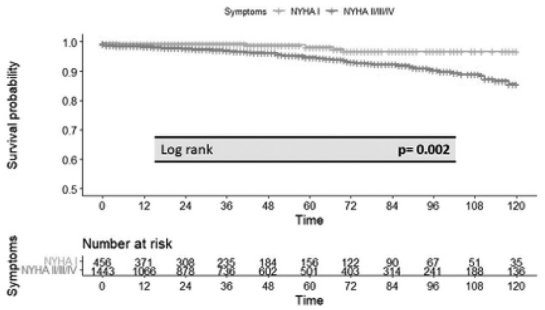
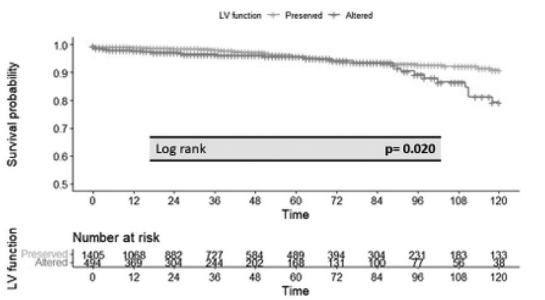
Background/Introduction: Until 2021, guidelines on surgical correction of severe aortic regurgitation focused on left ventricular systolic function (LVEF) and symptoms. Those situations are linked to post-operative mortality. Recommendations on LV end-systolic dimension (LVESD) gained strength in 2021 European guidelines. Moreover, lower cut-off values are now recommended (IIb) for low surgical risk, encouraging surgery before heart failure and its consequences on the outcome.
Purpose: The present study aims to assess the prognostic impact on post-operative survival of the surgical triggers in severe aortic regurgitation as recently updated in the 2021 ESC/EACTS guidelines on valvular heart disease, with a special focus on the new cut-off values proposed for left ventricle dilatation and ejection fraction.
Methods: Study population was 1899 patients operated for severe AR from AVIATOR registry in which 1443 (76%) had symptoms (NYHA > I), 494 (26%) had a reduced LVEF (≤50%) and 549 (29%) had a dilated LV (LVESD >50 mm or >25 mm/m^2). Cox proportional hazards models and Kaplan Meier survival curves were used to highlight guideline triggers' impact. Spline curves were built to study LVEF and LVESD as continuous variables.
Results: Patients with NYHA >1 have worse 10-year overall survival (86 ± 2%) than asymptomatic (97 ± 1%, $p = 0.002$). Patients with altered LVEF (≤50%) have worse survival (79 ± 5%) than preserved LVEF (91 ± 2%; $p = 0.020$). Patients with dilated LV (LVESD >50 mm or >25 mm/m^2) have worse survival (82 ± 4%) than non-dilated LVESD (90 ± 2%; $p = 0.010$). Spline function analyses showed an increased mortality with LVEF below 53% and LVESD above 23 mm/m^2.

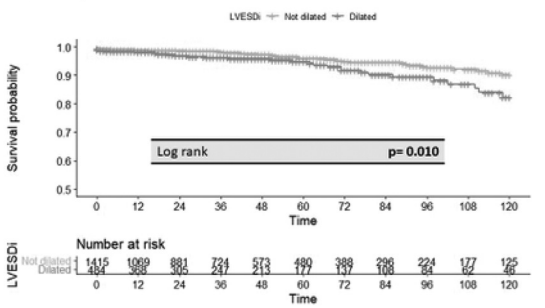
Post-operative survival according to symptom



Post-operative survival according to LVEF (50%)

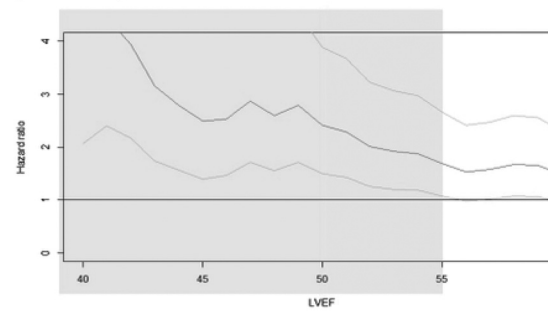


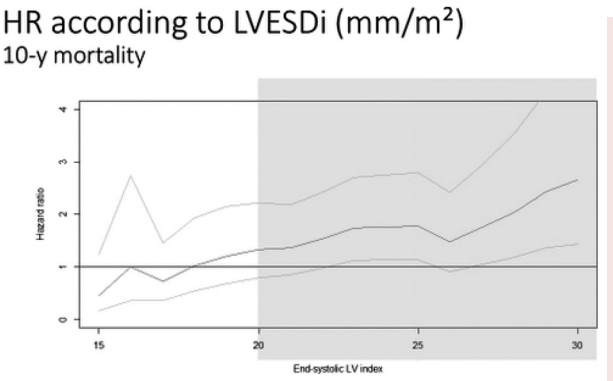
Post-operative survival according to LVESDi (25 mm/m²)



HR according to LVEF (Teicholz)

10-y mortality





Conclusion(s): In severe AR, post-operative mortality is linked to LVESD >50 mm or 25 mm/m^2, to LVEF ≤50% or symptoms, suggesting an outcome penalty of surgical triggers used in a class I recommendation. Survival tends to decrease for LVEF ≤53% and for LVESDi >23 mm/m^2, encouraging an earlier surgery.

INVASIVE/INTERVENTIONAL CARDIOLOGY

Evaluating the performance of the minimalistic hybrid approach in CTO PCI

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Background/Introduction: Dual catheter injection and large bore catheters are a cornerstone in the recently published The Global Chronic Total Occlusion Crossing (CTO). The Minimalistic Hybrid Approach (MHA) offers an alternative approach to reduce access sites and catheter size while maintaining procedural success.
Purpose: The current study aims to evaluate the distribution of patients among different treatment strategies, the different techniques used in each strategy, the overall procedural success, and the safety of the minimalistic hybrid algorithm.
Methods: Data from a consecutive series of patients with a CTO who underwent elective percutaneous coronary intervention (PCI) at the HartCentrum, Ziekenhuis Netwerk Antwerpen (ZNA) Middelheim, in Antwerp, Belgium between February 2019 and July 2021 were prospectively collected and retrospectively analysed.
Results: One hundred and forty-three consecutive CTO PCI in 135 patients were included. Nine procedures failed and 134 CTO were successfully recanalized, meaning the overall success rate is 93.7%. Eighty-nine procedures were completed through single access without contralateral injections for visualization. In the majority of these patients (90.7%) we used bilateral forearm access. One hundred and fifty-four out of 197 access sites were 6F sheaths. The greater part of patients (48.3%) were approached using strategy A 'AWE with interventional retrograde options', this strategy had a 98.6% success rate. There were a total of nine coronary perforations.
Conclusion(s): The minimalistic hybrid approach is a stepwise approach to reduce access sites (primarily through the forearm) and catheter size in CTO PCI while maintaining procedural success. Operators should be warned that this stepwise approach should only be adapted by experienced CTO operators who master the various dimensions of the classic hybrid algorithm.

Invasive assessment of coronary microvascular dysfunction in patients with atrial fibrillation

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Background/Introduction: Arrhythmia-induced cardiomyopathy (AIC) is a reversible impairment of the left ventricle (LV) due to a supraventricular ventricular arrhythmia. Atrial fibrillation (AF) is the most common supraventricular arrhythmia. The exact pathophysiological mechanisms of AIC have not been elucidated. Coronary microvascular dysfunction (CMD) is emerging as a potential determinant in many ischemic and non-ischemic cardiomyopathies.

Purpose: The aim of this study was to evaluate the role of invasively assessed CMD in patients with recently diagnosed AF with and without AIC.
Methods: This was a prospective, single-centre registry of patients with a recent diagnosis of AF undergoing invasive coronary angiography in which we performed invasive physiology measurements including assessment of microvascular function.
Results: Twenty-one consecutive patients were enrolled and divided into two groups according to the absence (control group, 10 patients) or presence (AIC group, 11 patients) of left ventricular dysfunction. We observed a larger amount of patients with CMD in the AIC group compared to the control group (100 *vs.* 20%; $p = 0.001$) through invasive measurements of CFR (3.320 *vs.* 1.446; $p < 0.01$), IMR (17.2 *vs.* 54.1; $p < 0.01$) and RRR (3.860 *vs.* 1.582, respectively, $p < 0.01$). The most prevalent AF pattern was paroxysmal (60%) in the control group and persistent (72.7%) in the AIC group. A proportional correlation between the entity of microvascular dysfunction and the LV dysfunction was observed (rho for correlation between CFR and AIC $= -0.702$, and between IMR and AIC $= 0.736$). Patients in the AIC group showed lower RRR, suggesting a reduced vasodilatory capacity.
Conclusion(s): In this study, all the patients with AF who develop AIC had a variable degree of CMD suggesting a potential link between coronary microcirculation and AIC.

Feasibility, safety and predictors of a successful 'blind wiring' antegrade approach in the percutaneous treatment of chronic coronary total occlusions

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Background/Introduction: Antegrade wiring using only antegrade guiding catheter without contralateral injection (defined as 'blind antegrade wiring') may represent a valid initial treatment strategy for selected chronic coronary total occlusions (CTOs) due to the potentially lower risk of vascular complications, as compared to the dual angiography nowadays advocated as standard in CTO percutaneous coronary intervention (PCI). A careful selection of lesions eligible for this strategy to optimize procedural success is paramount.
Purpose: The aim of the study is to determine the rate of successful revascularization, the potential predictors of failure, and the incidence of major complications when using a 'blind antegrade wiring' technique, taking into account that the use of very low tip load wires is mandatory when the contralateral injection is lacking.
Methods: In this multicentre study, consecutive patients with CTO undergoing PCI were retrospectively screened. All cases approached using the 'blind antegrade wiring' technique were included.
Results: Out of 155 CTO-PCIs, 94 involved an initial 'blind antegrade wiring' strategy. The mean J-CTO score of these lesions was: 1.67 ± 1.1. Successful revascularization using the 'blind antegrade wiring' technique was achieved in 73 (78%) patients. Final successful revascularization was obtained in 19 of the 21 procedures with 'blind antegrade wiring' failure using other techniques (by adding a second, contralateral guiding catheter; final total successful revascularization: 98%). Logistic regression analysis identified a higher J-CTO score as the only predictor of 'blind antegrade wiring' failure. One complication occurred (wire-based coronary perforation in a diagonal branch solved by fat embolization without sequelae for the patient).
Conclusion(s): 'Blind antegrade wiring' may be considered as an initial strategy for CTO-PCI, mainly for CTOs with low J-CTO scores. This strategy would allow in a substantial number of cases to avoid '*a priori*' dual injection, keeping it as a secondary strategy in case of 'blind antegrade wiring' failure.

Outcomes and trends of transcatheter aortic valve implantation: a single centre 13-year experience in Belgium

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Background/Introduction: Transcatheter aortic valve implantation (TAVI) has been adopted as an alternative to surgery in severe aortic stenosis (AS) treatment. While initially reserved mainly for patients at high surgical risk, trials demonstrated the safety of TAVI even at low-intermediate risk.

Purpose: The aim of this study is to retrospectively report our single-centre thirteen years TAVI-experience with an emphasis on the learning curve, referral indication, and trends in outcomes over time. The increase in operator experience along with improvements in valve prostheses, delivery systems, prosthesis sizing, and pre-procedural imaging, have made TAVI a far safer procedure indicated even in low surgical risk patients, dramatically reducing procedural risk as stated by real-world registries.
Methods: We included 361 consecutive patients who underwent TAVI from January 2008 to December 2020, grouped according to similar per year-volume of procedures: G1 (2008–2014), G2 (2015–2017), and G3 (2018–2020).
Results: The number of procedures increased (group size: 59 *vs.* 106 *vs.* 196, respectively). No major differences were observed in STSscore and EuroSCORE-II between groups. TAVI in patients with prior surgical revascularization was mainly performed in G1. The mean length of hospital stay decreased by 30%. Trans-aortic and trans-carotid TAVI were performed only in G1 and G2 and the trans-femoral approach was raised from 80.8 to 93.4%. The pre-dilatation rate was significantly higher in G1 with a low prothesis post-dilatation rate. At 30-days we observed a reduction in all-cause mortality, vascular complication, bleeding, and para-valvular leak combined with a higher rate of permanent pacemaker implantation over the groups. At 1-year there was no difference in all-cause mortality but an important reduction in cardiovascular death (8.5 *vs.* 7.5 *vs.* 4.6%).
Conclusion(s): Favourable trends were observed during the time, with an improvement in periprocedural outcomes and cardiovascular death at 1-year. Despite these clinical improvements, a shift in patients selection from higher-risk to lower-risk was not noted in the present analysis despite being evident in other studies.

Use of machine learning-based algorithms for the prediction of procedural success in the percutaneous revascularization of coronary chronic total occlusions

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Background/Introduction: The use of artificial intelligence for the prediction of clinical outcomes after interventions is A growing tool in translational medicine. At present, a limited number of clinically validated scores have been used to predict the procedural success of CTO-PCI (e.g. J-CTO and PROGRESS score), which also have a sub-optimal performance in real-life practice. We hypothesize that an AI-based prediction score could perform better than the currently available scores and help the clinicians in their decision-making process.
Purpose: The RECHARGE registry is a multi-centre registry that included patients undergoing percutaneous revascularization(PCI) of coronary chronic total occlusions(CTO) in Europe. A total of 1253 CTO PCI procedures in 1177 patients in 17 centres in France, Belgium, the Netherlands, and the United Kingdom were prospectively and consecutively included in the RECHARGE registry between January 2014 and October 2015. In this study, a high number of clinical and procedural variables were collected, creating a good source for analysis based on AI algorithms. In this analysis, we will specifically investigate the performance of an AI-based prediction score to assess the risk of failure/success of CTO-PCI. The primary outcome of this investigation will be the superiority of the area under the curve (AUC) at a ROC analysis of an AI-based prediction score of procedural success as compared with the currently available prediction scores (Japanese-CTO score and PROGRESS-score).
Methods: This is a subanalysis of the RECHARGE-registry(see Purpose Paragraph), for which no specific exclusion criteria were applied. The outcome variable was the dicotomical procedural success. All clinical variables (e.g. age, diabetes...) and procedural variables (e.g. calcium, occlusion length …) forming the dataset were included in the AI-based algorithms for the outcome prediction. The following algorithms were adopted: Logistic Regression with Lasso; Random Forest(RF) (including Boruta analysis); Support-Vector-Machines(SVM).
Results: After adequate pre-processing and subdivision of the dataset in a 'training-set' and 'test-set', the machine-learning-based algorithms were trained with the optimal computational load. These algorithms (especially the RF and the SVM) showed very high accuracy in predicting the technical failure (AUC at ROC curves 0.82 *vs.* 0.061 for J-CTO and 0.062 for the PROGRESS score, $p < 0.01$) and marked emphasis on 'new' features not included in the classical scores (e.g. presence of significant disease in the CTO vessel before/after the occlusion itself). Further details on the outcome of this analysis will be provided upon acceptance.
Conclusion(s): Machine-learning-based algorithms performed particularly well in predicting CTO-PCI outcomes, and may potentially be introduced in the clinical practice to guide treatment choices and improve our decision-making processes.

Intravascular ultrasound analysis variability of the left main coronary artery: a call for further education!

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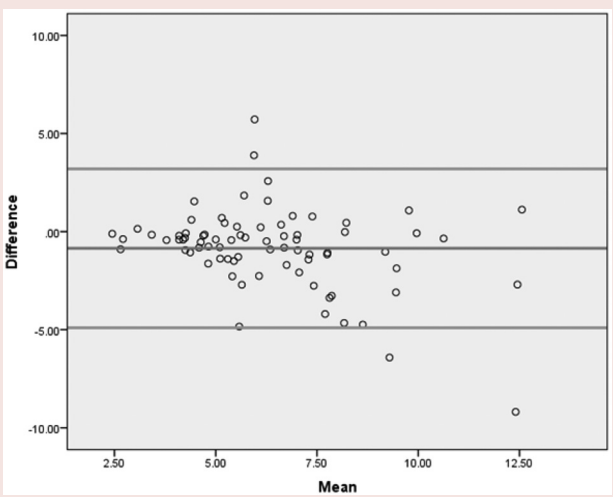
Background/Introduction: Intravascular ultrasound (IVUS) is superior to coronary angiography for the assessment of disease burden and vessel remodelling. IVUS is recommended for percutaneous coronary interventions (PCI) of left main (LM) lesions. When minimal lumen area (MLA) is $>6\,mm^2$, PCI can safely be deferred. However, LM IVUS assessment can be challenging due to a short length LM, diffuse disease, and calcification hampering reproducibility of the measurements.
Purpose: We sought to analyse the inter-observer variability between online assessment of LM IVUS pullbacks by operators during PCI procedures and an offline expert's review in a core laboratory.
Methods: In 77 patients enrolled in the Belgian Prospective Left Main Physiology Registry (PHYNAL) an automatic IVUS pullback either was recorded to evaluate moderate LM lesions. Interobserver variability and agreement on classification (£ *vs.* $>6\,mm^2$) were determined by comparing the MLA measured by the study operator online and the MLA measured offline by a blinded IVUS expert at UMONS Cœur core laboratory (corelab) using dedicated software. Median MLAs were compared with a Wilcoxon signed ranks test. Bland-Altman analysis and agreement of the number of patients who could have been deferred were performed.
Results: Median operators' MLAs (6.20 IQR 3.35 mm^2) differed significantly from median MLAs assessed in the corelab (5.85 IQR 2.61 mm^2; $p < 0.015$). The largest differences between corelab and online MLAs were $+5.72$ and $-9.19\,mm^2$. There was no proportional bias between MLAs. A MLA $>6\,mm^2$ was reported in 40 patients (51.9%) by the operators while in the corelab only 36 patients had a MLA $>6\,mm^2$ (46.7%) ($p =$ NS).

Patients characteristics		**n= 77**
Age (years)		71 IQR 14
Body mass index		27.0 IQR 5.8
Male	62	62
Smoker	16	16
Hypertension	60	60
Dyslipidemia	67	67
Diabetes mellitus	20	20
Coronary artery disease	33	33
Congestive heart failure	13	13
Chronic kidney disease	16	16
Stable angina	24	24
Silent ischemia	12	12
Dyspnea	32	32
Ostial left main lesion	29	29
Left main shaft lesion	19	19
Distal left main	47	47

Conclusion(s): Procedural online LM MLA measurements differed significantly from an offline expert's review due to, most of the time, inaccurate recognition of the frame with the 'narrowest-looking' lumen. It reflects limited experience with IVUS secondary to the lack of reimbursement in Belgium. With IVUS guiding treatment decisions, these findings highlight the need for further education in IVUS image interpretation and analysis.



Single-centre report on first consecutive transaxillary transcatheter aortic valve implantation (TAVI) cases in a Belgian Heart Valve Centre

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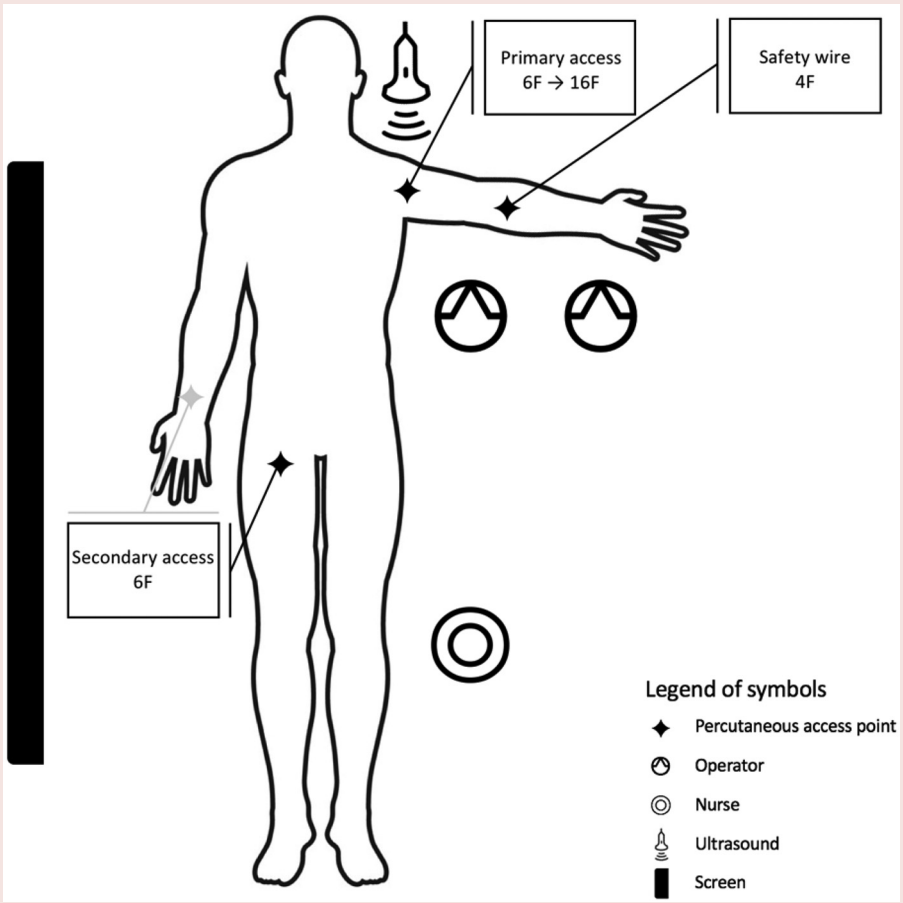
Background/Introduction: Transcatheter aortic valve implantation (TAVI) has proven to be a valid strategy for the treatment of severe aortic valve stenosis (AS). Percutaneous transaxillary access is becoming an increasingly used alternative technique if the transfemoral approach is unachievable.
Purpose: This study aims to evaluate the feasibility, safety, and outcome of the first consecutive transaxillary TAVI cases performed in a Belgian Heart Valve Centre.
Methods: Data were retrospectively collected from nine consecutive patients treated with percutaneous transaxillary TAVI between February 2020 and October 2021.
Results: Nine patients (mean age 81.78 ± 6.40 years; 66.67% men) at intermediate surgical risk (STS 5.74 ± 3.21%) were treated with transaxillary TAVI for severe symptomatic AS. All procedures were performed percutaneously after echo-guided puncture, using self-expanding transcatheter heart valves (THV) and suture and/or plug-based closure devices. Five procedures were performed under local anaesthesia, the remainder under conscious sedation. Successful delivery of the THV was achieved in eight (88.89%) cases. In one case, the THV was not deliverable due to a stented segment in the subclavian artery. Access site bleeding due to closure device failure was the most frequent procedural complication (33.33%; $N = 3$) necessitating the implantation of a covered stent with complete resolution of local bleeding in all cases. Both in-hospital and 30-day mortality and stroke were zero. Early mortality occurred in one patient (11.11%) that suffered non-cardiac death 5 months post-procedure.



Conclusion(s): Percutaneous transaxillary TAVI seems a feasible and safe technique and has evolved into the preferred alternative access when transfemoral approach is undesirable. Closure device failure remains an important pitfall, however, this complication can easily be overcome, keeping the procedure-related mortality rate low.

#Predicting complete functional revascularization using a virtual PCI Planner

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Background/Introduction: High FFR values after PCI carry a better prognosis than low post-PCI FFR values. Predicting post-PCI FFR might play an important role in procedural planning. Post-PCI FFR values can now be computed from pre-PCI coronary CT angiography (CCTA) using the FFR_{CT} Planner.
Purpose: This study aims at validating the accuracy of the FFR_{CT} Planner.
Methods: Multicentre, investigator-initiated, prospective study in CCS with significant lesions defined by invasive FFR $\leq$0.80. Standard of care CCTA images were processed for FFR_{CT}. Invasive trans-lesional pressure gradients were analysed by motorized FFR pullbacks. The FFR_{CT} Planner was applied to simulate PCI. The primary objective was the agreement between measured post-PCI FFR and predicted post-PCI FFR by FFR_{CT} Planner. Agreement on modelled FFR_{CT}Planner luminal dimensions was assessed using optical coherence tomography (OCT) as reference.
Results: We included 123 vessels in the analysis. The mean patient age was 64 ± 9 years, and 24% were diabetic. Measured FFR post-PCI was 0.88 ± 0.06 and Planner FFR_{CT} 0.86 ± 0.06 (mean difference 0.02 FFR units, LLA −0.12, ULA 0.15). OCT minimal stent area was 5.50 ± 1.99 mm^2 and FFR_{CT} Planner area 4.88 ± 2.95 mm^2 (mean difference 0.65 mm^2, LLA −2.33, ULA 3.63). The accuracy and precision of the FFR_{CT} Planner remained high in cases with focal and diffuse disease, low and high calcium burden, and across different CCTA image quality (Mean difference between FFR_{CT} and FFR post-PCI Likert score 2; 0.03 (0.08), Likert score 3; 0.02 (0.07) and Likert score 4; 0.02 (0.07); $p = 0.898$.
Conclusion(s): FFR_{CT} Planner was accurate and precise to predict FFR after PCI also in diffuse and calcific CAD. CCTA quality did not affect the predictive capacity of the FFR_{CT} Planner results.

#The Belgian Left Atrial Appendage Occlusion (BLAAO) Registry

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Background/Introduction: Transcatheter left atrial appendage occlusion (LAAO) is a valuable treatment for stroke prevention related to atrial fibrillation. Since January 2017, LAAO is reimbursed in our country under strict rules on patient and centres selection, with a quota of 300 procedures/year.
Purpose: The aim of the present study was to evaluate the safety and effectiveness of LAAO in Belgium.

Methods: Patients undergoing LAAO in Belgium between January 2017 and December 2020 were included in a dedicated database.
Results: Twenty-eight centres included 1291 patients (77 ± 9 years, 62% males, CHA2DS2-VASc 4.5 ± 1.4, HASBLED 3.3 ± 1.0) undergoing LAAO using the Amulet ($N = 859$) or the Watchman ($N = 432$) prosthesis. The number of procedures exceeded the quota of 300 in all but the first year. Device success was achieved in 98.1%. The rate of periprocedural complications decreased from 6% in 2017 to 2.5% in 2020. Among patients successfully implanted with a complete follow-up (1814 patient-years, mean duration 569 days), the actual annual stroke and the major bleeding rate were 1.7 and 2.5%, lower than the expected risk (5.3–66% reduction and 4.3–41% reduction, respectively). Overall survival was 75 ± 1% at 2-years follow-up with no difference between the device-type. In multivariate analysis, none of the criteria for patient selection to undergo LAAO was a predictor of stroke or death. The rate of patients under anticoagulant therapy was <10% at discharge and at follow-up. The outcome was not different among patients treated in high (≥10) from in low (<10) volume centres.
Conclusion(s): In Belgium, LAAO is safe and effective in stroke and major bleeding prevention without any anticoagulant given after the procedure in more than 90% of cases.

Safety and effectiveness of the short (0–1 h) high sensitive troponin protocol in real-life practice

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Background/Introduction: Recent European Society of Cardiology (ESC) guidelines recommend the use of a short 0–1 h high sensitive cardiac troponin (hs-cTn) algorithm in patients presenting with chest pain at the emergency department (ED). In our hospital, this new short hs-cTnI protocol was implemented in 2019.
Purpose: The present observational study evaluates the safety and effectiveness of the new 0–1 h hs-cTnI protocol in comparison with the standard 0–3 h cTnI protocol for the diagnosis of acute myocardial infarction (AMI).
Methods: A total of 2 × 100 consecutive chest pain patients presenting at the ED in November/December 2018 (standard 0–3 h cTnI group) and in November/December 2020 (short 0–1 h hs-cTnI group) were enrolled. Decision-making was based upon validated assay-specific cut-off values.
Results: The baseline characteristics of both groups were well-balanced except for a higher proportion of early presenters (<3 h) in the 0–3 h protocol group (56 *vs.* 41%). The final diagnosis of AMI was present in 24% of the 0–3 h group and in 20% of the 0–1 h group (*p*-value 0.50). The effectiveness of both protocols is shown in Figure 1. The overall accuracy was 88% in the 0–3 h group *vs.* 94% in the 0–1 h group (*p*-value 0.14). The 0–1 h protocol was associated with a higher rate of early hospital discharge (47 *vs.* 59% in the 0–3 and 0–1 h group, respectively, *p*-value 0.09) and with a shorter median length of stay for those patients (median 316 *vs.* 289 min, respectively, *p*-value 0.09). In addition, none of the early hospital discharge patients suffered MACE (major adverse cardiac event) within one month.
Conclusion(s): Transition from standard to short hs-cTnI protocol was safe and was associated with a clear trend toward better accuracy in detecting AMI and toward faster discharge.

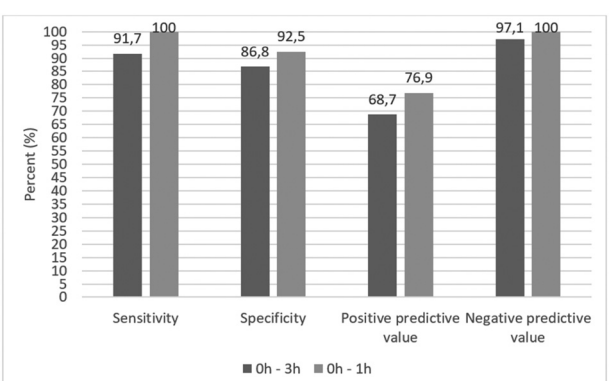

Figure 1. Effectiveness of the standard 0-3h cTnI group versus short 0-1h hs-cTnI group (hs-cTnI level at 3 hours after presentation for the observation group included).

*Does coronary lesion complexity and pre-procedural revascularization affect 5-year outcomes in patients undergoing transcatheter aortic valve implantation?

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Background/Introduction: Aortic valve stenosis (AS) and coronary artery disease (CAD) frequently coincide and in part share risk factors and pathogenesis. However, the indication for revascularization in these patients remains controversial.
Purpose: To investigate whether the presence of CAD, its complexity, and treatment with percutaneous coronary intervention (PCI) are associated with adverse clinical outcomes 5 years after transcatheter aortic valve implantation (TAVI).
Methods: Six hundred patients undergoing TAVI were included in a prospective registry between 2008 and 2021. Baseline SYNTAX score (SS) was calculated and patients were categorized according to low (1-median SS), intermediate (median SS-22), or high SS (>22). Whenever applicable, a residual SYNTAX score (rSS) was calculated after PCI.
Results: At five years, the presence of CAD was associated with a significantly worse survival (no CAD: 78%, CAD: 70%, HR: 1.415, $p = 0.029$) after TAVI (Figure 1). CAD complexity was associated with a significantly worse 5-year survival [no CAD: 78% ($n = 284$), low SS (1–15, $n = 149$): 72%, intermediate SS (16–22, $n = 67$): 70%, high SS (>22, $n = 100$): 67%, $p = 0.028$] (Figure 2) and significantly worse survival free from cardiovascular (CV) death (no CAD: 91%, low SS: 90%, intermediate SS: 84%, high SS: 83%, $p = 0.021$) (Figure 3). Pre-TAVI PCI in patients with an intermediate to high SS did not have an effect on survival (SS $\geq$16 + PCI: 65%, SS $\geq$16 without PCI: 71%, $p = 0.334$) or CV survival (SS $\geq$16 + PCI: 84%, SS $\geq$16 without PCI: 82%, $p = 0.712$) (Figure 4).
Conclusion(s): The presence of CAD and its anatomical complexity in patients undergoing TAVI are associated with significantly worse long-term outcomes without a clear positive effect of PCI. Hence, pre-procedural revascularization should probably be restricted to critical and simple lesions in proximal large vessels directly impacting procedural risk during TAVI.

Figure 1 All cause mortality 5 years after TAVI

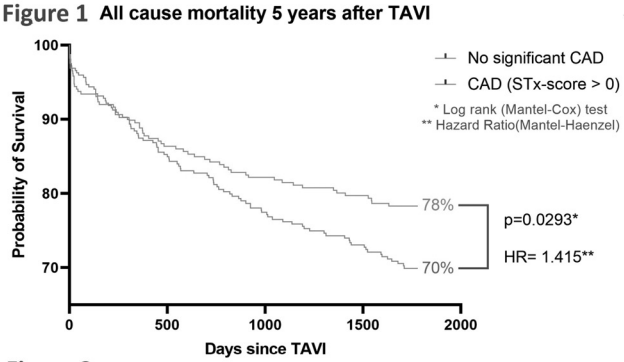


Figure 2 All cause mortality 5 years after TAVI

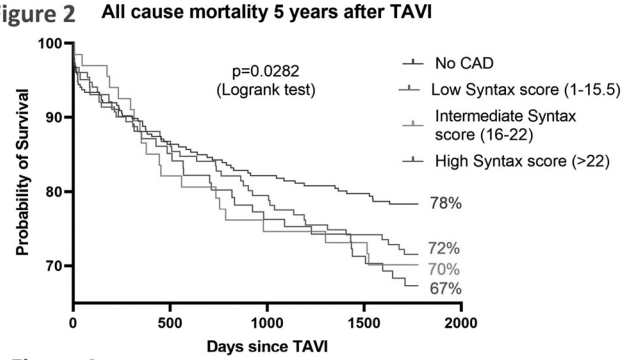


Figure 3

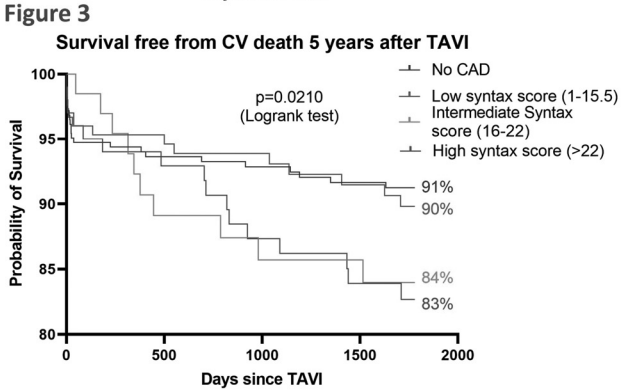
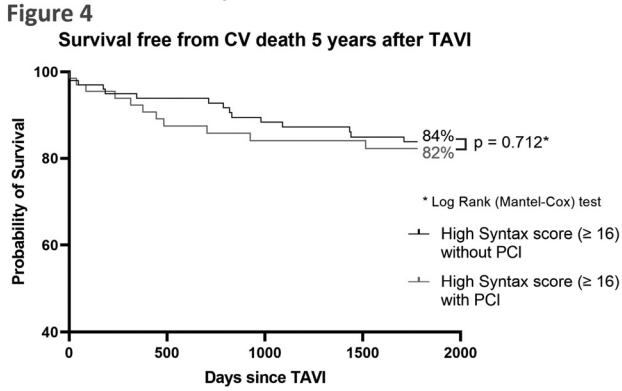


Figure 4



The ASZ-TEER Registry: report on first consecutive cases of percutaneous tricuspid valve edge-to-edge repair in a Belgian Heart Valve Center

Liesbeth Rosseel, Hadewich Hermans and Michael Rosseel

ASZ, Aalst, Belgium

Background/Introduction: Severe tricuspid valve regurgitation (TR) is prevalent and associated with high morbidity and mortality. Transcatheter tricuspid valve edge-to-edge repair (TTVR) is a promising novel percutaneous treatment option.
Purpose: To evaluate the safety and outcome in patients undergoing TTVR with the set-up of a novel tricuspid program within a Belgian Heart Valve Center.
Methods: The ASZ-TEER Registry is a prospective single-centre registry of consecutive TTVR cases.
Results: Six patients (mean age 80.3 ± 4.9 years) with severe TR at high surgical risk (mean EURO-II-score 5.5 ± 2.6%) were treated with a transcatheter edge-to-edge repair technique. The first case was performed in 2019, and the remaining five cases in 2021. All patients had heart failure due to ≥ severe functional TR with previous heart failure hospitalizations in four of six cases. All cases were performed in general anaesthesia under transoesophageal guidance. Acute device success (successful implantation of at least 1 device with no mortality or conversion to surgery) was achieved in all patients with immediate TR grade reduction to ≤ moderate in all patients. There were no other in-hospital complications. At 30-day follow-up, all patients improved NYHA Classification to ≤2, and a sustained reduction of TR ≤ mild was seen in five patients. One patient, with sub-optimal TR reduction to grade 3/5 at 30-days, developed acute kidney injury within the first 30 days post-procedure. After a total mean follow-up of 105 days (IQR31–174), there were no events of death, stroke, or major bleeding with no need for re-intervention.
Conclusion(s): This single centre experience demonstrates high procedural success with good reduction of TR and good clinical improvement. The set-up of a specific tricuspid valve team is required to deliver high-quality care to this specific subset of patients.

Case report: a successful percutaneous retrieval of an Amplatzer amulet device embolized in the mitral valve apparatus during a left appendage closure procedure

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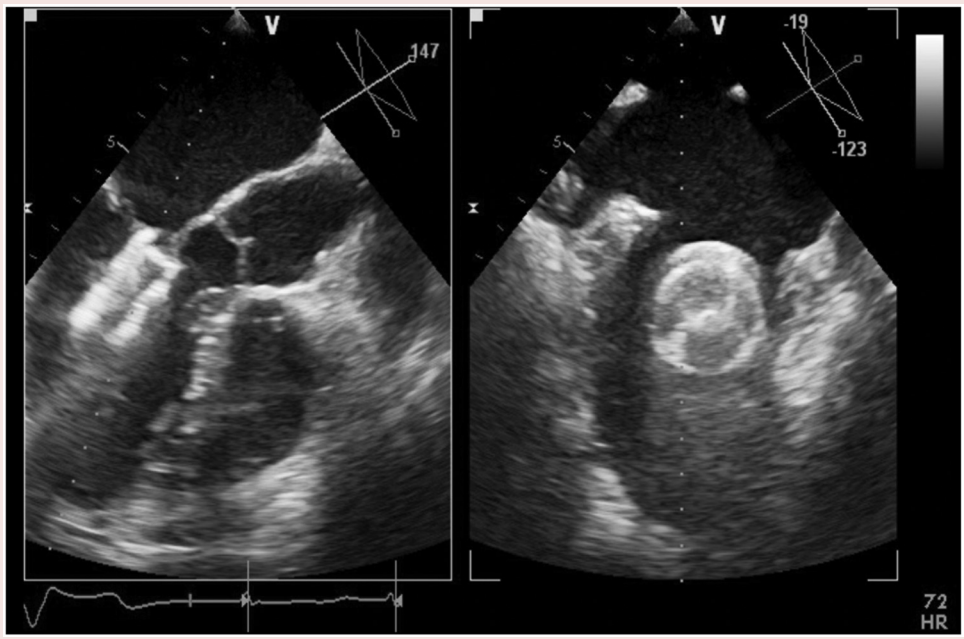
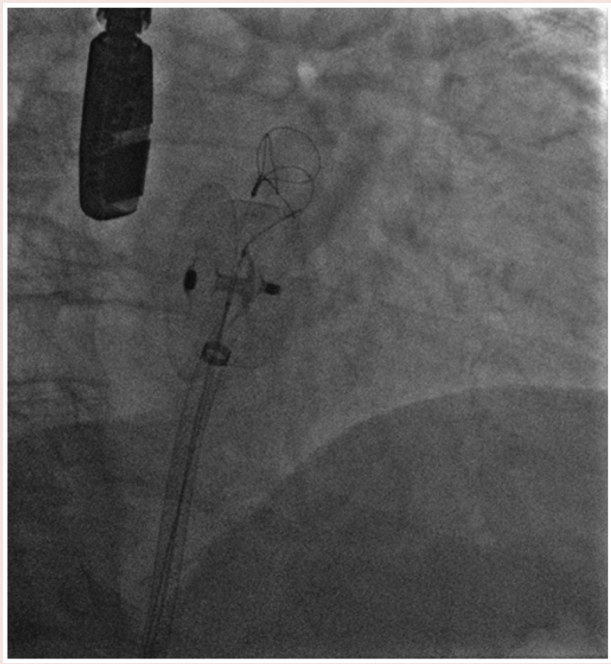
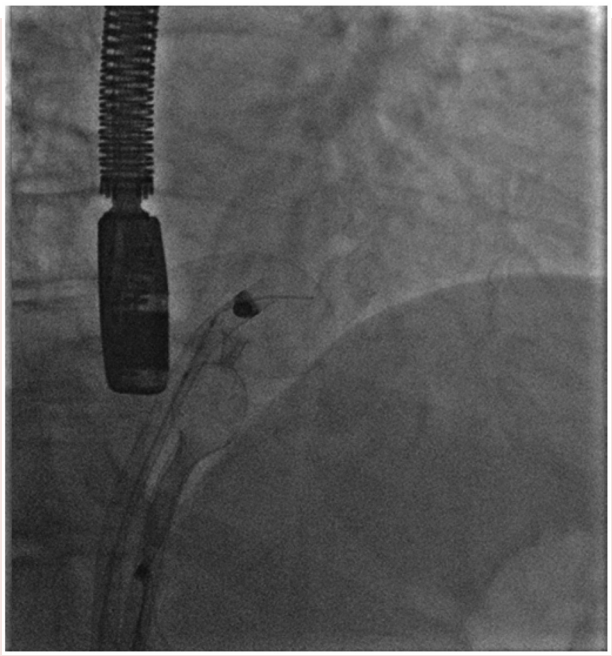
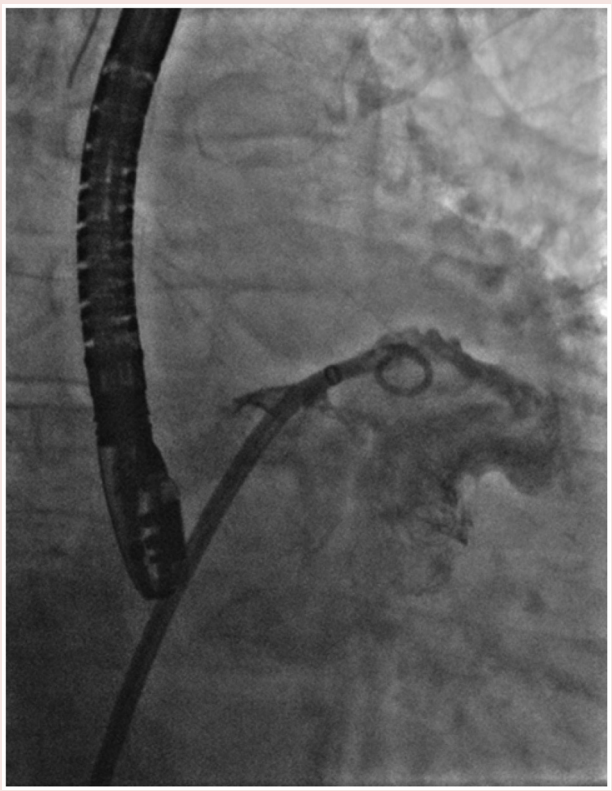
Background/Introduction:









Purpose: In this paper, we want to expose a clinical case of device embolization (DE) in the mitral apparatus during a percutaneous left auricular appendage closure treated by a successful percutaneous retrieval.
Methods: A 68years old man with a history of persistent atrial fibrillation and recurrent episodes of cardioembolic stroke under anticoagulation was sent to our clinic for left atrial appendage closure. A cardiac computed tomography revealed a windsock shape appendage with a total volume of 226cc. The ostium was 26×32 mm.
Results: An Amplatzer amulet occluder of 31 mm was chosen for this procedure. The implantation was realized following the manufacturer's standard guidelines and recommendations, after verification of the 5 criteria and after having performed a tug test. After 2 min, the device spontaneously dislodged from the appendage and embolized into the left ventricular cavity in the mitral apparatus, causing hemodynamic instability. The device was dislodged from the mitral apparatus with a retrieval forceps (Cook) passed through the transseptal sheath, and carefully dragged in the left atrium with the lobe in the first position to avoid any damage to the valve. A second sheath (Amplatzer Amulet 14F) was introduced through transseptal access, allowing

the operator to use a guiding EBU 6F to get around the device, to capture it at the level of the end screw pin with an N SNARE EV3, and to drag it into the sheath for extraction. The left appendage was then successfully occluded with a 34mm diameter occluder. The TTE at 24 h, 1, and 6 months confirmed a good device position, and no complications on the mitral apparatus.
Conclusion(s): With adequate retrieval tools, accurate knowledge, and sufficient experience, percutaneous retrieval of embolized LAA occluders devices can be performed successfully.

Right atrial pacing as predictor for permanent pacemaker implantation after TAVI implantation

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AZ Sint-Jan, Bruges, Belgium

Background/Introduction: The persistent growth in transcatheter aortic valve implantation(TAVI) calls for optimized early discharge programs to handle the increasing patient load. While procedural safety improved over the years, acquired conduction abnormalities and necessitating prolonged rhythm monitoring and permanent pacemaker(PPM) implantation have remained high, up to 33.7% for some TAVI platforms.
Purpose: *En passant* rapid atrial pacing (RAP) immediately following TAVI has recently been reported to be a valuable tool in PPM risk-stratification. We report here our single centre standard-of-care experience.
Methods: All TAVI candidates with no pre-existing pacemaker and in sinus rhythm received RAP before and after TAVI, using a pacing protocol from 80 to 120/min was applied to detect Wenckebach atrioventricular block (WB).
Results: Out of a total of 75 consecutive patients(from January till October 2021) receiving TAVI. In 42 patients, pre-or post-TAVI-implantation RAP could be performed. Nine patients(21%) had baseline AV block grade I, six patients (13%) had right bundle branch block and five patients (12%) had left bundle branch block. Before the TAVI procedure, 12 patients (29%) had pre-existing or baseline WB at RAP. Presence of baseline-WB was associated with PPM implantation (OR 6.43 [CI: 1.23–33.65], $p < 0.028$). Immediately after TAVI-procedure, WB was present in nine patients (24%) without total AV-block. Most importantly, the absence of WB at RAP immediately post-TAVI was observed in 29 patients (76%) and had a negative predictive value of 97%, with a strong association with no-PPM necessity (OR 14.00 [CI: 1.23–158.84], $p = 0.033$).
Conclusion(s): RAP appears to be a powerful risk-stratification tool for PPM necessity after TAVI. Pre-implantation WB identified patients at high risk for PPM, whereas the absence of post-implantation WB identified patients at low or no risk for PPM. TAVI-operators might consider using this safe and simple technique in their regular practice.

Mapping the recovery of cardiac services during the second year of COVID-19 pandemic in Iraq

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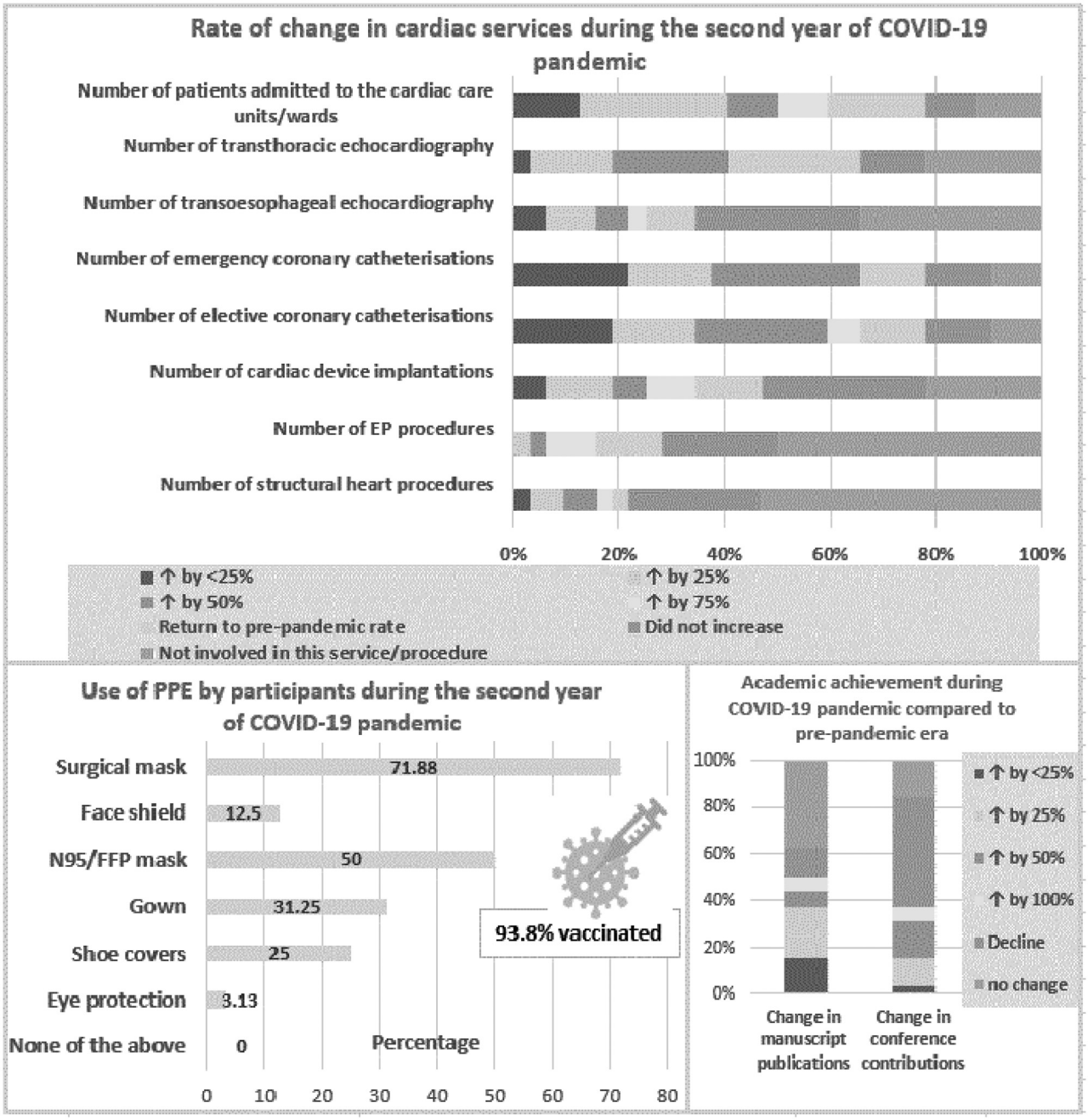
Background/Introduction: Earlier studies reported how significantly COVID-19 impacted the cardiology services globally. Many countries are surfing subsequent waves of COVID-19, yet, there is no global data in general nor from Iraq in particular regarding the extent of return of cardiac services to normal during the second year of the pandemic.
Purpose: To investigate the rate of change in cardiac services during the second year of the pandemic in Iraq.
Methods: A 23- item online survey was sent via social media to healthcare professionals who were involved in providing cardiac services. The survey focused on the rate of changes in non-invasive and invasive cardiac services in 2021 compared with 2020 and the type of PPE currently used by participants. It also assessed the academic achievements of respondents during the pandemic compared to the pre-pandemic era.
Results: Thirty-two healthcare professionals responded, 15.6% were women, 15.6% work in COVID-19 designated hospitals, 81.3% were interventional cardiologists, 9.4% were clinical cardiologists and 9.3% were pharmacists. Respondents were FITs in 54.3%. Transthoracic echocardiography and hospital admissions were the most reported cardiac services returning to the pre-pandemic rate of 25 and 18.8%, respectively. Telemedicine is used by 56.3% in outpatient consultations. Vaccine received by 93.8%, most commonly used PPE was a surgical mask (71.88%). Compared to pre-pandemic, no change in the number of academic publications was recorded in 37.5% while 46.9% reported a decline in their contribution to conferences during a pandemic, and 12.5% published COVID-19 related research.



Conclusion(s): During the second year of the pandemic there is an increase in most cardiac services in Iraq, especially in the non-invasive services which can be due to the increase in the number of vaccinated healthcare providers which enhanced the flow of cardiac services and procedures during the second year of pandemic.

OTHER

A word of caution on the pulse wave velocity calculated using the reflected wave transit time of a suprasystolic inflated brachial cuff

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Background/Introduction: Pulse wave velocity (PWV) is an independent cardiovascular risk factor but we lack accurate estimations easily implemented in a clinical setting. Measurement of the time interval between the early and late systolic peaks recorded with an arm cuff inflated at a suprasystolic pressure has been proposed to this end: the reflected wave transit time (RWTT).
Purpose: We sought to invasively validate during cardiac catheterization this proposed non-invasive PWV_{RWTT}.
Methods: After coronary angiography, 38 patients were enrolled. An invasive reference PWV_{INV} was computed from the transit time between the feet of (i) the aortic blood pressure (BP) recorded with a well-flushed fluid-filled catheter left just above the aortic valve and (ii) the pressure of the cuff inflated around the right calf. The distance used was the sum of the Jugulum-Symphisis distance (JS) + symphysis-calf. Simultaneously, the cuff of an oscillometry monitor was inflated at suprasystolic BP around the left arm. Two RWTT were computed, peak-to-peak between the anterograde and reflected waves, and foot-to-foot (see Figure 1). As described, the travelled distance used for PWV calculation was 2xJS. All invasive and non-invasive pressure curves and ECG were digitized at 1000 Hz for offline processing.
Results: Patients' mean age was 62 ± 9 years with 68% men, 73% hypertension, 34% diabetes mellitus, and 82% dyslipidaemia. Mean reference PWV_{INV} was 8.7 ± 1.6, $PWV_{RWTfoot}$ 5.0 ± 1.1 and $PWV_{RWTpeak}$ 5.7 ± 1.2 m/s. RWT peak-peak and foot-foot were highly correlated to each other (R^2 = 0.81) but not with PWV_{INV} (R^2 0.033 and 0.007, p = ns). There was a significant bias with PWV_{INV} of 3.7 ± 1.9 and 3.0 ± 1.8 m/s, respectively for $PWV_{RWTfoot}$ and $PWV_{RWTpeak}$.
Conclusion(s): Estimating PWV non-invasively is clinically attractive, but any simplified approach needs to hold accurate estimates against a straightforward invasively measured reference PWV. The RWTT method appears to miss this goal. The challenge might well precise assessment of the reflection site, supposed to be aorto-iliac bifurcation.

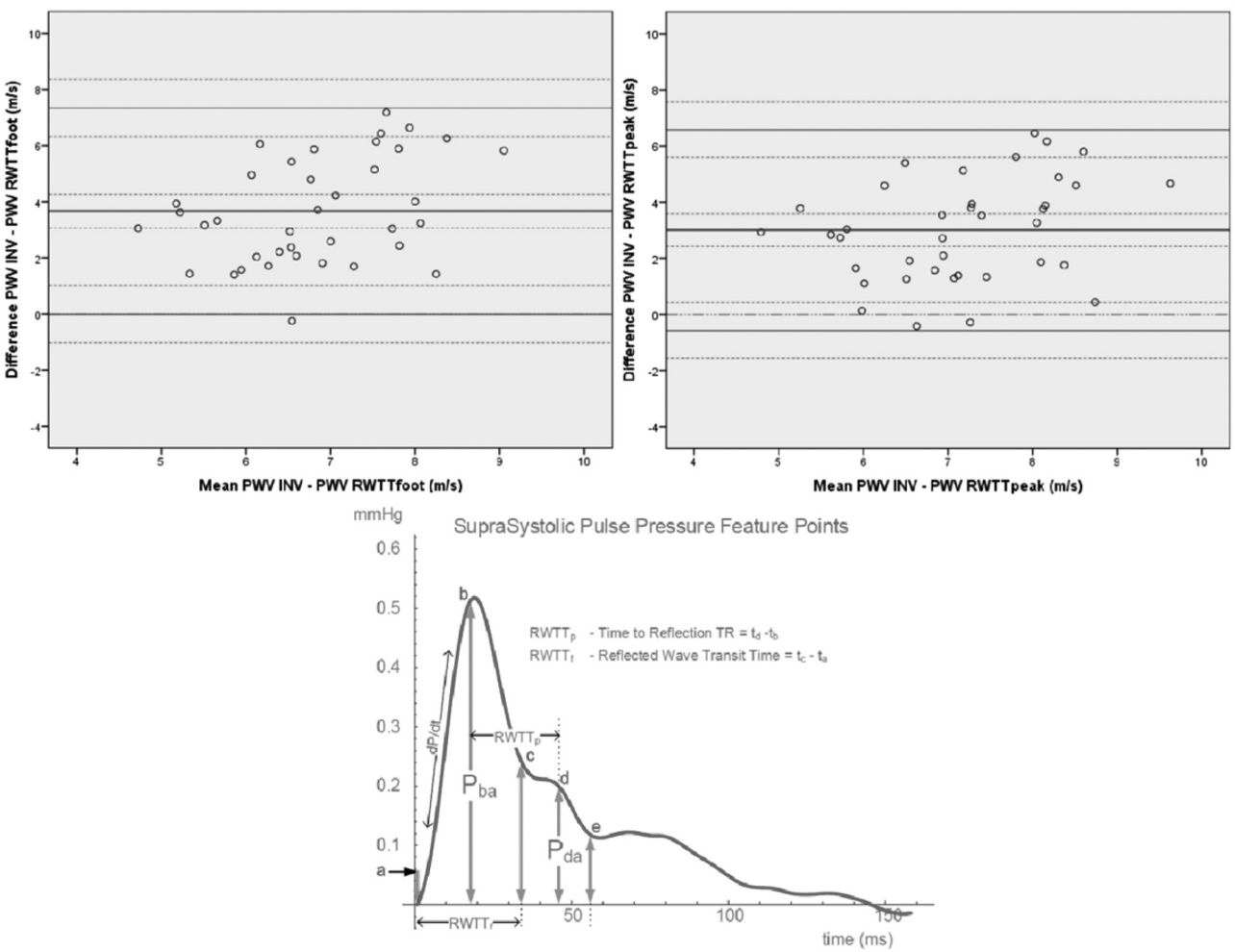

Figure 1. Bland-Altman chart comparing the invasive PWV (PWV INV) and the PWV derived from reflected wave transit time (RWTT) foot (left) or RWTT peak (right). Below, a representation of a blood pressure recording and the identification of the RWTT.

Long-term evolution of NT-proBNP-levels and exercise capacity in 132 left ventricular assist device recipients

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Background/Introduction: Little is known about the long-term evolution of NT-proBNP-levels in LVAD-recipients. Besides this, the potential correlation of NT-proBNP with exercise capacity in the long term after LVAD-implantation has not been previously studied.
Purpose: How do NT-proBNP-levels and exercise capacity evolute over time and how do both correlate in LVAD-supported patients?
Methods: We retrospectively analysed 132 single centre LVAD recipient records (HeartMate II/III; HeartWare; between March 2007 and January 2018; mean follow-up of 559 days). Blood samples, six-minute walking test, and maximal cardio-pulmonary exercise test were performed in a standardized way.
Results: Pre-LVAD NT-proBNP-levels were increased (9735.8 ± 1071.7 ng/L) and dropped significantly after implantation [14 days: 4359.5 ± 545.2 ng/L ($p < 0.0001$), 6 months: 1485.1 ± 139.2 ng/L ($p < 0.0001$)]. Afterwards a steady state was reached during follow-up (after one year: 1592.0 ± 213.9 ng/L, after five years: 1678.8 ± 311.4 ng/L). Submaximal exercise capacity significantly improved post-operatively [%6MWT 50 ± 16% (0–3 months); 61 ± 18% (3–6 months ($p < 0.001$)], with a steady state afterwards [66 ± 15% (6–12 months, $p = 0.08$); 64 ± 18%, $p = 0.70$ later on]. We found a gradual increment of $\%VO_2$max post-operatively [44 ± 10% (0–3 months); 49 ± 13% (3–6 months); 52 ± 14% (6–12 months); 53 ± 12% (after 12 months)] with a significant improvement between 0 and 3 months *vs.* after the first year on LVAD. Furthermore, we showed a significant correlation between NT-proBNP-levels and results at both the six-minute walking test (correlation coefficient: −0.31, $p < 0.0001$) and cardiopulmonary exercise testing (correlation coefficient: −0.28, $p < 0.0001$).
Conclusion(s): We showed that submaximal (six-minute walking test) and maximal exercise capacity (cardiopulmonary exercise testing) improve after LVAD implantation and demonstrated an inverse correlation of both tests with NT-proBNP-levels.

Intra-hospital prevalence of atrial fibrillation and consequences on intra-hospital death in elderly patients: a single centre study over one year

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Background/Introduction: Atrial fibrillation (AF) affects 7.3–13.7% of community-dwelling patients aged 80 years or older. AF is related to a wide panel of complications among which an augmented risk of mortality, hospitalization, stroke, and heart failure as well as cognitive decline. Intra-hospital prevalence and impact of those complications are not well-described in the elderly.
Purpose: This study aims to analyse the prevalence of AF among patients older than 74 years and its association with intra-hospital death.
Methods: Anonymized medical data from 7653 hospitalization stays of patients 75 years and older between 01/01/2019 to 31/12/2019 were extracted from the central 'minimal medical summary' from Jolimont Hospital. To consolidate data, variables were also extracted from the medical history from medical files.
Results: Among 7670 hospital stays of patients 75 years and older, 671 (8.7%) deaths were recorded among which 324 (48%) had atrial fibrillation. AF was recorded in a total of 2492 (38%) hospital stays among which 324 (324/2492, 11%) deaths were recorded. Among studied variables, Age, Atrial Fibrillation, Hypertension, Oncologic diagnosis, and heart failure were strongly associated with mortality ($p < 0.001$). After adjusting for age and heart failure, AF remained significantly associated with in-hospital death ($p = 0.017$, OR 1.23).
Conclusion(s): This pilot study reports a very high prevalence of AF at 38.35%. Near half (48%) of the recorded deaths were concomitantly recorded with atrial fibrillation whereas the mortality rate during hospital stay among patients with atrial fibrillation was 11.01%. The difference between the mortality rate of hospitalized patients with AF and without AF (11.01 *vs.* 7.34, $p < 0.0001$) was highly significant. AF was significantly related to in-hospital mortality even after adjusting for HF and age.

#Heparin dosing in cardiogenic shock patients supported by short-term percutaneous microaxial left ventricular assist devices: less might be more

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Background/Introduction: Impella™ is increasingly used in cardiogenic shock (CS). However, both thromboembolic and bleeding events are frequent during pMCS and the optimal anticoagulation strategy remains underexplored.
Purpose: This study compares centres aiming at therapeutic range aPTT UFH anticoagulation strategies in Impella™-supported CS patients to a centre with an intermediate-range aPTT anticoagulation strategy.
Methods: This hypothesis-generating multi-centre cohort study investigated 170 matched patients with left-Impella™ support. We (A) compared bleeding/thrombotic events in two centres aiming at therapeutic range activated partial thromboplastin time (aPTT 60–80s) and (B) compared bleeding/thrombotic events of these centres with one centre aiming at intermediate range aPTT (aPTT 40–60s).
Results: After propensity score matching, there were no differences in patients characteristics. In centres aiming at therapeutic aPTT-ranges, major bleeding was significantly higher in patients that achieved aPTT $\geq$60s within 48h of left-Impella™ support *vs.* patients that did not [aPTT $\geq$60s: 22 (37.3%) *vs.* aPTT$<$ 60s 14 (23.7%); Hazard ratio [HR], 0.06 (95%) CI, 0.01–0.45; $p = 0.006$]. Major cardiovascular and cerebrovascular adverse events (MACCE) did not differ between both groups. Centres aiming at a therapeutic range aPTT-strategy showed higher major bleeding rates [therapeutic range: 8 (47.1%) *vs.* centres aiming at an intermediate range strategy: 1 (5.9%); Hazard ratio [HR], 0.06 (95%) CI, 0.01–0.45; $p = 0.006$]. MACCE were lower in the intermediate range aPTT group as well [MACCE - therapeutic range 12 (70.6%) *vs.* intermediate range 5 (29.4%) HR, 0.32 (95%) CI, 0.11–0.92; $p = 0.034$].
Conclusion(s): This multi-centre, propensity-matched pilot analysis showed that lowering the UHF-targets to intermediate levels in left-Impella™ supported CS patients seems to be a safe and promising strategy for reducing major bleeds without increasing MACCE. These findings need to be validated in larger, randomized clinical trials.

#Heart failure hospitalization in adult patients with congenital heart disease: risk factors for repeated admissions

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Background/Introduction: Heart failure hospitalizations in adult patients with congenital heart disease (ACHD) are increasing and associated with higher healthcare-related costs.
Purpose: We aimed to evaluate factors that are associated with repeated ACHD heart failure (ACHD-HF) hospitalizations and whether ACHD-HF hospitalizations are related to adverse outcomes.
Methods: Out of 3995 patients under active follow-up in our institution (last visit $>$2010), 256 patients (mean age 49.5 ± 16.7 years) had ACHD-HF and were included in the study. Medical records were reviewed, including heart failure hospitalization before and after study inclusion. A combined endpoint of death, ventricular assist device, and transplantation was defined.
Results: Overall, 136 ACHD-HF patients (53%) had a prior heart failure hospitalization. Over a mean follow-up of 2.5 ± 2.3 years, 44 patients (17%) had repeated heart failure hospitalizations. Of these, 31 patients (12%) had 1; nine patients (4%) 2 and four patients (2%) 3 repeated heart failure hospitalizations. Patients with repeated heart failure hospitalizations had higher NYHA class ($p = 0.031$), were more likely to have end-organ dysfunction ($p = 0.025$), and were more likely to have a prior heart failure hospitalization ($p < 0.001$). In multivariable Cox regression analysis, only end-organ dysfunction (HR 2.431, 95%CI 1.516–43.896, $p < 0.001$) was related to repeated hospitalization. Seventy patients (27%) reached the combined endpoint of death, VAD, or transplantation (event rate 11% per year). Repeated heart failure hospitalizations were not related to the combined endpoint in Cox regression analysis.
Conclusion(s): Heart failure hospitalizations are frequent in ACHD-HF. End-organ dysfunction appears to be a strong determinant of repeated heart failure hospitalizations. Event-rate is high in patients with ACHD-HF, but repeated heart failure hospitalizations were not related to the outcome in this short-term follow-up study.

KCNMA1-related pathology—expanding the clinical phenotype of a rare channelopathy

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Background/Introduction: *KCNMA1* mutations have recently been associated with a wide range of dysmorphological, gastrointestinal, cardiovascular, and neurological manifestations.
Purpose: In two cases presenting with diverse phenotypical manifestations that did not fit into well-known clinical entities, we searched for a plausible genetic cause.
Methods: Whole exome sequencing was performed to identify the underlying pathogenic mutation.
Results: In an 8-year-old boy presenting with severe aortic dilatation, facial dysmorphism, and overgrowth at birth a de novo p.Gly375Arg *KCNMA1* mutation was identified which has been reported previously in association with gingival hypertrophy, aortic dilatation, and developmental delay. Additionally, in a 30-week-old foetus with severe growth retardation and duodenal atresia a *de novo* p.Pro805Leu *KCNMA1* mutation was identified. The latter has also been reported before in a boy with severe neurological manifestations, including speech delay, developmental delay, and cerebellar dysfunction.
Conclusion(s): The current report presents the first antenatal presentation of a pathogenic *KCNMA1*mutation and confirms the specific association of the p.Gly375Arg variant with early-onset aortic root dilatation, gingival hypertrophy, and neonatal overgrowth. Further research will be necessary to understand the observed clinical variability and to better understand *KCNMA1*-related pathology.

Association between ECG changes and prognosis in subarachnoid haemorrhage

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Background/Introduction: Cardiac complications are frequently seen in patients with subarachnoid haemorrhage (SAH). Previous studies that examined the relation between electrocardiographic and echocardiographic changes in SAH patients and prognosis were conflicting.
Purpose: We evaluated the association between ECG changes at admission and patient outcomes (ICU length-of-stay; in-hospital mortality) in SAH patients and explored the use of echocardiography.
Methods: Patients with aneurysmal SAH admitted to ICU, Ghent University Hospital, between 01/06/2017 and 31/12/2020, were enrolled. We reviewed ECG at admission for ST/T and QTc changes and echocardiography (TTE) for left ventricular function (LVF). Univariate regression analysis or Chi-square testing was used wherever applicable.
Results: Of 150 SAH patients, five had no ECG at admission and were excluded, 74 patients had a normal ECG (group 1), 71 patients had ECG changes (group 2): prolonged QTc (66%), ST-T changes (12%) or both (21%). Age, sex, smoking history, and known cardiovascular disease did not differ between groups. Arterial hypertension was more prevalent in group 2 ($p = 0.033$). Seven patients underwent a TTE in group 1 (9%) *vs.* 18 in group 2 (25%). Ten TTE's showed reduced LVF (group 1: 0%, group 2: 55%). ICU length-of-stay was lower in group 1 compared to group 2 (7.7 *vs.* 12.2 days, $p = 0.003$). In-hospital mortality was lower in group 1 (6.7 *vs.* 20.0%, $p = 0.021$). Reduced LVF was not associated with mortality.
Conclusion(s): ECG changes at admission in SAH patients are associated with a worse prognosis. Echocardiography was performed in only 25% of patients with ECG changes. In SAH patients with an abnormal ECG, reduced LVF was present in more than 50%. Further research to clarify the prognostic role of echocardiography in SAH patients is warranted.

Value of 18F-FDG PET/CT for prognostic assessment in patients with infective endocarditis

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Background/Introduction: 18F-FDG PET/CT is a valuable diagnostic tool in infective endocarditis (IE). However, the prognostic value is unclear.
Purpose: This study aims to evaluate the prognostic performance of 18F-FDG PET/CT in native valve endocarditis (NVE) and prosthetic valve endocarditis (PVE).
Methods: We retrospectively included 76 patients treated for definite IE (NVE and PVE) that underwent 18F-FDG PET/CT between January 2016 and December 2018. Clinical, echocardiographic, and 18F-FDG PET/CT (pathologic valvular 18F-FDG uptake, extracardiac complications) data were collected. The primary endpoint was defined as mortality or recurrence of IE at a one-year follow-up.
Results: Pathologic valvular 18F-FDG uptake was detected in 32 of 57 (56.1%) patients, 30% (9/30) in the NVE and 85.2% (23/27) in the PVE group. Atrial fibrillation (OR 3.90, 95% CI =1.14–16.3), prior anticoagulation therapy (OR 6.37, 95% CI =1.89–26.7), large vegetation (≥10mm) (OR 4.05, 95% CI =1.14–16.1), perivalvular complications (OR 7.22, 95% CI =1.68–55.1) and abscess (OR 10.9, 95% CI =1.84–283) were associated with positive PET/CT. Extracardiac complications were found in 27 of 76 (35.5%) patients, 42.9% (18/42) in the NVE and 26.5% (9/34) in the PVE group. Pathological valvular tracer uptake (HR 1.20, 95% CI =0.43–3.37) or extracardiac complications (HR 0.58, 95% CI =0.21–1.62) were not associated with occurrence of the primary endpoint.
Conclusion(s): Our study could not demonstrate a prognostic value of 18F-FDG PET/CT in IE, but confirms the high diagnostic performance, especially in prosthetic valve endocarditis. This may compromise the prognostic significance by accelerated optimal treatment because of earlier diagnostic certainty.

Impact of pulmonary vascular resistance lower than 3 wood units in characterizing pulmonary hypertension

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Background/Introduction: The definition of pulmonary hypertension (PH) has recently been revised by lowering the mean pulmonary artery pressure (mPAP) > 20 mmHg from 25 mmHg, associated with a pulmonary vascular resistance (PVR) value ≥3 wood unit (WU) (Simonneau et al., 2019). However, more recent data suggest that a PVR ≥2.2 WU is associated with increased mortality (Maron et al., 2020).
Purpose: Our aim is to describe the clinical, hemodynamic (invasive and non-invasive) and functional characteristics of patients with PVR ≤3 WU and to assess the impact of a decrease in PVR to 2.2 WU in this population.
Methods: This is a retrospective chart-based study of patients with a PVR ≤3 WU measured at right heart catheterization (RHC). The impact of RHC and non-invasive tests were analyzed by dichotomizing the population into two subgroups with a PVR threshold set at 2.2 UW.
Results: A total of 97 patients had a PVR ≤3WU and were distributed as follows: 64 (66%) with PVR <2.2 WU and 33 (34%) with PVR ≥2.2 UW. Forty-one patients (42.3%) had a PAPm >20 mmHg. Sixteen patients (16.5%) with PAPm ≥20 mmHg and PAWP <15 mmHg were unclassifiable and did not reach the 3 WU of PVR required for pre-capillary forms according to the new definition. In the PVR ≥2.2 WU group, patients were older ($p = 0.036$) and there were more heart failure (HF) patients ($p = 0.044$) than in the PVR <2.2 WU group.
Conclusion(s): Our analysis suggests that the new definition of PH identifies more patients. A decrease of the PVR threshold to 2.2 WU appears to identify more patients with HF than individuals with pulmonary vascular disease.

Prevalence of hyperventilation in patients with reflex syncope following tilt training

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Background/Introduction: Treatment for reflex syncope (RS) preferably consists of education, lifestyle modification, physical counterpressure manoeuvres, and tilt training. Patients currently referred for tilt training in our University Hospital often present with stress-related symptoms and hyperventilation (HV). These might compromise tilt training response and might require a separate treatment approach.
Purpose: To determine the prevalence of objectively diagnosed HV in patients with RS and to describe the effect of HV on tilt training outcomes.
Methods: Between July 2014 and March 2021, 172 patients with a positive diagnostic tilt test, were referred for tilt training. Supervised tilt training was provided once a week and patients were instructed to perform 2 home sessions on a weekly base. When HV was suspected, patients were referred for an HVPT, whereafter they were categorized into three groups: (1) patients with a suspicion of HV and a positive HVPT (HVobj), (2) patients with a suspicion of HV and a negative HVPT (HVsubj), and (3) patients without suspicion of HV (No-HV).
Results: HV was suspected in 43 patients (25%) with RS. In 29 (67%) of these patients, HV was diagnosed using an HVPT. The suspicion of HV was significantly higher in female patients (HVobj: 83% *vs.* HVsubj: 100% *vs.* No-HV: 67%; $p = 0.009$). The duration of the first tilt training was significantly lower in patients in whom HV was suspected (HVobj: 21 [14–37] *vs.* HVsubj: 28 [10–39] *vs.* No-HV: 36 [18–45] min; $p = 0.031$) (Figure 1).
Conclusion(s): Hyperventilation is not uncommon in patients with RS. A more comprehensive treatment approach might be necessary for these patients including not only tilt training but also breathing advice and rehabilitation. Further prospective research is necessary to confirm these findings.

	HVobj N=29	HVsubj N=14	No-HV N=129	p-value
Age (years)	28 [17-37]	21 [15-26]	29 [17-55]	0.079
Gender (female (n;%))	24 (83)	14 (100)	87 (67)	**0.009**
Antidepressants, antipsychotics, hypnotics, sedatives or anxiolytics (n;%)	4 (14)	1 (7)	12 (2)	0.925
Duration tilt test (minutes)	27 [16-35]	21 [11-37]	21 [13-34]	0.488
Duration 1st tilt training (minutes)	21 [14-37]*	28 [10-39]*	36 [18-45]	**0.031**
Sessions until 3x45 minutes (n)	7 [5-8]	9 [8-11]	6 [4-10]	0.413
Sessions until 1st negative tilt training (n)	1 [0-3]	3 [1-4]	1 [0-2]	0.141
Type RS during diagnostic tilt test° (n;%)				0.832
Type I	11 (38)	6 (43)	50 (39)	
Type IIa	0 (0)	0 (0)	2 (2)	
Type IIb	7 (24)	5 (36)	28 (22)	
Type III	11 (38)	2 (21)	49 (38)	

*Figure 1: Tilt training outcomes in 3 groups based on result HVPT. Data are expressed as median [Q1-Q3] or as n (%). HVobj: Patients with suspicion of hyperventilation and a positive hyperventilation provocation test; HVsubj: Patients with suspicion of hyperventilation and a negative hyperventilation provocation test; No-HV: Patients without suspicion of hyperventilation; RS: Reflex syncope; Type I: Mixed (pre-) syncope; Type IIa: Cardioinhibitory syncope without asystole; Type IIb: Cardioinhibitory syncope with asystole; Type III: Vasodepressor (pre-) syncope. °Type of RS based on Vasis Classification. *Significant difference with No-HV group. p<0.05.*

Tilt training as treatment for reflex syncope: still standing strong!?

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Background/Introduction: Reflex syncope (RS) is the most common non-traumatic cause of transient loss of consciousness. Despite RS being a benign condition, the impact on the quality of life of patients is significant. European guidelines recommend education (class I), lifestyle modification (class I), and physical counter-pressure manoeuvres (class IIa) as the most important treatment components in patients with RS. Tilt training may be recommended in RS, but evidence on this topic is scarce and outdated.
Purpose: We wanted to re-evaluate the effectiveness of tilt training in patients with RS by describing both the occurrence of the first negative tilt training, the adherence to the tilt training program, and (pre-) syncope recurrence after 1 year of tilt training completion in a recent cohort of patients.
Methods: Between July 2014 and March 2021, 172 patients (27 [17–48] years; 73% female) with a positive diagnostic tilt test, were referred for tilt training. Supervised tilt training was provided once a week and patients were instructed to perform 2 home sessions on a weekly base. Criteria for tilt training completion are depicted in Figure 1.
Results: Demographic characteristics of the study population are presented in Figure 2. The most frequent types of RS were type III (39%) and type I (37%) (Figure 3). The first negative tilt training was reached after a median of 1 [0–2] sessions. One hundred six (62%) patients completed the tilt training program and 33% dropped out. The remaining 5% did not follow the standard tilt program. One year after tilt training completion, none of the patients needed to restart because of syncope. Recurrence of pre-syncope was present in 19% of patients.
Conclusion(s): In the current era, tilt training still works in patients with RS. Motivation is essential for tilt training completion and prevention of (pre-) syncope recurrence.

Treatment completion was reached when

1) patients with a first positive tilt training were able to persevere 45 minutes in tilted position (60° Westminster protocol) during 3 consecutive weeks.
2) patients with a first negative tilt training and a second positive tilt training after 6 weeks were able to persevere 45 minutes in tilted position during 3 consecutive weeks.
3) patients with an initial negative tilt training achieved a second negative training after 6 weeks.

Figure 1: Criteria for tilt training completion

N=172	
Age (years)	27 [17-48]
Gender (female (n;%))	125 (73)
Duration asystole (RS Type IIb*) (seconds)	12 [7-24]
Duration diagnostic tilt test (minutes)	22 [13-35]
Duration 1st tilt training (minutes)	35 [17-45]
Sessions until 1st negative tilt training (n)	1 [0-2]
Sessions until 3x45 minutes (n)	6 [5-9]

*Figure 2: Demographic characteristics. Data are expressed as median [Q1-Q3] or as n (%). RS: Reflex syncope. *Type of RS based on Vasis Classification.*

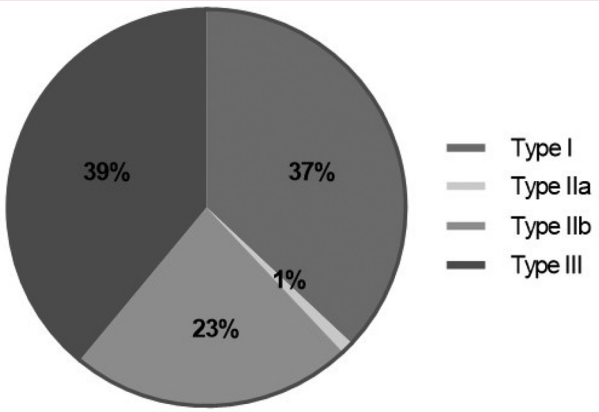

Figure 3: Type of RS based on Vasis Classification. Type I: Mixed (pre-) syncope; Type IIa: Cardioinhibitory syncope without asystole; Type IIb: Cardioinhibitory syncope with asystole; Type III: Vasodepressor (pre-) syncope.

Role of NT proBNP in the characterization of pulmonary vascular diseases: pre *vs.* post-capillary pulmonary hypertension

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Background/Introduction: NT-proBNP is a prognostic marker of pulmonary hypertension (PH) irrespective of its cause, which response to increased left or right ventricular filling pressures. However, the clinical determinants of NT-proBNP are incompletely understood in PH due to left heart disease (PH-LHD). In addition, confounding factors, such as atrial fibrillation (AF) and left ventricular dysfunction may increase NT-proBNP independently of the presence of PH.

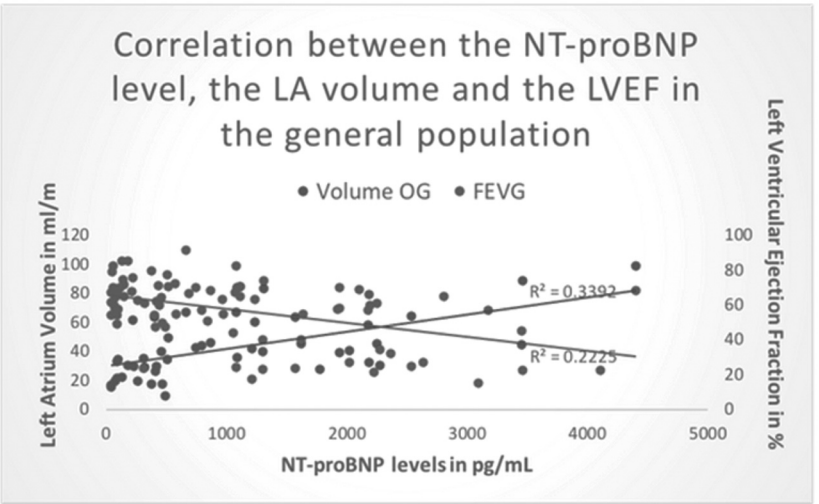

Figure 1. Correlation between the NT-proBNP level, the LVEF, and the volume of the LA in the general population.

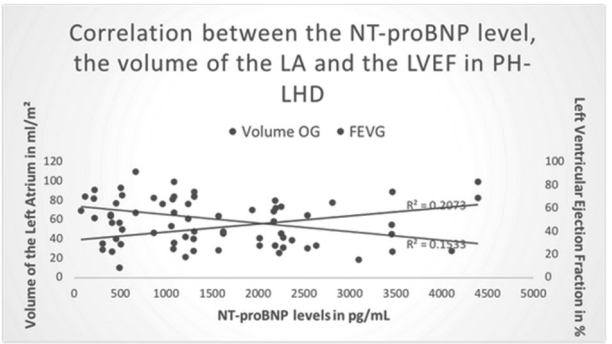

Figure 2. Correlation between the NT-proBNP level, the LVEF, and the volume of the LA in the PH-LDH patients.

Purpose: Our objective was to analyse the clinical and haemodynamic determinants associated with NT-proBNP levels in PH-LHD compared with Pulmonary Arterial Hypertension (PAH), with a specific focus on the role of pulmonary capillary wedge pressure (PCWP) in NT-proBNP release in PH-LHD.
Methods: Patients with either PAH or PH-LHD were included in this monocentric retrospective study. Data were collected at the time of PH diagnosis and included anthropometric, clinical, functional, biological, echocardiographic, and hemodynamic variables.
Results: Compared with PAH, patients with PH-LHD had a different profile which included a higher rate of AF (37.7 *vs.* 79.3%, $p < 0.001$) and a higher burden of cardiovascular risk factors. At time of diagnosis, NT-proBNP was higher in PH-LHD compared with PAH (median 1267 *vs.* 288.5 pg/mL, $p < 0.001$). On multivariate analysis, NT-proBNP was associated with left atrial dilatation and decreased LVEF. An association between NT-proBNP and PCWP was found in PH-LHD (CI 1.7–231.06, $p = 0.047$).
Conclusion(s): Our study suggests that an elevated PCWP and an enlarged size of the left atrium are determinants of NT-proBNP increase in PH-LHD, but not in PAH. This can be explained, at least in part, by the presence of AF in patients with LHD.

CARPREG (cardiac disease in pregnancy) score to predict mortality in pregnant women with heart disease

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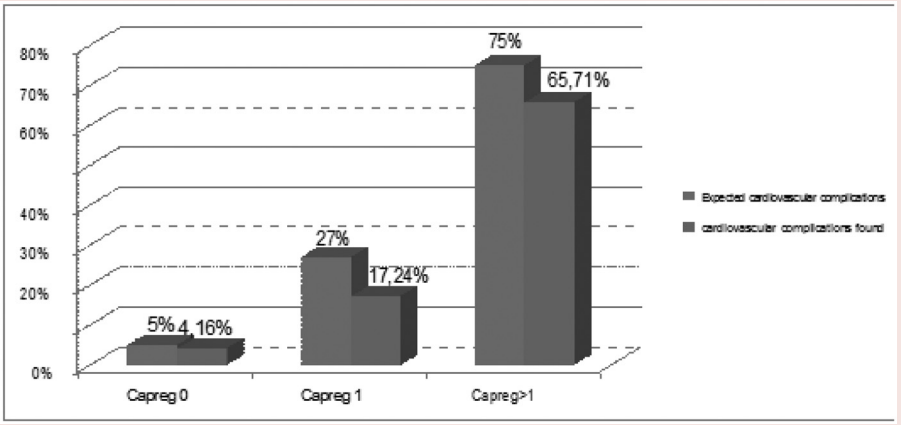
Background/Introduction: The association of pregnancy with maternal heart disease is a high-risk situation that can compromise the maternal and foetal prognosis. CARPREG is a score used by clinicians to evaluate the risk of pregnancy. This scoring

system is based on simple information that could be obtained from a detailed history of the patient, a physical examination, and echocardiography.
Purpose: Assessing cardiovascular complications in cardiac parturients and comparing them with complications predicted by the carpreg score.
Methods: This is a single-centre retrospective study spread over a period of 6 years, from 1 January 2015 to 31 November 2020, and covering cardiac parturients hospitalized in the obstetric intensive care unit of the CHU IBN ROCHD CASABLANCA. The patients in this study were divided into three groups: those with a score of CARPREG 0, CARPREG 1, and CARPREG$>$ 1, and the percentage of CV complications occurring in each group was compared to that predicted by this score: 5, 27, and 75%, respectively.
Results: Eighty-eight patients were included in the study and were divided into three groups according to CARPREG score. Patients with a CARPREG score of 0 had 4.16% of CV complications in our series. Patients with a CARPREG score of 1 had 17.24% CV complications. Pregnant women classified as CARPREG >1 had a significantly higher number of complications during pregnancy (65.7%) than those classified in the other CARPREG classes ($p = 0.0013$). This is shown in the figure below.
Conclusion(s): The CARPREG score is a reliable score for predicting cardiovascular complications in cardiac parturients. Thus, the management of pregnant women and their deliveries requires a multidisciplinary heart and pregnancy team.



Clinical presentation of acute pulmonary embolism: about 120 cases

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Background/Introduction: Acute pulmonary embolism is a frequent life-threatening disease that is often under-diagnosed. it remains one of the most frequent causes of hospital mortality.
Purpose: The aim of our study was to identify the different types of clinical manifestations of acute pulmonary embolism in our population that should draw the physician's attention to this diagnosis.
Methods: We conducted a retrospective study of 120 patients hospitalized between 2016 and 2018 for acute pulmonary embolism in the cardiology department of CHU Casablanca. We collected the circumstances of the occurrence and the first clinical symptoms that occurred in these patients.
Results: One hundred and twenty patients with confirmed pulmonary embolism were included in this study (mean age 54.3 ± 17.7 years). 77.5% were women. The most frequent symptom was dyspnoea, which was sudden in 86% of our patients. Basithoracic pain was present in 54% of patients. A dry or productive cough was present in 38% of patients, palpitations in 31%, feverish sensations in 16% of patients, haemoptysis in 12%, and syncope or lipothymia in 9%. It should be noted that a painful lower limb suggestive of an associated deep vein thrombosis was present in 29% of the patients.
Conclusion(s): Acute dyspnoea remains the most frequent functional sign of pulmonary embolism. this symptom alone is sufficient to alert the physician to this diagnosis and should lead to a search for favourable factors as well as the performance of other complementary examinations.

Evolution of the left ventricular ejection fraction (LVEF) at 6 months postpartum in parturients with meadows heart disease

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Background/Introduction: Peripartum cardiomyopathy (CMP-PP) or Meadows syndrome is a dilated cardiomyopathy occurring during pregnancy or up to 5 months postpartum, defined as heart failure with left ventricular dysfunction. This rare entity is not clearly understood and several hypotheses have been proposed.
Purpose: To assess recovery of the LVEF at 6 months postpartum in parturients with meadows heart disease.
Methods: We have conducted a prospective study with a prognosis aim, between January 2017 and September 2021 including all the patients admitted for peripartum cardiomyopathy in the tertiary care centre clinical of Casablanca. Baseline characteristics, echocardiographic data, and prognosis factors of patients were analysed.
Results: Thirty-seven patients were included in our study with a mean age of 29 ± 5 years. At the initial assessment: 78.5% of parturients had a left ventricular dysfunction, the median LVEF was 32.3% with a minimum of 20% and a maximum of 45%. The 6-month evolution was favourable in 62.5% of patients with complete recovery of left ventricular function: LVEF >53% ($p = 0.013$) 26.7% of patients had no improvement in LVEF at 6 months postpartum: median LVEF =28.3%, mean telediastolic diameter at 57.3 mm ($p = 0.026$). Four patients died during follow-up.
Conclusion(s): CMP-PP is a rare, unrecognized, and life-threatening pregnancy-associated disease. Its management is essentially symptomatic, identical to any heart failure. its unpredictable evolution and risk of recurrence even after normalization of LVEF justifies long-term multidisciplinary follow-up.

Can bedside haemodynamic parameters predict risk and in-hospital outcomes in non-ST elevation acute coronary syndromes? Data from a resource-limited settings in Iraq

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Background/Introduction: There is lack of data on the value of bedside hemodynamic parameters in predicting risk and outcomes in NSTE-ACS.
Purpose: To assess if bedside haemodynamic tests like mean arterial pressure (MAP), shock index (SI), pulse pressure (PP), and proportional PP (PPP) can predict risk and adverse in-hospital outcomes in NSTE-ACS.
Methods: Patients with NSTE-ACS were prospectively included, we calculate the GRACE score, SI, MAP, PP, and PPP. Patients were stratified into low, intermediate, and high GRACE risk classes.
Results: $n = 179$, 31% had SI ≥0.7, those with SI ≥0.7 were at high GRACE risk class in 52.5 *vs.* 24.3%, $p < 0.001$. AF was recorded in those with SI ≥0.7 in 19.7 *vs.* 3.7%, $p < 0.001$. Time to catheterization (days) was 3.26 ± 2.55 in SI ≥0.7 *vs.* 3.23 ± 1.96, $p = 0.9$, hospitalization duration (days) 5.11 ± 2.8 in SI ≥0.7 *vs.* 4.8 ± 2.7, $p = 0.4$. For those who developed cardiogenic shock; MAP was 86.1 ± 17.6 *vs.* 100.04 ± 15.3, $p = 0.03$ and SI was 0.91 ± 0.3 *vs.* 0.63 ± 0.2, $p = 0.02$ compared to those who did not develop cardiogenic shock. No significant differences in PP and PPP between two groups. There was significant correlation between SI and GRACE score, $p < 0.001$; same with EF%, $p < 0.001$. MAP correlated with GRACE score, $p = 0.001$. On multiple regression analysis: high GRACE risk class [95% CI 0.002–0.056, $p = 0.03$] and SI ≥0.7 [95%CI 0.007–0.12, $p = 0.02$] were significant predictors of in-hospital death, while high GRACE risk class predicted in-hospital AHF [95% CI 0.13–0.26, $p < 0.001$]. SI ≥0.7 predicted in-hospital stroke [95% CI 0.008–0.082, $p = 0.01$]. While MAP, PP, and PPP did not predict in-hospital outcomes.
Conclusion(s): SI is more readily obtainable than the GRACE score and can be used to guide management, particularly in resources-limited settings where proper risk stratification is needed to choose those who will benefit the most from invasive strategy.

Smokers' paradox in non-ST elevation acute coronary syndromes: does it exist?

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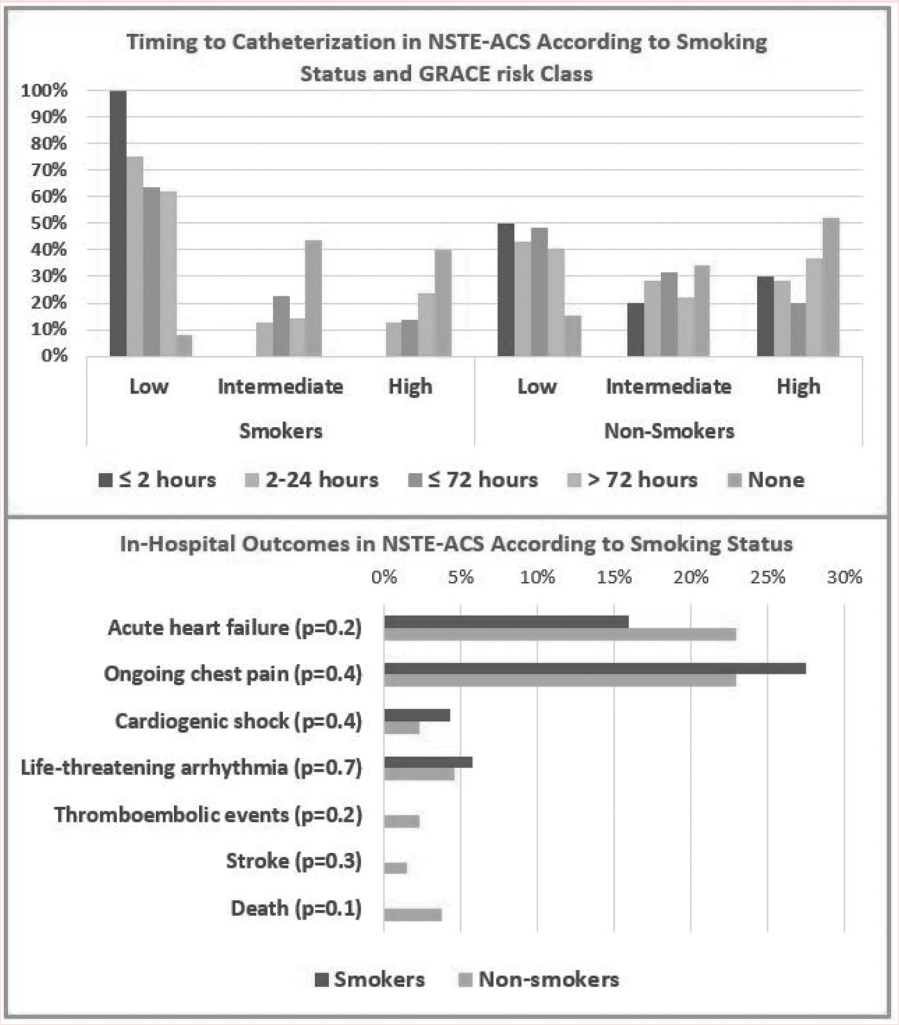
Background/Introduction: In Iraq; about a third of males and 4% of females are smokers. Yet there is no data from Middle Eastern countries including Iraq on the impact of smoking on prognosis in ACS.
Purpose: To assess the hypothesis that there is a smokers' paradox in patients with NSTE-ACS in terms of lower adverse in-hospital outcomes in smokers.

Methods: Patients with NSTE-ACS were prospectively included. GRACE score was calculated. Patients were categorised into two groups: smokers *vs.* non-smokers.



Results: $n = 200$, 34.5% were smokers, smokers were younger 53.6 ± 11.2 *vs.* 61.46 ± 11.2, $p < 0.001$ and males in 89.9 *vs.* 60.3%, $p < 0.001$ and were hypertensive in 55.1 *vs.* 77.1%, $p = 0.001$. No significant differences between the two groups in having DM, IHD, positive family history of IHD nor in troponin positivity. Smokers had higher GFR 91.4 ± 21.9 *vs.* 79.4 ± 22.1, $p = 0.001$ and higher haemoglobin 13.8 ± 1.9 *vs.* 13.2 ± 2.1, $p = 0.04$. AF was recorded in 2.9% of smokers *vs.* 11.5%. No statistical difference between groups regarding prescribed drugs including aspirin, P2Y12 inhibitors, B-blockers, ACEI/ARBs, CCB, nitrate, anticoagulant, statin, MRA, or diuretic. Smokers were at high GRACE risk class in 21.7 *vs.* 38.2%, $p = 0.01$, yet, they were catheterized in 76.8 *vs.* 65.6% in non-smokers, $p = 0.1$. For those who were catheterized, timing to catheterisation did not differ with smoking, $p = 0.06$. There was no significant difference between the two groups regarding developing in-hospital outcomes.

Conclusion(s): No smokers' paradox was observed as there were no differences in developing adverse in-hospital outcomes according to smoking status, yet smokers presented at lower risk class which can be explained by younger age and lower comorbidities in smokers. Preventive programs should be the goal to encourage smoking cessation to reduce cardiovascular diseases and mortality.