

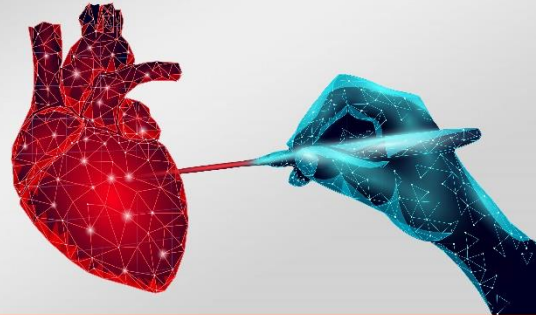


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NVVC-NVT Najaarscongres 2023



NVVC-NVT NAJAARSCONGRES 2023

Invasief, innovatief of conservatief



Donderdag 2 en vrijdag 3 november | Papendal

**Abstracts of the Scientific Autumn
Congress of the Netherlands Society of
Cardiology
2 - 3 November 2023**



Sessie 1: CONGENITAL HEART DISEASE AND GENERAL CARDIOLOGY

Machine Learning for Risk Stratification Using Clinical and Echocardiography Data in Patients with Chronic Coronary Syndrome

Presenting author: M.A. Molenaar
Department: Cardiology

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Purpose:

Risk stratification in patients with chronic coronary syndrome (CCS) primarily relies on echocardiographic evaluation of left ventricular (LV) function. Machine learning (ML) methods enables analysis of complex datasets including transthoracic echocardiography (TTE) studies. We aimed to evaluate the accuracy of ML using clinical and TTE data to predict all-cause five-year mortality in patients with CCS.

Methods:

Data of consecutive patients with CCS were retrospectively collected if they attended the outpatient clinic of a tertiary center between 2015 and 2017 and underwent TTE assessment. A ML model (eXtreme Gradient Boosting) was trained on clinical data and data extracted from TTE reports to predict all-cause five-year mortality. The ML model was evaluated with data from a different tertiary center and against traditional risk scores as the reference standard.

Results:

A total of 1253 patients (775 train set, 478 test set) were included, of which 176 patients (105 train set, 71 test set) died during the five-year follow-up period. The ML model demonstrated a superior performance (area under the curve [AUC] 0.79, Figure 1) compared to the Framingham risk (AUC 0.62) score, SCORE2/SCORE2-OP (AUC 0.67), a Cox-based model (AUC 0.76), and LV function (AUC 0.64). The ML model showed good external performance (AUC 0.78, Figure 1). Seven clinical variables and two TTE variables (left ventricular dysfunction and tricuspid regurgitation) were included in the final model.

Conclusion:

This study showed that an ML model using TTE and clinical data can accurately identify high risk CCS patients, with a prognostic value superior to traditional risk scores.

Keywords:

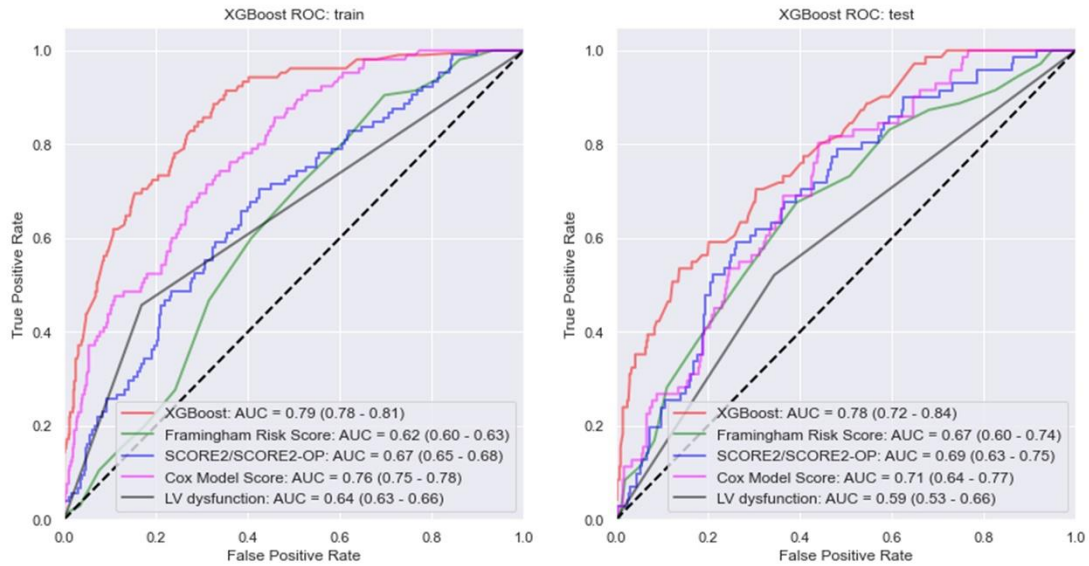
Coronary artery disease, Machine learning, Prognosis



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Figure:
ROC curves for machine learning model (XGBoost) and traditional risk scores for the train set (Left Figure) and external test set (Right Figure).





Prognostic Value of the Electrocardiogram in Patients with Bicuspid Aortic Valve Disease

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Department: Cardiology

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**, ** : equal contributions*

Purpose:

Identifying bicuspid aortic valve (BAV) patients at risk for cardiac events remains challenging and the role of the electrocardiogram (ECG) has not yet been described. Therefore, this study aims to describe ECG parameters in BAV patients, and investigate their prognostic value.

Methods:

In this single-center prospective study, patients with BAV without a prior aortic valve replacement (AVR) were included. Transthoracic echocardiogram and 12-lead resting-ECG were obtained. Associations between ECG parameters and the composite endpoint of all-cause mortality and AVR were assessed using Cox-proportional hazard analysis.

Results:

120 patients with BAV were included (median age 30 years, 61% male). Median aortic jet velocity was 2.4 m/s [IQR: 1.7-3.4] and 5 patients (4%) had severe aortic regurgitation. All patients were in sinus rhythm. Any ECG abnormality was present in 57 patients (48%). Median PR-interval was 156 [IQR: 138-170] msec. A deviating heart axis was found in 17 patients (14%) and Cornell criteria for LVH were fulfilled in 20 patients (17%). Repolarization abnormalities were present in 12 patients (10%). Median follow-up duration was 7.0 [6.3-9.8] years, during which 23 patients underwent AVR and 2 patients died. In univariable analysis, P-wave duration, PR-interval and S-wave amplitude in I were associated with the endpoint. After adjusting for age, a longer PR-interval was associated with worse intervention-free survival (HR 1.02, 95% CI: 1.01 – 1.04).

Conclusion:

Almost half of the patients with BAV had abnormalities on their ECG. Moreover, the PR-interval may be an interesting prognostic marker for intervention-free survival in BAV patients.

Keywords:

Bicuspid aortic valve, Electrocardiography, Prognosis



SCAD Not Only a Diagnosis for Cardiologist

Presenting author: S.A.M. Gerth

Department: Cardiologie

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Purpose:

Spontaneous coronary artery dissection (SCAD) is characterized by the development of a false lumen inside the coronary wall due to the spontaneous intramural hematoma (IMH) or intimal disruption that compromises the true lumen. Very little is known about the prevalence of concomitant fibromuscular dysplasia (FMD) in patients with SCAD.

Methods:

Patients were included from our local registry until January 2023. The data from our population was extracted using the EORP: SCAD Registry study. The primary outcome is the prevalence of FMD in our population. Secondary outcomes are the tortuosity score, the patient characteristics, and the affected vessels by FMD. Data was analysed using IBM SPSS statistics version 28.0.0.0.

Results:

We included 63 patients with SCAD from August 2009 to February 2023. Average age was 54 years, and almost all were women (93.7%). Of all cases referred to vascular medicine, 27.9% were diagnosed with fibromuscular dysplasia (FMD).

Conclusion:

SCAD predominantly affects women of young age, with a third of these patients having FMD. Both FMD and tortuosity are associated with recurrent SCAD.

Keywords:

SCAD, FMD, Coronary angiogram



Safety, Tolerability, and Short-Term Effects of SGLT2 Inhibitors for Heart Failure in Adult Congenital Heart Disease

Presenting author: R.M.L. Neijenhuis

Department: Cardiology

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Purpose:

To evaluate the safety, tolerability, and short-term effects of sodium-glucose cotransporter 2 inhibitors (SGLT2i) in adult congenital heart disease (ACHD) patients with heart failure.

Methods:

ACHD patients with symptomatic heart failure (New York Heart Association (NYHA) class \geq II) and at least moderately reduced systemic ventricular function, who were treated with an SGLT2i, were included. Blood pressure, laboratory parameters, NYHA class, side effects, and hospitalisations were evaluated at 4 weeks and most recent follow-up.

Results:

From 04/2021 to 12/2022, 20 patients (10 systemic left ventricle, 9 systemic right ventricle, 1 hemi-Fontan) were treated with dapagliflozin (n=18) (AstraZeneca, London, England) or empagliflozin (n=2) (Boehringer Ingelheim, Ingelheim, Germany) 10 mg per day. Mean age was 51.7 (\pm 18.1) years, 9 (45%) were female, and 2 (10%) had type 2 diabetes. At 4 weeks, there were no significant changes in blood pressure, electrolytes, glucose, or renal function. At a median follow-up of 5.8 [1.3–8.5] months, a slight decrease in estimated glomerular filtration rate was observed (median 73 [59–82] to 65 [53–81] ml/min/1.73m², p=0.045). NYHA class improved significantly (p=0.014, n=8), and NT-proBNP decreased in 10/13 patients (Figure). Two female patients had an uncomplicated urinary tract infection, and no other side effects were reported. One (5%) patient had 2 heart failure-related hospitalisations. No patients discontinued SGLT2i.

Conclusion:

SGLT2i were well-tolerated in a small cohort of 20 ACHD patients with heart failure, with a significant improvement in NYHA class. To further investigate the potential of SGLT2i in the growing cohort of ACHD patients, multicentre studies are essential.

Keywords:

Sodium-Glucose Cotransporter-2 inhibitors, Adult Congenital Heart Disease, Heart Failure



Ventriculo-Arterial Coupling in Chronic Pulmonary Regurgitation: the Pulmonary Arterial Unloading Effect

Presenting author: R.S. Alipour Symakani
Department: Experimental and Pediatric Cardiology

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Purpose:

Right ventricular (RV) failure is an important determinant of outcome in congenital heart disease. Chronic pulmonary regurgitation (PR) increases the risk of developing RV failure, commonly seen in tetralogy of Fallot. So far, clinical markers fail to predict which patients are at risk and require interventions like pulmonary valve replacement. In this study, ventriculo-arterial coupling (VAC) was investigated as a marker of early RV dysfunction by serial assessments in a model of RV hypertrophy and chronic PR.

Methods:

A porcine model of sequential RV overload was developed. Neonatal pulmonary artery banding induced RV hypertrophy during 1 month. Subsequently, banding was removed and PR was created by a transannular patch (TAP, n=7). Sham animals (n=5) underwent sham surgeries. Over 4 months of follow-up, monthly pressure-volume loops were performed to assess contractility, afterload and their ratio VAC.

Results:

Despite decreased cardiac index, VAC was preserved over time in PR. Although contractility was similar to sham, PR lowered afterload drastically. End-diastolic pulmonary artery pressures almost approximated central venous pressure in TAP animals.

Conclusion:

Preservation of VAC in PR makes it unsuitable as an early marker of RV dysfunction. However, the decrease in afterload is a novel finding, which might be caused by pulmonary arterial unloading: regurgitant flow emptying the proximal pulmonary arteries in diastole. Pulmonary arterial unloading can compensate VAC and pseudo-normalize systolic function and chronic low afterload might lead to deconditioning of contractile function. This phenomenon provides an explanation for the prolonged "tolerance" of PR, resulting in heart failure only after decades of exposure.

Keywords:

right heart failure, tetralogy of fallot, ventriculo-arterial coupling

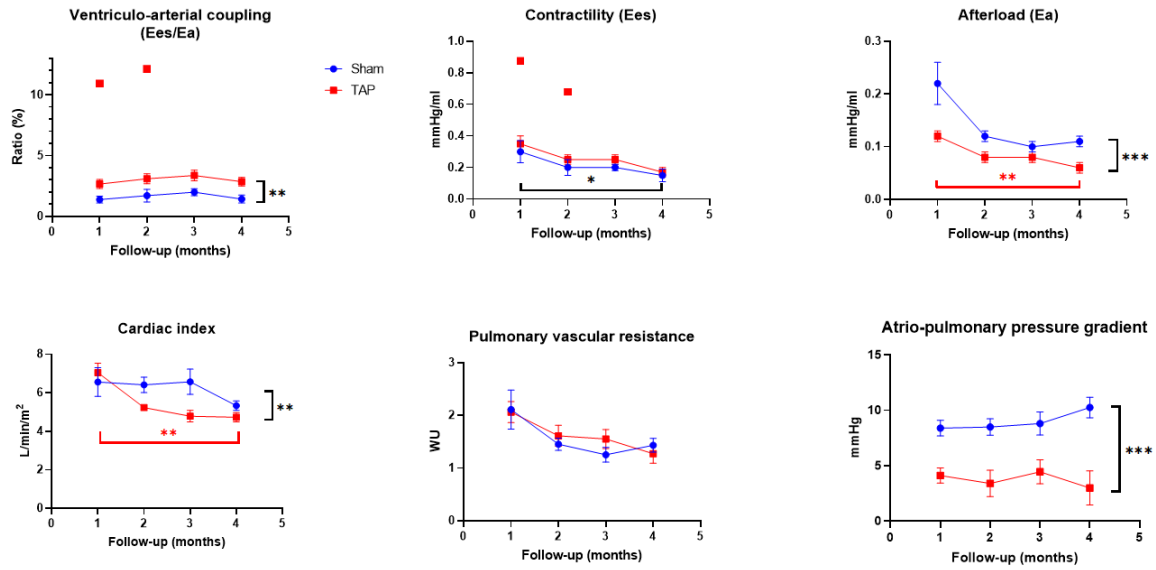


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Figure:

Figure: ventriculo-arterial coupling is preserved over time. Data presented as mean \pm standard error. Ea: arterial elastance; Ees: end-systolic elastance; TAP: transannular patch group; WU: Wood units.





Efficacy of Combination Therapy with Rosuvastatin plus Ezetimibe in Achievement of Guideline-recommended LDL after Acute Coronary Syndrome Compared to Atorvastatin Monotherapy

Presenting author: R.D. Janssen
Department: Cardiology

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Purpose:

The management of low-density lipoprotein (LDL) is an important prevention for cardiovascular death because the risk of atherosclerotic cardiovascular diseases is determined by the absolute LDL level and the period of exposure to a high level of LDL. It is important to lower this risk of cardiovascular events with medication, especially in the first few months after Acute Coronary Syndrome (ACS). The golden standard for lowering the LDL level is statin monotherapy. With this monotherapy, the European Society of Cardiology's recommendation for the LDL goal is often challenging. In the Spaarne Gasthuis Hospital, the standard choice for therapy is the combination of rosuvastatin with ezetimibe to aggressively treat the LDL and to get a low value of LDL quickly which lowers the risk of events.

The primary aim of this study is to determine differences in lowering LDL after starting with atorvastatin compared to rosuvastatin plus ezetimibe therapy.

Methods:

This cross-sectional observational analysis used data from the Cardiology research department of the Spaarne Gasthuis Hospital in Haarlem, Netherlands. All patients who had acute coronary syndrome (ACS) from the year 2022 until January 2023 were included in this study. In the first period of inclusion time, the golden standard for statin choice is atorvastatin 80 milligrams. In the second period of inclusion time, this standard is rosuvastatin 20 milligrams in combination with ezetimibe 10 milligrams. The exclusion criteria for this study are the use of lipid-lowering medication, no lipid measurements before or after starting with the medication, different doses use of the drugs or not starting with lipid-lowering medication. The first LDL measurement is upon hospitalization, and the second LDL measurement is at the cardiology outpatient clinic with an average of six weeks after hospitalization.

Results:

A total of 119 patients were included (74% men), 43 in the monotherapy group and 76 in the combination therapy group. The median LDL in the second measurement in the atorvastatin group is 1.9 [1.6 to 2.3] and in the rosuvastatin group 1.2 [0.95 to 1.4]. In the rosuvastatin group, 95% of the patients achieved a 50% reduction of the LDL concentration in the blood. Only 63% of the patients achieved this reduction in the atorvastatin group. The lowering percentage of LDL is significantly different between the atorvastatin group and the rosuvastatin group (-50% [-61.1 to -31.5] versus 68% [-74,6% to -59.7%], $p < 0.001$). Only 1% of the patients had side effects from the rosuvastatin with ezetimibe treatment. In the atorvastatin group, 19% of the patients described side effects from the medication.

Conclusion:

The combination therapy with rosuvastatin and ezetimibe results in a 95% reduction of LDL with minimal side effects compared to monotherapy with atorvastatin.

Keywords:

LDL, Rosuvastatin, Atorvastatin



Prevalence of Transthyretin Cardiac Amyloidosis in a Heart Failure with Preserved Ejection Fraction Cohort

Presenting author: A. Achten

Department: Cardiology

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Purpose:

Heart failure with preserved ejection fraction (HFpEF) represents a heterogeneous syndrome with multiple underlying causes such as transthyretin cardiac amyloidosis (ATTR-CA). Still, the true prevalence of ATTR-CA is not known as the indication for screening has been very variable. As treatment needs to be started early, ATTR-CA should be diagnosed even before development of e.g. significant left ventricular hypertrophy (LVH) in HFpEF patients. To determine the prevalence of ATTR-CA in an all comers HFpEF cohort.

Methods:

From 2019 to 2023, HFpEF-diagnosed patients underwent prospective screening for ATTR-CA, using bone scintigraphy, conform recommendations.

Results:

The study included 193 HFpEF patients (63.2% women, 79±7 years). A total of nine patients (4.7%) showed cardiac uptake on the scintigraphy of which six were subsequently diagnosed with wild type ATTR-CA (figure 1). A significantly higher proportion of males were diagnosed with ATTR-CA compared to females (7.1% vs 0.8% respectively, p 0.016). ATTR-CA patients had more carpal tunnel syndrome (66.7% vs 7.8%; p<0.001) and polyneuropathy (66.7% vs 8.5%; p<0.001) compared to other HFpEF patients. ATTR-CA patients, also demonstrated higher median N-terminal pro-brain natriuretic peptide (3772 vs 888pg/ml; p<0.001), and higher left ventricular wall thickness (septal wall: 15 [11-17] vs 10 [9-11], p<0.001). Notably, two (33.3%) of the ATTR-CA patients had no LVH. There were no differences in age, atrial fibrillation and rate of pacemakers.

Conclusion:

ATTR-CA accounted for 4.7% of all HFpEF cases. This is less than reported in literature but still substantial. Probably, this depends on the screening algorithms used particular the preselection of patients. These results strike out the need for a prediction model to increase the pre-test probability.

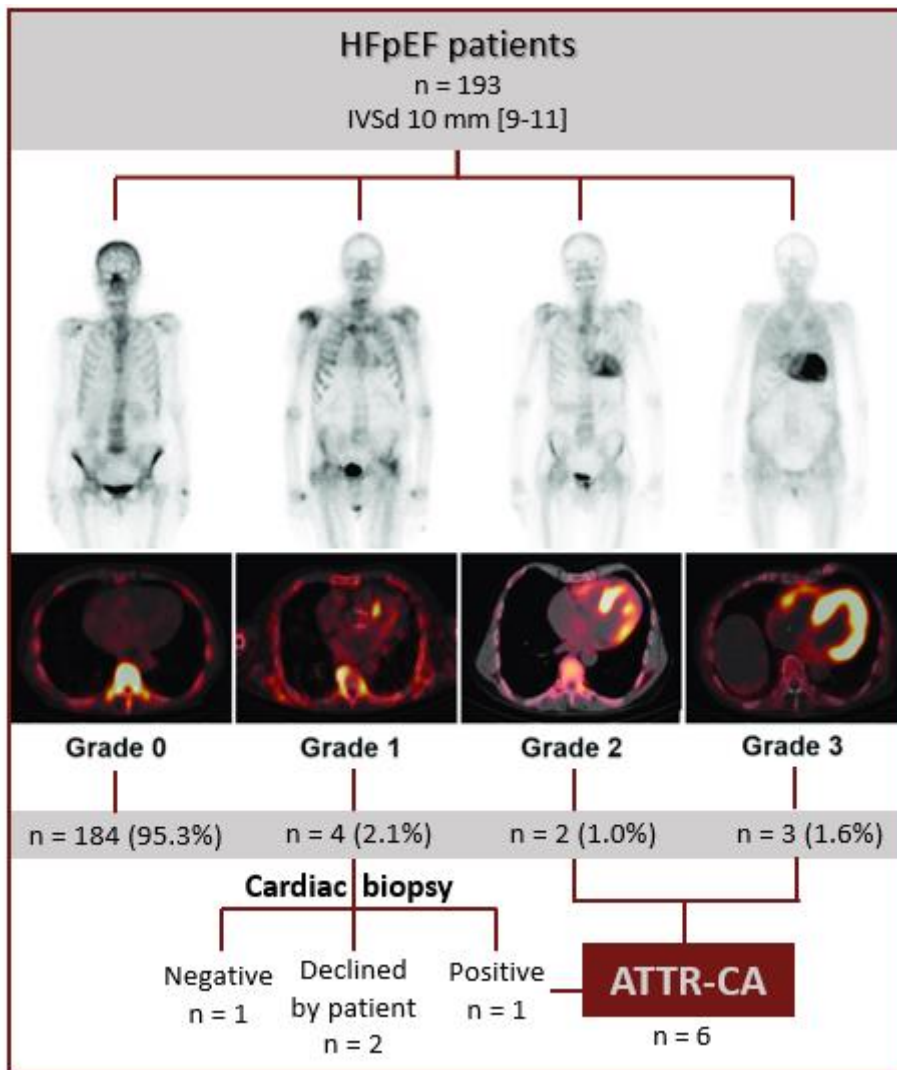
Keywords:

Cardiac amyloidosis, HFpEF



Figure:

Figure 1: Flow chart of diagnostic trajectory of transthyretin cardiac amyloidosis in patients with heart failure and preserved ejection fraction irrespective of left ventricular hypertrophy. Abbreviations: HFpEF, heart failure with preserved ejection fraction; IVSd, interventricular septal wall thickness; ATTR-CA, transthyretin cardiac amyloidosis. Adapted from Min Zhao et al, Nuclear Molecular Imaging of Disease Burden and Response to Treatment for Cardiac Amyloidosis 2022





Survival and Time Until Readmission of Patients with Acute Decompensated Heart Failure Admitted for Treatment with Intravenous Loop Diuretics

Presenting author: F.J.P. Jager
Department: Cardiology

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Purpose:

Acute decompensated heart failure (ADHF) often requires hospitalization for management with intravenous loop diuretics. This study aimed to investigate the time to mortality and readmission of patients with ADHF admitted for intravenous diuretic treatment.

Methods:

This retrospective, observational cohort study was conducted at the cardiology ward of the Deventer Ziekenhuis. Kaplan-Meier analyses were performed to determine survival and time to the composite endpoint comprising of mortality or HF related readmission. Cox regression analysis was employed to build a model of the most relevant predictors. Quality of life (QoL) was assessed at 1 year post discharge.

Results:

The median survival for the cohort of 92 patients was 357 days (95% CI 157–557), with a median time to the composite endpoint of 177 days (95% CI 75–279). Atherosclerotic vascular disease, low kidney function, and NT-proBNP levels exceeding 1000 pmol/l showed an independent correlation with mortality in the multivariate model. Only atherosclerotic vascular disease was significantly correlated with the composite endpoint. QoL under surviving patients was better than the norm of a general U.S. population older than 65 years.

Conclusion:

This study demonstrates the very poor prognosis of patients with ADHF admitted for treatment with intravenous loop diuretics. Notably, a medical history of atherosclerotic vascular disease, low kidney function, and elevated NT-proBNP were associated with higher mortality rates. Awareness of this prognosis and predicting factors could lead to more individualised treatment that may benefit both patients with a poor and relatively good prognosis. Further research is imperative to validate this model.

Keywords:

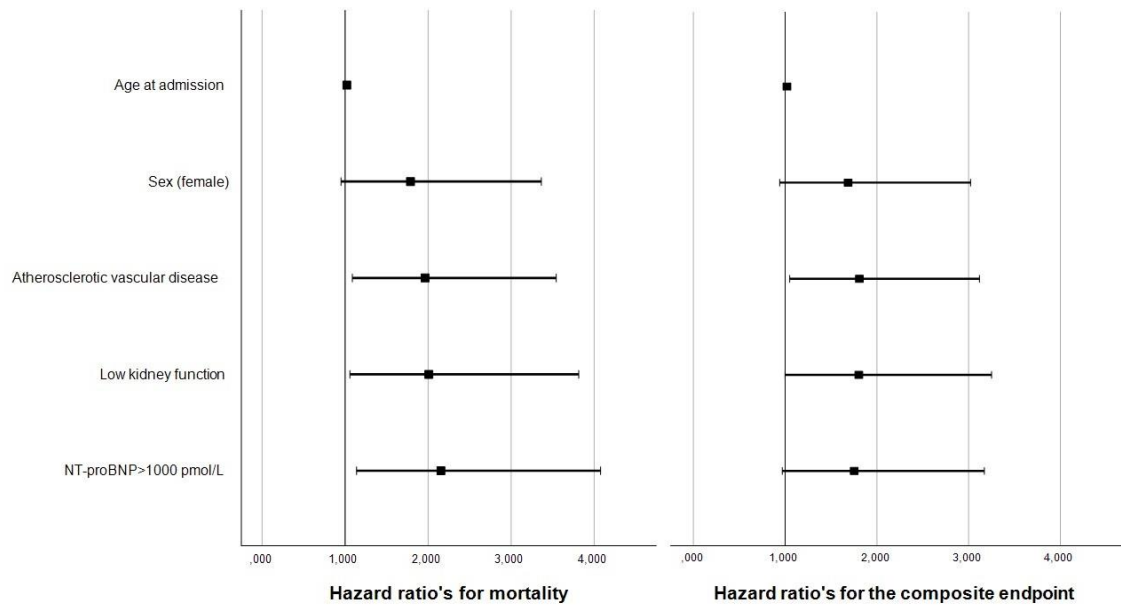
Decompensated Heart failure, Prognosis, Quality of life



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Figure:
Hazard ratio's multivariate cox regression models for mortality and the composite endpoint





Sessie 2: CARDIAC SURGERY AND TAVI

The Effect of New Left Bundle Branch Block after Transcatheter Aortic Valve Intervention on Clinical Outcomes and Quality of Life

Presenting author: A.J.R. Voskens

Department: Department of Interventional Cardiology

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Purpose:

Considering the pre-identified risk of developing new left bundle branch block (LBBB) after transcatheter aortic valve intervention (TAVI), this study aimed to investigate the effect of new LBBB after TAVI on clinical outcomes and quality of life.

Methods:

Retrospective analysis was performed with a local subset of the NHR (Dutch Heart Registry) cohort that underwent TAVI (n=1131). Electrocardiograms were checked for the presence of LBBB, after which the cohort was divided into two groups: (1) new onset LBBB and (2) no LBBB, subsequently analyzed using recorded follow-up data.

Results:

No significant differences were found in the need of pacemaker implantation (<30 days), as well as other clinical outcomes. The choice of vascular access (HR 1.03 95% CI 1.01-1.06) and post-dilatation (HR 1.96 95% CI 1.03-3.73) individually influenced 1-year mortality and 3-years mortality, respectively. No significant effect of new LBBB on quality of life was found (n=85). History of atrial fibrillation or flutter (p=0.02), post-procedure heart rhythm (p=0.001), post-dilatation (p=0.048), and extracardiac arterial vascular pathology (p=0.047) showed an individual effect on quality of life.

Conclusion:

Our study indicates that patients are not more likely to have adverse clinical outcomes or reduced quality of life with new LBBB after TAVI. Other factors are found to influence all-cause mortality and quality of life, both in patients with new LBBB and without new LBBB.

Keywords:

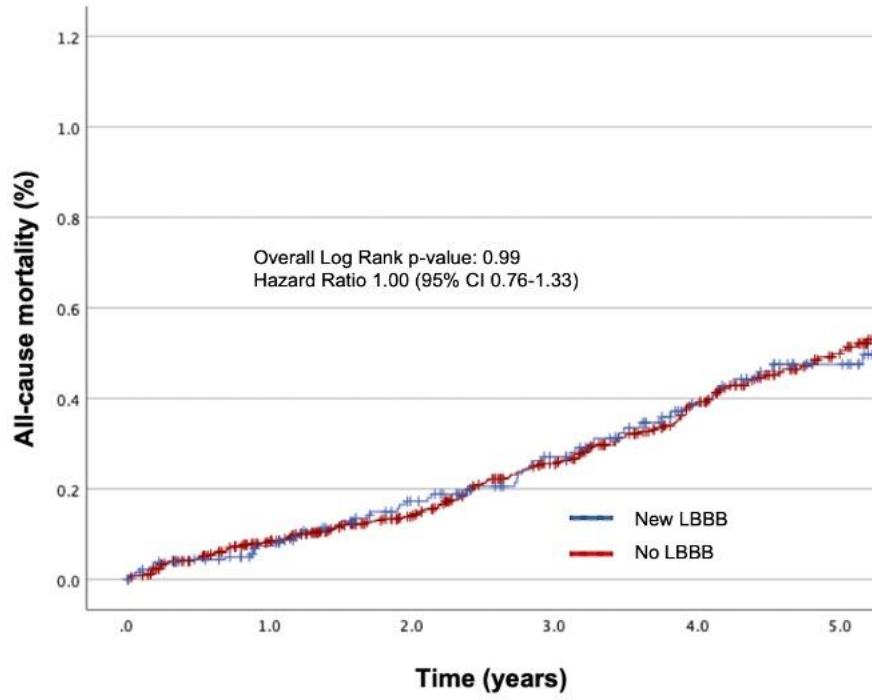
TAVI, LBBB, Clinical outcomes



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Figure:
Hazard function according to the presence or absence of new LBBB.





The Effect of Valve Type on the Risk of New Onset Left Bundle Branch after Transcatheter Aortic Valve Implantation

Presenting author: A.Q. Otten

Department: Department of interventional cardiology

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Purpose:

Conduction abnormalities after transcatheter aortic valve implantation are frequently described. However, it is unclear if new-onset LBBB is dependent on valve type. This study assessed the effect of the use of a self-expandable valve (SEV) on LBBB versus the use of a balloon-expandable valve (BEV) on the risk for LBBB after TAVI.

Methods:

This is a single-centre retrospective analysis. 1138 patients that underwent TAVI were assessed and patients with pre-existing LBBB, RBBB, PPM were excluded. A total of 858 patients were included in this analysis. Patients were evaluated for new LBBB at 3 predetermined time-points: 1-day post-TAVI, at discharge, and after 30-60 days.

Results:

The incidence of LBBB for all patients was 22.3% at the day after TAVI, 25.0% for the day of discharge and 14.2% for the 30–60-day follow-up. The difference in incidence of LBBB between the SEV and BEV was only significant at discharge (23.2% versus 31.7 % ($P=0.029$)). At discharge and at the 30–60-day follow-up, the SEV is a significant predictor for LBBB ($P=0.002$ and $P=0.047$, respectively). Although the relative risk of LBBB after TAVI was increased in the SEV group, this risk progressively declined each year (see image).

Conclusion:

Incidence of new onset LBBB after TAVI decreases over time, and persistent LBBB is present in only 60% of patients that are discharged with new-onset LBBB. Although SEV appears to increase the risk of LBBB, this effect could be caused by a learning curve and is mitigated by increased usage of SEV devices and optimising implantation techniques.

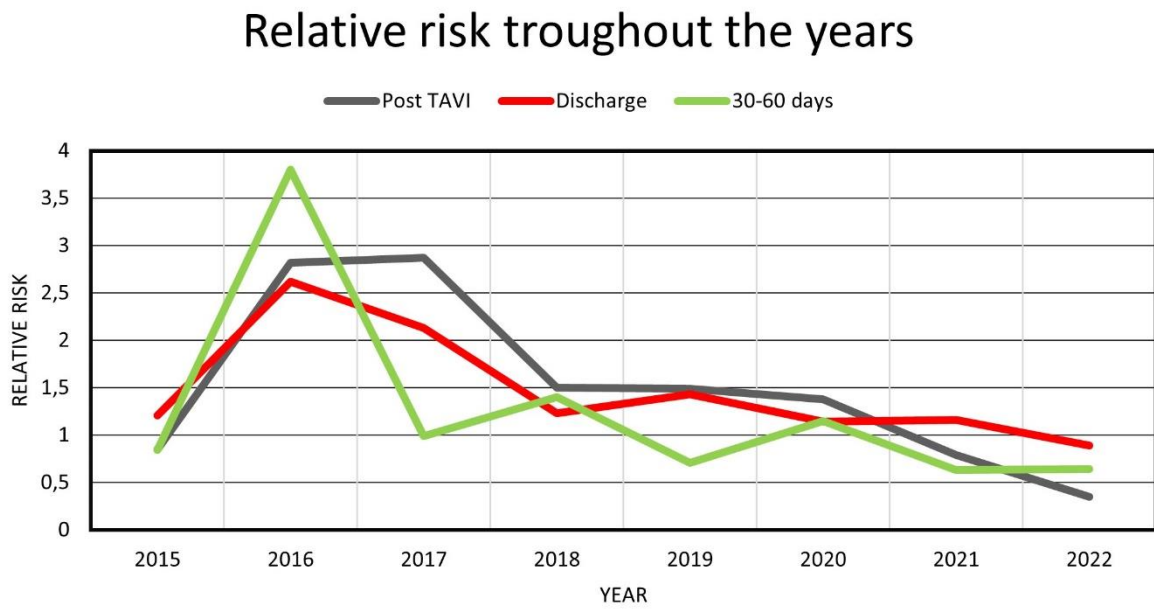
Keywords:

TAVI, LBBB



Figure:

Figure 1. Relative risks on LBBB for the SEV versus the BEV throughout the years 2015-2022 for post TAVI, discharge and 30-60 days follow up.





The Impact of Pacemaker Implantation after TAVI on Mortality and Quality of Life: a POPular TAVI Substudy

Presenting author: P.J.A. van Nuland
Department: Cardiology

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Purpose:

Conduction disturbances after transcatheter aortic valve implantation (TAVI) are some of the most common periprocedural complications. The incidence of permanent pacemaker implantation (PPI) after TAVI ranges between 2.3% and 36.1%, and is highly dependent on valve type, implantation technique and prior conduction abnormalities. Data on how PPI after TAVI affects mortality is inconsistent. On top of that, elderly patients often prioritize quality of life (QoL) over longevity, but data on how PPI after TAVI affects health related QoL is limited. In this POPular TAVI sub-analysis, our aim was to evaluate the impact of PPI after TAVI on mortality and QoL during the first year after TAVI.

Methods:

The POPular TAVI was a randomized clinical trial, which evaluated the addition of clopidogrel to aspirin (cohort A) or oral anticoagulation (cohort B) in patients undergoing TAVI. For the current analysis, all patients with prior pacemaker implantation were excluded. The other patients were classified in two groups: patients with no PPI after TAVI; and patients with PPI after TAVI. Besides clinical outcomes, QoL was assessed using the SF12 and EQ-5D-5L, which was protocol mandated before TAVI, and at 3, 6 and 12 months after TAVI. Physical and mental QoL were measured using SF12, of which the physical (PCS) and mental component summary (MCS) scores were derived. General QoL was measured using the EQ-5D-5L, resulting in an index score and a visual analogue score (VAS). Kaplan-Meier curves were estimated to assess the impact of bleeding and thromboembolic events on mortality; unpaired t-tests were used to evaluate their impact on QoL at individual time points. Statistical analyses were performed using IBM SPSS statistic (version 26).

Results:

A total of 978 were included in the Popular TAVI, of which 103 patients were excluded in this analysis with pre-existing pacemaker (n=100) or missing data (n=3). Of the included 875 patients, 109 patients (12.5%) got a permanent pacemaker implantation after TAVI, the majority within 30 days after TAVI (97 patients (11.1%)). As compared to patients with no PPI after TAVI, patients with PPI within 30 days after TAVI were not associated with an increased risk of death (8.8% vs. 10.3%, p=0.69) (Figure 1).

Regarding QoL, there were no significant differences in MCS, PCS, EQ5D index and VAS between patients without PPI and with PPI within 30 days after TAVI, before the procedure, and 3 months, 6 months, and 12 months after the procedure.

Conclusion:

Although permanent pacemaker implantation is a common complication for patients who underwent TAVI, this analysis show that PPI is not associated with an increased risk of death after TAVI. In addition, PPI after TAVI is not associated with decreased mental, physical or



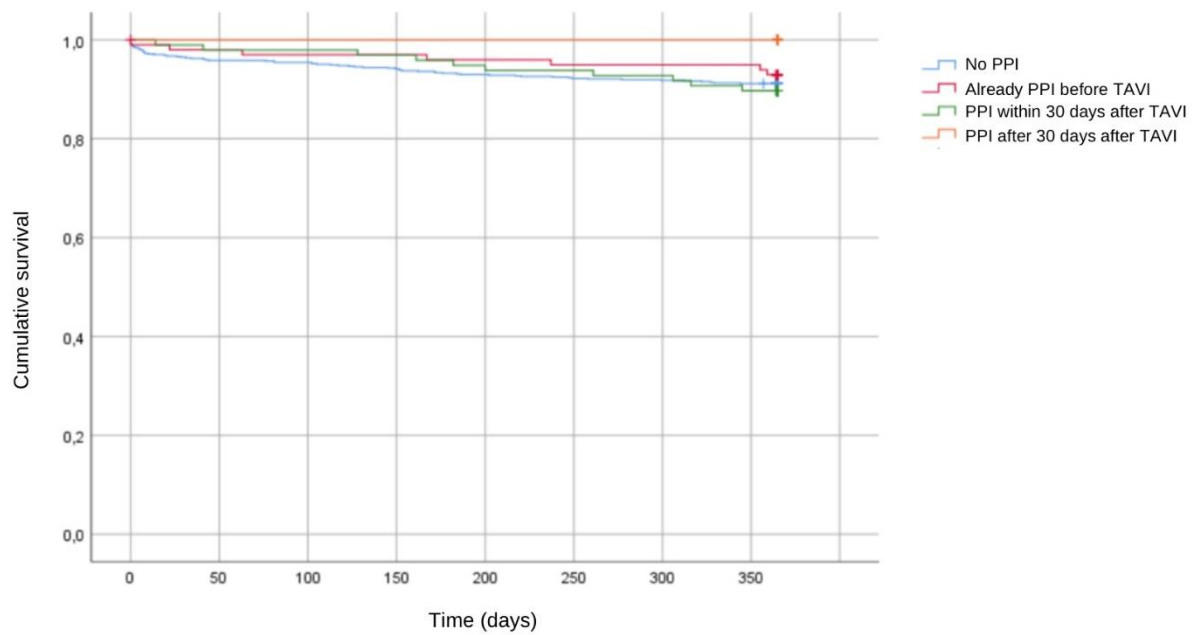
general quality of life during the first year of follow-up.

Keywords:

TAVI, Pacemaker, Quality of Life

Figure:

Figure 1. Cumulative survival in a Kaplan-Meier curve.





Endoscopic Coronary Artery Bypass Grafting in 1500 Patients

Presenting author: J. Claessens

Department: Cardiac surgery

J. Claessens (Hasselt University, Hasselt); S. Van Genechten (Jessa Hospital, Hasselt), A. Kaya (Jessa Hospital, Hasselt), A. Yilmaz (Jessa Hospital, Hasselt)

Purpose:

Several minimally invasive techniques for coronary artery bypass grafting (CABG) have been developed, including fully endoscopic surgery, either robotically or in an endoscopy setting. A study of 423 consecutive patients who had endoscopic CABG employing long-shafted tools and an endoscope (Endo-CABG) was reported in 2016. They concluded that Endo-CABG is a safe and effective treatment for single- and multi-vessel coronary artery disease. The purpose of this trial is to look into this technique in a bigger group of 1500 patients.

Methods:

From January 2016 to January 2023, 1500 patients who received Endo-CABG were included in this single-center, retrospective analysis. To harvest the internal mammary arteries, three endoscopic ports (5mm) were placed in the second, third, and fourth intercostal spaces. The anastomosis was carried out using a utility port (3 cm). The primary goals were to reduce major adverse cardiac and cerebrovascular events (MACCE), which included cardiac death, nonfatal stroke or myocardial infarction, and reoperation of the replaced valve. Additionally, the 30-day mortality, and all-cause mortality was investigated.

Results:

Patients were followed for up to 6.5 years, with a mean follow-up index of 0.75 ± 0.37 . The total surgical time was 234.50 ± 69.05 minutes, including 104.10 ± 47.37 minutes of cardiopulmonary bypass and 59.08 ± 21.40 minutes of aortic clamping. A mean of 2.66 ± 0.82 bypasses were used with 696 (46.49%) in-situ bilateral internal mammary arteries and a Y-graft was produced in 630 (42.08%) patients. After the procedure, the Endo-CABG patients were ventilated for 10.71 ± 26.65 hours and stayed in the intensive care unit for 70.42 ± 90.87 hours. Furthermore, the average length of stay in the hospital was 6.79 ± 11.27 days. Four (0.27%) patients required in-hospital permanent pacemaker implantation. Furthermore, 28 (1.87%) patients experienced graft failure during the follow-up period. Our primary outcome, MACCE, occurred in 40 (2.67%) of patients within 30 days and in 123 (8.21%) of patients over the entire follow-up period. After 30 days, the mortality rate was 1.87%, whereas at the conclusion of the follow-up, it was 8.73%.

Conclusion:

Endoscopic CABG can be considered a safe and feasible technique with favorable short and mid-term clinical outcomes.

Keywords:

endoscopic cardiac surgery



Postoperative 30-day Mortality in Native- and Prosthetic Valve Endocarditis According to Surgery Type: a Nationwide Study

Presenting author: A.J.L. Peijster

Department: Cardiology

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Purpose:

Endocarditis can be life-threatening and surgery is often indicated. Thorough pre-operative risk-assessment is crucial. Data on mortality among the different types of endocarditis surgery is limited. We assessed postoperative mortality across surgery types for native- and prosthetic valve endocarditis (NVE and PVE).

Methods:

All surgical endocarditis patients of 2007-2021 in the Netherlands Heart Registration were included. Cases were excluded if follow-up was less than 30 days or patients underwent another cardiac surgery. 30-day mortality between aortic- and mitral valve, and right-sided valve surgery was analyzed for NVE and PVE.

Results:

3066 endocarditis surgeries (1990 NVE, 1076 PVE) were performed. Overall, 30-day mortality was 14.3% (95% CI 13.0 – 15.5) and absolute 30-day mortality was higher in PVE than in NVE (19.0%, 95% CI 16.7 – 21.4 vs. 11.7%, 95% CI 10.4 – 13.2; $p < 0.001$). Isolated aortic valve surgery in NVE patients had the lowest mortality (7.3%, 95% CI 5.4 – 9.5) and PVE patients undergoing double valve- and aortic surgery (25.8%, 95% CI 17.3 – 35.9) had the highest. 30-day mortality was significantly higher in isolated mitral valve surgery than in isolated aortic valve surgery in NVE and PVE (13.5% vs. 7.3%, $p < 0.001$; 20.5% vs. 14.2%, $p = 0.007$ respectively).

Conclusion:

Postoperative mortality rates are remarkably varying among different types of endocarditis surgery. 30-day mortality is substantially higher in isolated mitral valve surgery than in isolated aortic valve surgery. We stress the importance of individualized pre-operative risk assessment.

Keywords:

Infective endocarditis, Type of valve surgery, 30-day mortality



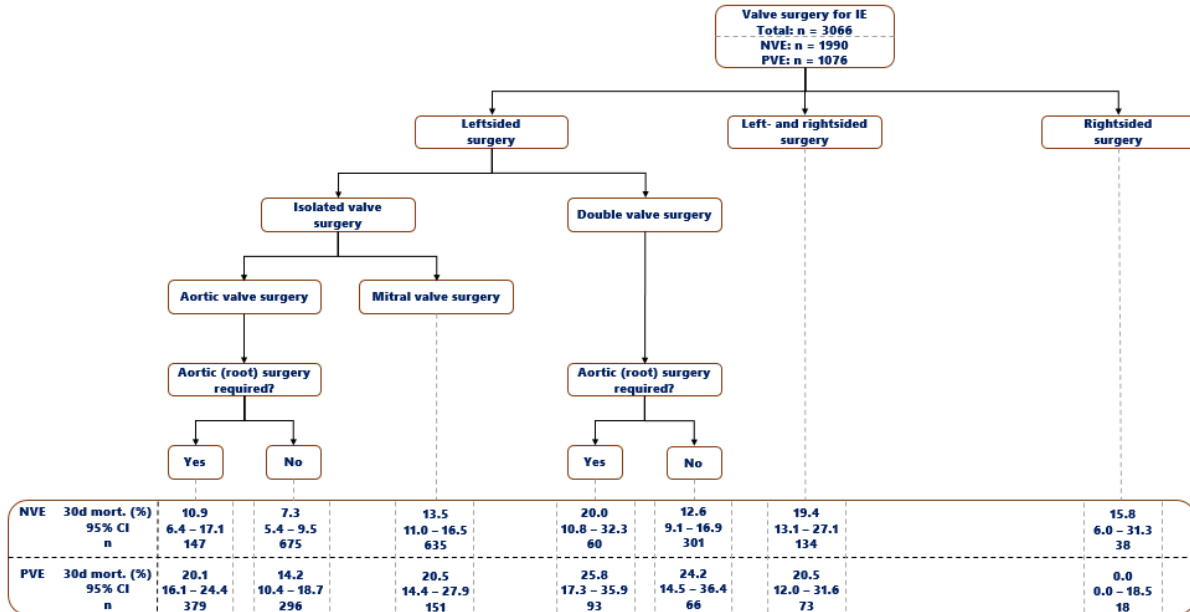
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Figure:

Figure 1. Postoperative 30-day mortality rates for NVE and PVE according to surgery type. IE, infective endocarditis; NVE, native valve endocarditis; PVE, prosthetic valve endocarditis; n, number of patients in cohort; 30d mort., 30-day mortality rate; CI, confidence interval

Postoperative 30-day mortality rates for native- and prosthetic valve endocarditis according to surgery type





External Validation of EuroSCORE I and II in Patients with Infective Endocarditis

Presenting author: F.J. Heinen

Department: Cardiology

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Purpose:

To externally validate the EuroSCORE I and II in patients with endocarditis.

Methods:

We performed a complete-case analysis of all patients who underwent valve surgery for infective endocarditis in the Netherlands between 2013 and 2021. Cases were retrieved from the Netherlands Heart Registration. The predictive performance was assessed by discrimination (area under the curve) and calibration (calibration in the large and calibration plots).

Results:

2569 IE patients were included (median age 64 years (IQR 53 – 71). 76.1% was male and 37.7% had previous cardiac surgery of which 86.3% previous valve surgery. Overall 30-day mortality was 10.2%. The mean EuroSCORE I and II were 27.9% (SD 22.0) and 14.9% (SD 16.3) respectively. The area under the curve for EuroSCORE I and II were 0.73 (95% CI 0.70 – 0.76) and 0.72 (95% CI 0.69 – 0.76) respectively. Calibration in the large showed that both models overpredict risks, with an observed to expected ratio of 0.37 (95% CI 0.21 – 0.55) for EuroSCORE I and 0.69 (95% CI 0.43 – 0.87) for EuroSCORE II. The calibration plot showed that EuroSCORE I overpredicts mortality across the full range. Calibration of EuroSCORE II was acceptable in patients with low predicted probabilities, but overpredicts mortality above 10% predicted probability.

Conclusion:

EuroSCORE I and II substantially overestimate postoperative 30-day mortality in endocarditis patients. Use of EuroSCORE I and II may lead to disadvantageous decision making if patients with a high predicted 30-day mortality risk are subsequently withheld from life-saving surgical treatment. Further research will need to recalibrate the EuroSCORE II including endocarditis-specific variables.

Keywords:

Endocarditis, Cardiac surgery, Risk prediction



Characterizing the Incidence and Underlying Cause of Urgent Post-CABG Coronary Artery Revascularisation

Presenting author: R. Bova

Department: Cardiologie

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Purpose:

Myocardial infarction (MI) following coronary artery bypass grafting (CABG) is a serious complication. In typical ST-segment elevation myocardial infarction (STEMI) patients, timely intervention is crucial and mechanical revascularization rates are >90%. However, this rate may differ in post-CABG patients. We aimed to investigate the rationale behind revascularisation of suspected postoperative MI.

Methods:

We screened all patients undergoing isolated elective CABG in an academic referral centre between 2017-2021, and identified patients undergoing unplanned postoperative angiography (uCAG) within 30 days. Patients undergoing revascularization (REV) were compared to conservatively (CONS) treated patients.

Results:

Of the 1,918 patients screened, 78 individuals underwent uCAG (4.1%) and 45 immediate revascularisation (2.3%, REV/uCAG: 57%). Baseline characteristics were comparable but REV patients had a higher surgical risk (EuroSCORE: 3.5 ± 3.9 vs. 7.3 ± 10.9 , $p=0.023$). STEMI rates were similar (REV: 75,5% , CONS: 75,7%; $p=NS$) and only 58% of patients with a working diagnosis of STEMI underwent revascularization. Graft-failure was more frequent in the REV group (13.3% vs 72.7%, $p=0.001$). uCAG patients had a higher thirty-day mortality than the screened cohort (1.2% vs 11.5%, $p=0.001$) but there was no difference between the study groups (CONS: 11.1%, REV: 12.1%, $p=0.890$). Only graft-failure (as compared to other angiographic findings) was independently associated with unplanned revascularization (OR: 13.4 [95%CI 3.3-55.3]; $p<0.001$).

Conclusion:

Postoperative CAG is performed in only 4% of elective isolated CABG cases but is associated with increased 30 days mortality. Immediate revascularization occurs in just 57% of patients, primarily driven by graft failure rather than the initial STEMI diagnosis

Keywords:

coronary artery bypass graft surgery, unplanned coronary angiography



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Figure:

Figure 1. Results “Unplanned Coronary Angiography after Isolated Coronary Artery Bypass Surgery”.

BMI= Body Mass Index, COPD= Chronic obstructive pulmonary disease, PAD = peripheral artery disease, LVEF= left ventricular ejection fraction, TIA= trans ischemisch accident, CVA=Cerebro Vasculair Accident, AP CCS= Canadian Cardiovascular Society grading of angina pectoris, EUROSCORE II= European System for Cardiac Operative Risk Evaluation, MIDCAB= Minimally invasive direct coronary artery bypass, CABG=Coronary artery bypass graft surgery , OPCAB= Off-Pump Coronary Artery Bypass, STE= ST elevation, LBBB= left bundle branch block, CAG= coronary angiography.

	CONS (n=33)	REV (n=45)	TOT (n=78)	P value
BASELINE CHARACTERISTICS				
AGE (years)	66,52 (±9,8)	67,01 (±7,7)	66,80 (±1,98)	0,808
MALE PATIENTS	27 (81,8%)	37 (82,2%)	64 (82%)	0,963
BMI	28,63 (±4,1)	26,16 (±3,4)	27,2 (±0,861)	0,01
CREATININE (µmol/L)	86,15 (±19,7)	90,64 (±25,6)	88,74 (±5,5)	0,415
HYPERTENSION	2 (6%)	6 (13,3%)	8 (10,2%)	0,624
HYPERCHOLESTEROLEMIA	31 (93,9%)	43 (95,5%)	74 (94,9%)	0,643
DIABETES MELLITUS	10 (30,3%)	13 (28,9%)	23 (29,4%)	0,892
COPD	0 (0%)	6 (13,3%)	6 (13,3%)	0,036
PAD	4 (12,1%)	10 (22,2%)	14 (31,1%)	0,251
LVEF (%)	51,09 (6,1)	51,60 (10,9)	51,38 (2,1)	0,801
TIA/CVA	3 (9%)	5 (11,1%)	8 (10,2%)	0,975
AP CCS	2,58 (±0,936)	2,47 (±1,023)	2,51 (±0,163)	0,771
EUROSCORE	1,98 (±1,9)	4,26 (±8,4)	3,3 (±1,49)	0,042
LOGISTIC EUROSCORE	3,50 (±3,9)	7,27 (±10,9)	5,67 (±1,99)	0,023
CAG REASON				
STE / LBTB	25 (75,7%)	34 (75,5%)	59 (75,6%)	0,984
Other	8 (24,3%)	11 (24,5%)	19 (24,3%)	0,984
DAYS BETWEEN CABG AND CAG				
Days between CABG and CAG	2,00 (±4,63)	2,76 (±6,01)	2,44 (±1,25)	0,543
CAG results				
native coronary stenosis or no evident stenosis	24 (72,7%)	6 (13,3%)	30 (37,2%)	0,001
graft or anastomosis stenosis	9 (27,3%)	39 (86,7%)	48 (51,3%)	0,001
Mortality				
Mortality at 30 days	4 (12,1%)	5 (11,1%)	9 (11,5%)	0,89



Incidence, Predictors and Clinical Impact of Early Coronary Graft Failure in Patients Undergoing Coronary Artery Bypass Graft Surgery

Presenting author: M.J.H. van Oort

Department: Cardiology

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Purpose:

Coronary graft failure (CGF) may occur early after coronary bypass graft surgery (CABG). The aim of this retrospective observational study was to identify clinical and perioperative risk factors of early CGF and to evaluate the long-term clinical impact of early CGF.

Methods:

A total of 92 CABG patients (79% male, 66.1±10 years-old) who underwent coronary angiography (CAG) prior to discharge in our tertiary center between 2012-2022 were included. Comparisons between patients with vs. without early CGF were performed based on clinical and echocardiographic data. All CAGs were retrospectively reviewed by two interventional cardiologists and a thoracic surgeon. Early CGF was defined as a dysfunctional coronary graft resulting from any of the following angiographic findings: stenosis of proximal or distal anastomosis or bypass conduit, bypass occlusion, reduced bypass flow (TIMI<1) and kinking/tenting/dissection of the bypass. Kaplan-Meier and multivariate analysis was performed to estimate cumulative survival free of MACE at 5-years follow-up and to identify predictors of early CGF.

Results:

Early CGF was present in 55(60%) patients. At 5-years follow-up, MACE was observed in 58(63%) patients, of whom 44(76%) had early CGF. Patients with early CGF had a significantly lower MACE-free five-year survival rate($p<0.001$). Venous jumpgrafts($p=0.006$), Y-graft configuration($p<0.001$) and the need of inotropic agents 12-hours postoperatively($p=0.028$) were associated with early CGF.

Conclusion:

Early CGF was present in a majority of CABG patients undergoing clinically indicated CAG during initial hospitalisation. Patients with early CGF showed a higher rate of MACE at 5-years follow-up. Venous jumpgrafts, Y-graft configuration and the need of inotropic agents were associated with early CGF.

Keywords:

Early coronary graft failure, Coronary angiography, Coronary bypass graft surgery

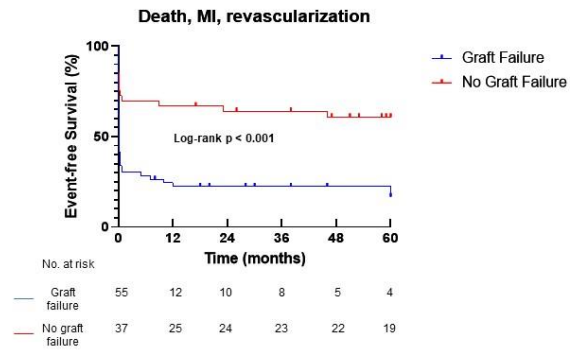


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Figure:

Figure 1: Five-year event-free survival of patients with early coronary graft failure (blue line) vs. without early coronary graft failure (red line).





Sessie 3: ELECTROPHYSIOLOGY AND DEVICES

Left Atrial Functional Changes Post Pulmonary Vein Isolation in AF Patients - a Cardiac Magnetic Resonance Imaging Study

Presenting author: N. van Pouderoijen

Department: Cardiology

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Purpose:

While restoration of sinus rhythm after catheter ablation for atrial fibrillation (AF) may lead to reversed left atrial (LA) remodeling, direct and long-term ablation injury may affect LA function.

The aim of this study is to evaluate the impact of radiofrequency (RF) pulmonary vein isolation (PVI) ablation on both LA tissue and function in the acute and chronic phase post PVI, as assessed with cardiac magnetic resonance imaging (CMR).

Methods:

Thirteen patients with AF who underwent primo RF PVI as part of the EVALUATE-PVI STUDY underwent a CMR scan pre-PVI, <72 hours and 3 months after PVI ablation. LA volume and function were obtained using two-chamber and four-chamber cine images. Maximum LA volume was indexed to body surface area to compute LAVI_{max}. Longitudinal LA strain was analyzed through feature tracking, and subdivided into reservoir, conduit, and contractile strain.

Results:

In the acute stage, both LA reservoir and contractile strain significantly decreased as compared to pre-PVI ($p < 0.01$ and $p < 0.001$, respectively). At 3 months post-PVI, all LA strain measures significantly improved compared to the acute stage (Fig. 1). LAVI_{max} showed a tendency for reduction in the chronic stage compared to the acute stage post-PVI.

Conclusion:

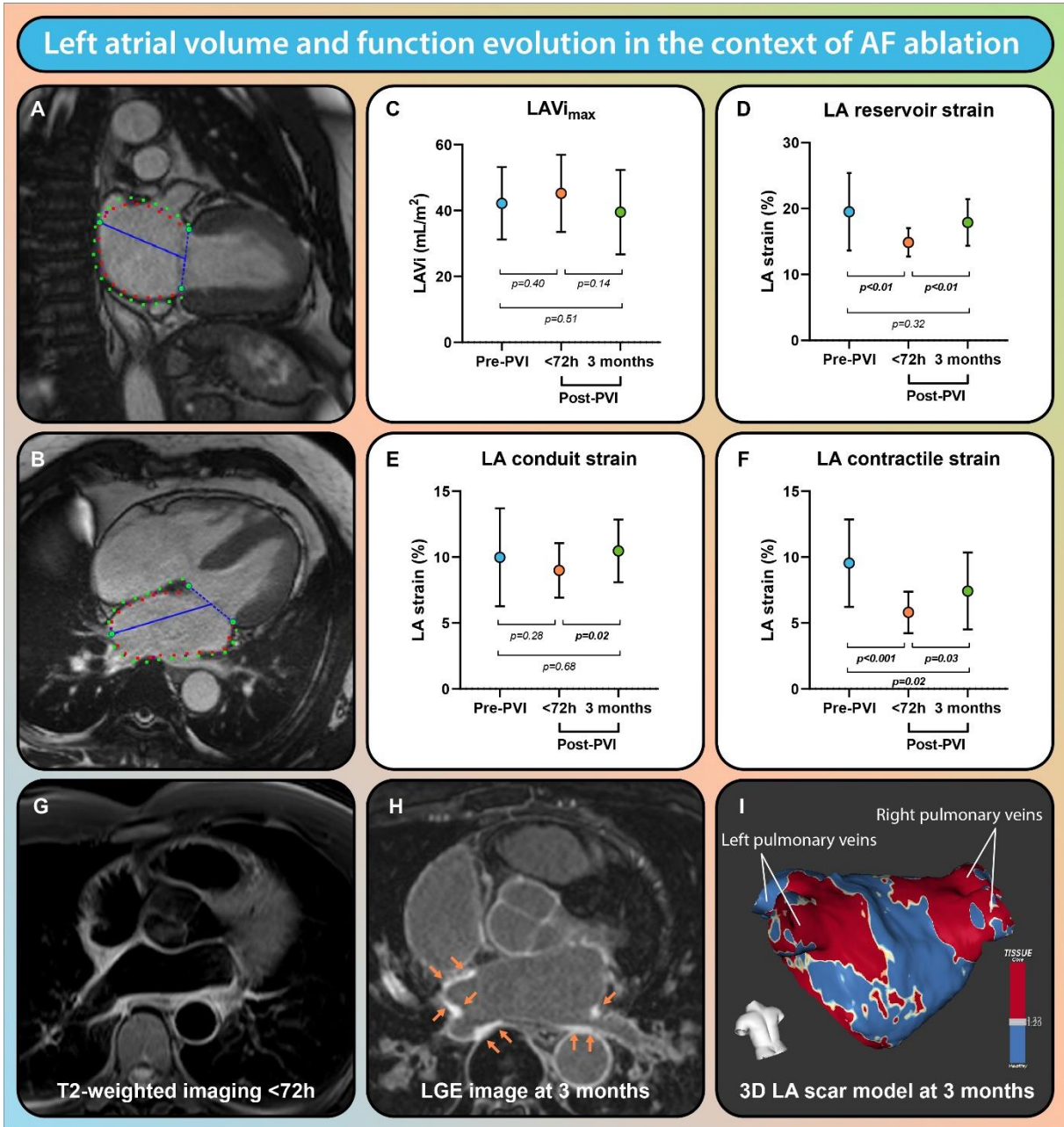
PVI ablation resulted in reduced LA function in the acute phase, potentially due to LA wall edema and thickening (Fig. 1G). Subsequent improvements in LA function are observed at 3 months, though full recovery did not occur as evidenced by reduced contractile strain, possibly due to replacement of atrial cardiomyocytes by ablation scar tissue (Fig. 1H-I). The trend towards reduced LAVI after ablation may indicate potential reverse remodeling.

Keywords:

Pulmonary vein isolation, Left atrial function, Cardiac magnetic resonance



Figure:





Charge Density Mapping-guided Ablation for Atrial Arrhythmia after Surgical Ablation

Presenting author: B.G.S. Abeln

Department: Cardiology

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Purpose:

Charge density (CD) mapping with the AcQMap system (Acutus Medical, Carlsbad, USA) enables non-contact whole-chamber activation-mapping that can be used to identify pathologic conduction patterns (PCPs) during atrial fibrillation (AF). Ablation targeting PCPs, in addition to PVI, yields beneficial outcomes in primo and repeat catheter ablation procedures for AF. No studies have reported on the value of CD mapping for repeat ablation after surgical ablation for AF.

Methods:

Patients that had repeat ablation for arrhythmia recurrence after surgical ablation were selected from a prospective observational study on CD mapping-guided ablation. Incomplete surgical ablation lesions, regular supraventricular tachycardias (SVTs) and PCPs of AF were mapped and targeted with radiofrequency ablation. Follow-up included 7-day Holter monitoring at 6- and 12-months post-procedure.

Results:

Between November 2020 and November 2022, 19 patients were included in the cohort. Incomplete ablation lesions were identified and ablated in 17 patients. Regular SVTs were observed in 11 patients, and non-inducibility was reached in 7 of these patients. AF was mapped in 13 patients, enabling ablation of 3[2-3] PCPs per patient. During follow-up of 15[12-24] months, 17 patients had arrhythmia recurrence. The arrhythmia burden was lower than 10% for 11/18 patients at 6-months and 6/12 patients at 12-months.

Conclusion:

CD mapping can be used to assess surgical ablation lesions and to identify arrhythmia mechanisms that were not addressed by prior ablation lesions. Ablation of these targets did not result in absolute freedom from arrhythmia for most patients, but nevertheless yielded a low arrhythmia burden on Holter monitoring in half of the cohort.

Keywords:

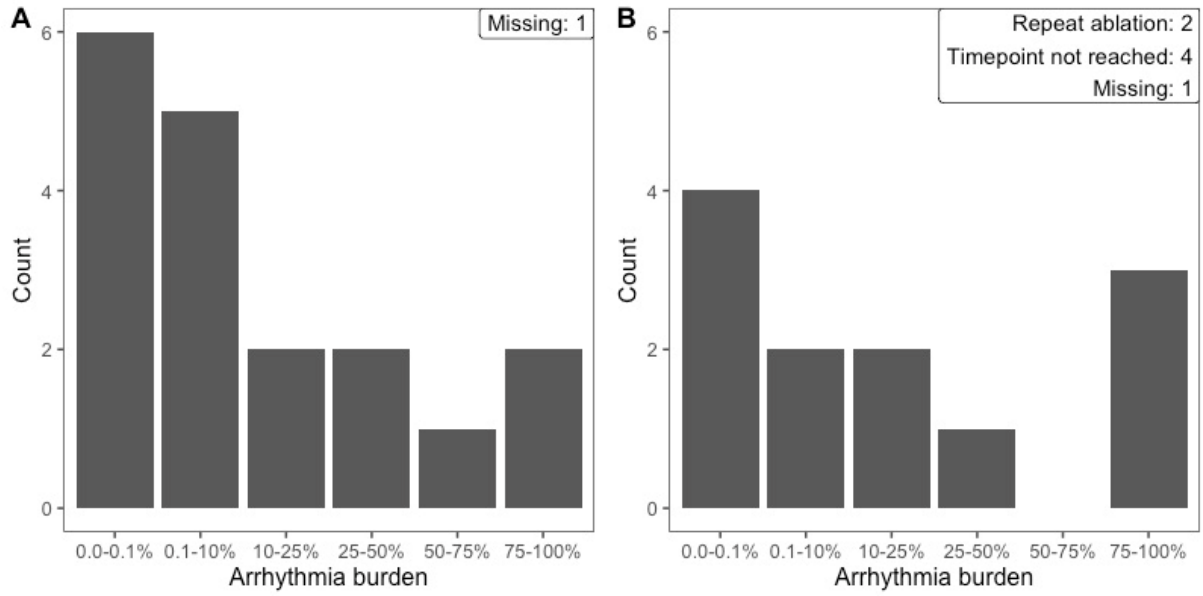
Repeat ablation, Charge density mapping, Surgical ablation



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Figure:

Atrial tachyarrhythmia burden at follow up. Bar charts illustrating the counts of patients in an arrhythmia burden category (e.g., 0.0-0.1% of atrial tachyarrhythmia). Panel A: Arrhythmia burden at 6 months post ablation. Panel B: Arrhythmia burden at 12 months post ablation.





Timing of Administration of Beta-blockers: Effects on de Novo Postoperative Atrial Fibrillation

Presenting author: N.L.M. de Kruijf

Department: Translational Electrophysiology & Cardiometabolic Epidemiology

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Purpose:

Postoperative atrial fibrillation (PoAF) is the most common complication after cardiac surgery, with an incidence ranging from 20% to 50%. The guidelines recommend perioperative beta-blocker usage for the prevention of PoAF. Despite these recommendations and the improvement of surgical skills and postoperative care, the occurrence of PoAF has remained similar in the last years. We therefore examined the effect of pre- and post-operative beta-blockers usage on development of early (≤ 5 days after surgery) PoAF.

Methods:

Adult patients (N=302) who had coronary artery bypass grafting and/or valve surgery were retrieved from an existing database and used for investigating the relation between administration of beta-blockers and occurrence of de novo PoAF.

Results:

De novo AF occurred in 106 (35.10%) patients and mainly on the second post-operative day. Post-operative administration of beta-blockers started at day 0 to day 5 in 7 (2.32%), 125 (41.39%), 67 (22.19%), 35 (11.59%), 15 (4.97%), and 7 (2.32%) patients, respectively. Preoperative beta-blockers usage did not reduce the prevalence of de novo PoAF (35.33% versus 34.75%; odds ratio 1.26 [95% CI, 0.60- 1.58]) whereas postoperative beta-blockers usage reduced the incidence of de novo PoAF (21.80% versus 65.93%; odds ratio 0.14 [95% CI, 0.08 to 0.25, $p < 0.05$]). Administration of either pre- or post-operative beta-blockers did not prevent de novo PoAF in 23.05% of the patients.

Conclusion:

De novo POAF can most effectively be prevented by administration of beta-blockers after, but not prior to cardiac surgery. However, this therapy is only moderate effective in preventing POAF.

Keywords:

Postoperative atrial fibrillation, Beta-blockers, Prevention



Ventricular Dyssynchrony Imaging, Echocardiographic and Clinical Outcomes of Left Bundle Branch Pacing and Biventricular Pacing

Presenting author: A.A.A. Verstappen
Department: Cardiology

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Purpose:

Left bundle branch pacing (LBBP) is a novel physiological pacing technique which may serve as an alternative to cardiac resynchronization therapy (CRT) by biventricular pacing (BVP). This study assessed ventricular activation patterns and echocardiographic and clinical outcomes of LBBP and compared this to BVP.

Methods:

Fifty consecutive patients underwent LBBP or BVP for CRT. Ventricular activation mapping was obtained by ultra-high-frequency ECG (UHF-ECG). Functional and echocardiographic outcomes and hospitalization for heart failure and all-cause mortality after one year from implantation were evaluated.

Results:

LBBP resulted in greater resynchronization vs BVP (QRS width: 170 ± 16 ms to 128 ± 20 ms vs 174 ± 15 to 144 ± 17 ms, $p=0.002$ (LBBP vs BVP); electrical dyssynchrony (e-DYS) 81 ± 17 ms to 0 ± 32 ms vs 77 ± 18 to 16 ± 29 ms, $p = 0.016$ (LBBP vs BVP)). Improvement in left ventricular ejection fraction (LVEF) (from 28 ± 8 to 42 ± 10 percent vs 28 ± 9 to 36 ± 12 percent, LBBP vs BVP, $p=0.078$) was similar. Improvement in NYHA function class (from 2.4 to 1.5 and from 2.3 to 1.5 (LBBP vs BVP)), hospitalization for heart failure and all-cause mortality were comparable in both groups.

Conclusion:

LBBP resulted in greater resynchronization (e-DYS and QRS duration) with a strong trend towards better improvement in LVEF. Improvement in NYHA functional class, hospitalization for heart failure and all-cause mortality at one year of follow up were comparable in both groups.

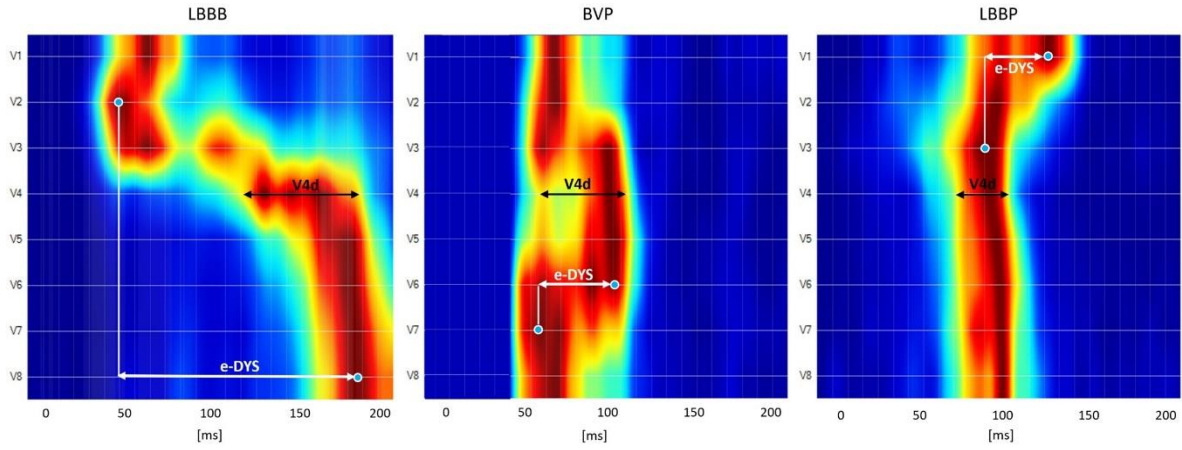
Keywords:

left bundle branch pacing, cardiac resynchronization therapy, ventricular activation mapping



Figure:

Typical examples of the ventricular depolarization map of LBBB, BVP and LBBP





Identifying Patients at Risk of Mortality Within One Year After an ICD or CRT-D Pulse Generator Replacement

Presenting author: M. Feijen
Department: Cardiology

M. Feijen (Leiden University Medical Center, Leiden); A.D. Egorova (Leiden University Medical Center, Leiden); T. Kuijken (Leiden University Medical Center, Leiden); M. Bootsma (Leiden University Medical Center, Leiden); Martin J. Schalij (Leiden University Medical Center, Leiden); L. van Erven (Leiden University Medical Center, Leiden)

Purpose:

Implantable cardioverter defibrillators (ICD) can significantly improve survival in selected patients. However, the expected individual ICD benefit should be weighed against the risk of device-associated complications. Identifying patients who are not likely to benefit from ICD therapy remains challenging. Easily implementable guidelines to potentially avoid a pulse generator exchange are currently lacking. This study investigates the 1-year mortality of patients who underwent an ICD or CRT-D generator exchange in a tertiary hospital.

Methods:

All patients with a follow-up of ≥ 365 days (or prior mortality) after an ICD or CRT-D exchange at the Leiden University Medical Center from 01-01-2018 until 01-12-2021 were eligible. Patient and procedure related factors were stratified and predictive values for 1-year mortality were evaluated with a cox-proportional hazard model. A stepwise, backward selection method was used to construct a multivariable model.

Results:

Data of 588 patients, 77% male, 69 [60-76] years, 46% ischemic cardiomyopathy, 59% primary prevention and 37% mildly reduced ejection fraction, was included. The all-cause 1-year mortality of the current cohort was 6.8%. Patients that underwent a CRT-D replacement (11%) or upgrade (12%) had a significantly higher mortality when compared to ICD replacement (3%), $p < 0.05$. Furthermore, LVEF $\leq 30\%$, NYHA class ≥ 3 , eGFR ≤ 30 ml/min/m² and Hb < 7 mmol/L were independently associated with mortality (Figure 1).

Conclusion:

Patients that underwent a CRT-D pulse generator exchange or upgrade had a significantly higher 1-year all-cause mortality when compared to ICD exchange patients. Prospectively validated risk scores to weight individualized risk of mortality with the expected ICD therapy benefit are urgently needed.

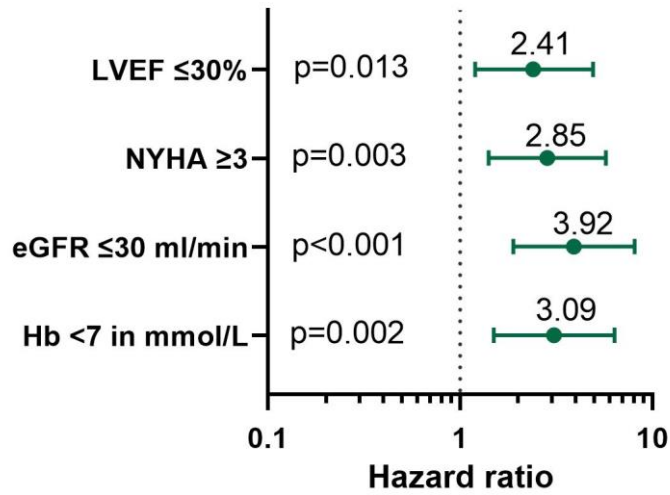
Keywords:

Pulse generator replacement, Cardiac Implantable Electronic Device, Mortality risk



Figure:

Factors that were independently associated with 1-year mortality after a ICD of CRT-D pulse generator exchange.





Ventricular Septal Defect Characteristics Influence Presence and Properties of Septal Anatomical Isthmuses in Patients with Repaired Tetralogy of Fallot

Presenting author: J. Wallet

Department: Cardiology

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Purpose:

In repaired tetralogy of Fallot (TOF), the septal anatomical isthmuses (AI), 3, between ventricular septal defect (VSD) and pulmonary annulus, and 4, between VSD and tricuspid annulus, are important ventricular tachycardia (VT) substrates when slow conducting. Patients with TOF exhibit heterogeneity in VSD location and border which may influence presence and properties of septal AIs.

Methods:

This study included all consecutive patients with TOF who (1) underwent electroanatomical mapping (EAM) between 2005 and March 2023 for treatment of ventricular arrhythmias, risk stratification, or before pulmonary valve replacement and (2) had a surgical report of initial repair available.

Results:

In 95 of 154 (62%) patients a report was available (64% male, median age at repair 1.6 years [IQR 0.6-6.4], mean age at EAM 32 ± 17 years), which provided details of VSD in 71. The majority (69/71) had an outlet VSD (muscular n=4, perimembranous n=60, doubly-committed juxta-arterial n=5; Figure). EAM revealed presence of AI 3 in 70/71 (99%; blocked/absent in 7), and AI 4 in 4/71 (6%).

All patients with a doubly-committed juxta-arterial VSD with a fibrous-posteroinferior rim (n=3) had a blocked/absent AI 3/4, one with a muscular posteroinferior rim had a blocked/absent AI 3 and normal conducting AI 4 and the other had a blocked/absent AI 3/4. The two other patients with AI 4 had an outlet perimembranous VSD or an outlet muscular VSD.

Conclusion:

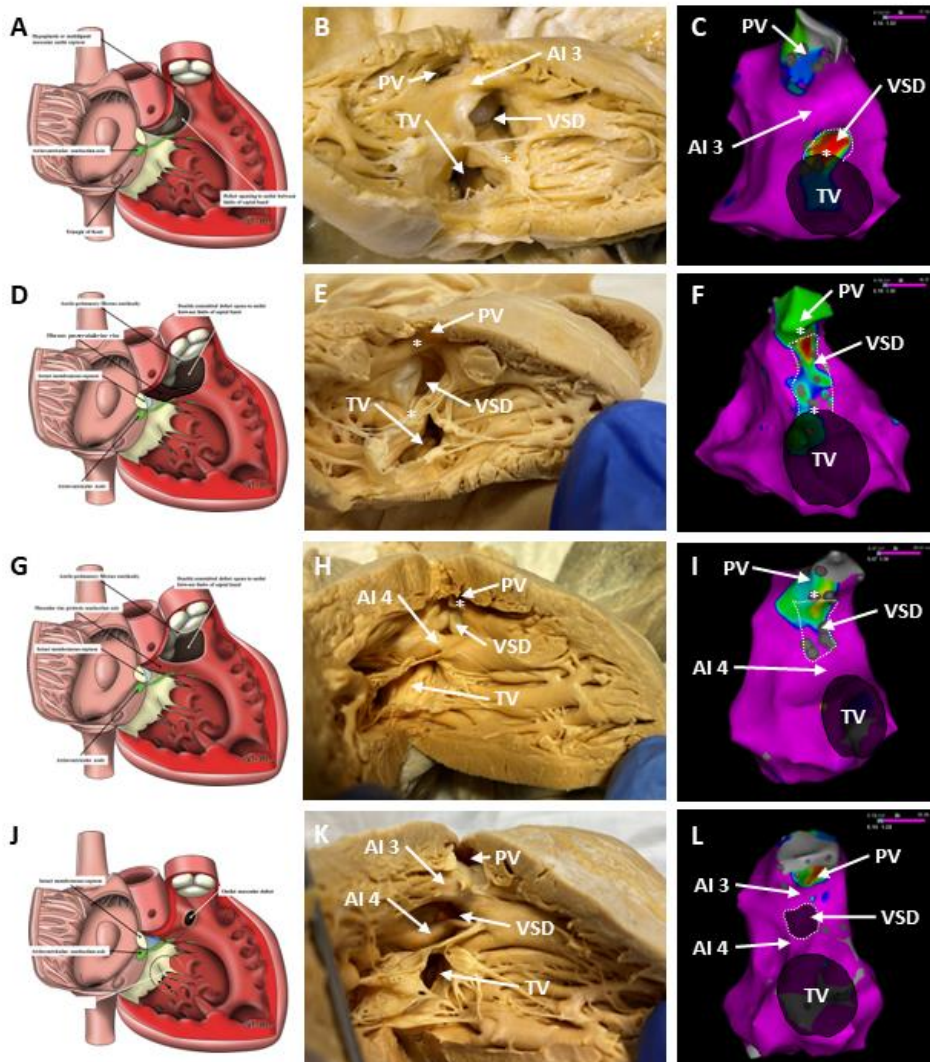
VSD characteristics influence presence and properties of septal AIs. In patients with doubly-committed juxta-arterial VSD septal VT substrates seem to be rare. Detailed surgical information is desirable for patient management.

Keywords:

Tetralogy of Fallot, Congenital heart disease, Ventricular tachycardia

Figure:

(A-C) Illustrates a tetralogy of Fallot patient with an outlet perimembranous VSD. (A) Schematic. (B) Anatomical specimen. (C) Electroanatomical voltage map. (D-F) Patient with a doubly-committed juxta-arterial VSD with fibrous posteroinferior rim. Note the absence of all septal AIs in (E) and (F). (G-I) Patient with a doubly-committed juxta-arterial VSD with muscular posteroinferior rim. Note the absence of AI 3 and presence of AI 4 in (H) and (I). (J-L) Show a patient with an outlet muscular VSD. AI 3 and AI 4 are present (see (K) and (L)). (L) Depicts a fictive electroanatomical map (the electroanatomical map of the only included patient with AI 3 and AI 4, studied in 2007, was not available anymore). * represents fibrous continuity. Abbreviations: AI, anatomical isthmus; PV, pulmonary valve; VSD, ventricular septal defect; TV, tricuspid valve.





Clinician-reported EHRA and NYHA Scores Only Moderately Reflect Patient-reported Quality of Life in Atrial Fibrillation and Heart Failure

Presenting author: J.A.A. van de Pol

Department: -

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Purpose:

In the management of heart failure (HF) and atrial fibrillation (AF), treatment decisions are often made based on the amount and severity of symptoms. It is expected that treating the patients' symptoms positively impacts the patients' burden of disease. Clinician-reported symptoms are expected to agree with patient-perceived symptoms. However, patients may value (the impact of) symptoms on their quality of life (QoL) differently to clinicians. This study aimed to gain insights on how patients perceive the impact of AF and HF on QoL, compared to how clinicians perceive (the impact of) patients' symptoms. To this end, the clinician-reported severity of symptoms was assessed in relationship with patient-reported QoL within 12 months after diagnosis.

Methods:

Newly diagnosed AF and HF patients were included between November 2014 and January 2023 in four non-academic hospitals situated in the Southeast of the Netherlands. During routine visits to AF- and HF-outpatient clinics trained nurses collected information on among others symptoms and QoL at diagnosis and 12 months of follow-up. Severity of symptoms was determined through a clinician-reported NYHA classification for HF and EHRA score for AF. QoL was assessed through the use of the CareQoL questionnaire for HF and AFEQT questionnaire for AF. Medians and interquartile-ranges (IQR) were used to assess symptoms and QoL at diagnosis and 12 months of follow-up. In addition, one-way ANOVA's were employed to assess difference in symptoms and QoL over a period of 12 months.

Results:

In total, 890 AF patients and 292 HF patients were available for analysis with complete 12 month follow-up information. A moderate correlation was observed between EHRA score and AFEQT at diagnosis and 12 months follow-up (Pearson's R -0.357 and -0.302, respectively). A comparable correlation was observed between NYHA classification and CareQoL (Pearson's R 0.290 and 0.491). A clinician-reported improvement in AF or HF symptoms from diagnosis to 12 months follow-up was associated with a patient-reported improvement in QoL (AF: $F(762,3) = 25.86$, $p < .001$, and HF: $F(256,2) = 8.87$, $p < .001$). When clinicians reported no change or worsening symptoms, no significant changes in QoL were reported by patients. Furthermore, a large variation was observed in patient-reported quality of life, even if clinicians reported no symptoms (i.e. EHRA I / NYHA I) for both AF and HF (Median (IQR); 84.3 (25.1) and 2.49 (1.05), respectively) (see Figure 1a & 1b).

Conclusion:

In this study only a moderate correlation was observed between clinician-reported symptoms and patient-reported quality of life with large individual variation in patient reported QoL. A clinician-reported worsening of symptoms was not always reflected in a decrease of patients'



QoL. The clinician-reported EHRA and NYHA classification does often not accurately reflect the burden of disease as perceived by patients.

Keywords:

Atrial Fibrillation, Heart Failure, Quality of Life

Figure:

Discrepancy between clinician-reported symptoms and patient-reported quality of life for heart failure and atrial fibrillation. For heart failure the NYHA-classification and CareQoL (a higher score indicates lower quality of life) are used. For atrial fibrillation the EHRA-score and AFEQT questionnaire (a higher score indicated higher quality of life) are used.

Figure 1a

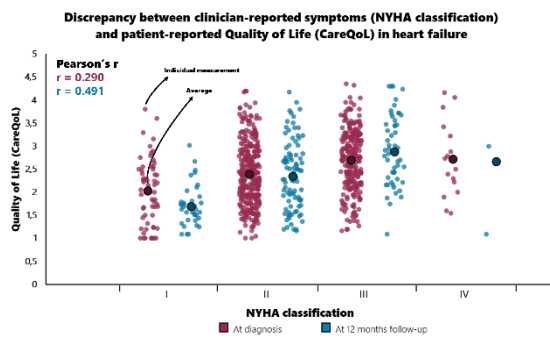
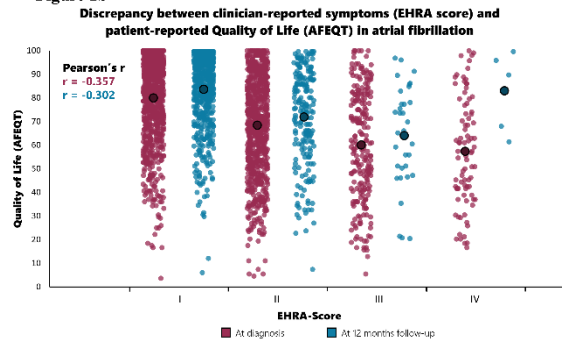


Figure 1b





Safety and Feasibility of Magnetic Resonance Imaging in Patients with Cardiovascular Implantable Electronic Devices: A Retrospective Cohort Study Using the Leiden Protocol

Presenting author: J.J. van Rijn
Department: Cardiology

J.J. van Rijn (Leiden University Medical Center, Leiden); D. Yilmaz (Leiden University Medical Center, Leiden); L. van Erven (Leiden University Medical Center, Leiden)

Purpose:

Cardiovascular implantable electronic devices (CIEDs) are increasingly prevalent, necessitating the need for safe magnetic resonance imaging (MRI) procedures in this patient population. The Leiden University Medical Centre (LUMC) protocol has been proposed to achieve safe MRI scans in patients with CIEDs, including those with epicardial leads, abandoned leads, non-MR-conditional devices, or device-lead manufacturer mismatch. This study aims to assess the safety of MRI imaging in patients with CIEDs using the LUMC protocol.

Methods:

A single-centre retrospective cohort study was conducted, enrolling adult patients with CIEDs who underwent MRI scans. Data, including patient characteristics, MRI details, and 30-day follow-up reports, were collected and analysed. Incidence rate calculations were performed to compare MRI-related complications in different patient subgroups.

Results:

Data from 662 MRI scans in 465 patients were analysed. Adverse events related to MRI scans were minimal, with only three occurrences (0,45%) reasonably attributed to the procedure. MRI-unsafe patients reported a significantly higher incidence rate, with an incidence rate difference of 0,01145 (95% CI 0,02194-0,00096; p=0,0323) compared to MRI-safe patients.

Conclusion:

This study provides evidence supporting the safety of MRI in patients with CIEDs, even in cases with epicardial leads, abandoned leads, non-MRI-conditional devices, or device-lead manufacturer mismatch, when managed using the LUMC protocol. The findings offer valuable insights for clinicians, reassuring them of the feasibility and safety of MRI scans in this patient population. Adhering to the LUMC protocol can ensure safer MRI procedures for patients with CIEDs, facilitating access to essential diagnostic imaging while maintaining high standards of patient care.

Keywords:

Cardiac Implantable Electrical Devices, Magnetic Resonance Imaging



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Figure:

Incidence rates and incidence rate ratios of difference patient subgroups with their respective Poisson 95% confidence interval and p-value.

	Incidence rate (95% CI)		p-value	Incidence rate ratio (95% CI)		p-value
MRI-safe	0	(0-0,0092)				
MRI-unsafe	0,0115	(0,00236-0,0335)				
Difference	0,0115	(0,0219-0,00096)	0,032	-		-
Secondary outcomes						
Non-hybrid devices	0,0055	(0,000138-0,0304)				
Hybrid devices	0,0074	(0,00089-0,0266)				
Difference	0,00189	(-0,0133-0,0171)	0,808	1,35	(0,070-79)	0,859
MRI-safe device	0,0071	(0,00086-0,0257)				
MRI-unsafe device	0,00314	(0,000079-0,0175)				
Difference	0,00398	(-0,0074-0,0153)	0,491	2,27	(0,118-133)	0,555
Non-epicardial leads	0,0046	(0,00095-0,0134)				
Epicardial leads	0	(0-0,369)				
Difference	0,0046	(-0,0374-0,047)	0,830	-		-
Non-abandoned leads	0,0046	(0,00095-0,0134)				
Abandoned leads	0	(0-0,53)				
Difference	0,0046	(-0,046-0,055)	0,858	-		-
Other	0,0055	(0,00114-0,0161)				
MRI-heart	0	(0-0,0313)				
Difference	0,00552	(-0,0079-0,0189)	0,420	-		-

CI: confidence interval, MRI: magnetic resonance imaging



Sessie 4: IMAGING

Limited Applicability of Sokolow-Lyon Criteria for Cardiac Remodelling in Athletes: Results from the ELITE Cohort

Presenting author: M.A. van Diepen

Department: (Sports) Cardiology

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Purpose:

To evaluate the diagnostic accuracy of Sokolow-Lyon's left ventricular hypertrophy (LVH) criteria in detecting increased myocardial mass as demonstrated on cardiac magnetic resonance imaging (CMR) in elite athletes, following its omission from current ECG guidelines for athletes.

Methods:

Elite athletes from the ELITE cohort were assessed with ECG using Sokolow-Lyon criteria (S in V1 + R in V5/6 > 35mm) and CMR for end-diastolic left ventricular mass (LVM) and maximum wall thickness (maxLVWT). Sex-specific cut-off values for LVM, indexed to body surface area (BSA), and maxLVWT were 75g/m² and 13mm for men and 59g/m² and 11mm for women, respectively. Primary outcomes were Sokolow-Lyon's accuracy, sensitivity and specificity in detecting increased LVM/BSA and LVWT.

Results:

Among 267 elite athletes (58% men, median age 25), 30% met Sokolow-Lyon ECG criteria for LVH, which was more prevalent in men than women (42% vs 12%, p<0.001). Overall, the LVH criterion showed 65% accuracy, 37% sensitivity, and 73% specificity for enlarged LVM/BSA, and 70%, 44%, and 71% for increased maxLVWT, respectively. In women, the LVH criterion showed for both LVM/BSA and maxLVWT high accuracy (80% and 88%) and specificity (93% and 89%). Sensitivity for detecting maxLVWT in women appeared to be higher than in men (67% vs 38%).

Conclusion:

Sokolow-Lyon criterion has limited overall diagnostic accuracy in detecting increased myocardial mass in elite athletes. While fewer female elite athletes meet the LVH criterion, our data suggest a higher accuracy in women. Studies incorporating artificial intelligence or machine learning could improve diagnostic accuracy in detecting cardiac remodelling in athletes.

Keywords:

Athlete, ECG, Left ventricular hypertrophy



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Figure:

Table: Demographic Data, Cardiac Magnetic Resonance Imaging Measures, and Sokolow-Lyon Diagnostic Metrics Compared Between Female and Male Elite Athletes. BMI body mass index, BSA body surface area, LVEDV left ventricular end-diastolic volume, LVESV left ventricular end-systolic volume, LVM left ventricular wall mass, maxLVWT maximum left ventricular wall thickness, ECG electrocardiogram, LVH left ventricular hypertrophy

Mean (SD)	<u>Female</u> (N=113)	<u>Male</u> (N=154)	<u>P-value</u>
Median [min-max] age (years)	25.2 [17 - 45]	24.6 [18 - 64]	0.820
BMI (kg/m ²)	22.2 (2.0)	23.2 (2.6)	<0.001
BSA (m ²)	1.79 (0.14)	2.03 (0.18)	<0.001
LVEDV/BSA (ml/m ²)	109 (14)	125 (18)	<0.001
LVESV/BSA (ml/m ²)	46.6 (7.8)	55.5 (11)	<0.001
LVM/BSA (g/m ²)	50.1 (11)	66.4 (12)	<0.001
maxLVWT (mm)	8.3 (1.2)	10.3 (1.8)	<0.001
<u>Sokolow-Lyon criterion:</u>			
No hypertrophy on ECG	99 (88%)	89 (59%)	<0.001
Hypertrophy on ECG	14 (12%)	65 (42%)	
<u>LVM/BSA exceeding:</u>			
Exceeding	25 (22%)	34 (22%)	1.000
Not exceeding	88 (78%)	120 (78%)	
<u>MaxLVWT exceeding:</u>			
Exceeding	3 (3%)	13 (8%)	0.088
Not exceeding	110 (97%)	141 (92%)	
<u>Accuracy LVH crit. for LVM</u>			
Accuracy	80%	54%	
Sensitivity	32%	41%	
Specificity	93%	58%	
<u>Accuracy LVH crit. for LVWT</u>			
Accuracy	88%	56%	
Sensitivity	67%	38%	
Specificity	89%	57%	



Personalized Cardiac MRI-Derived ECG Imaging - a feasibility study

Presenting author: P.J. Reitzema

Department: Cardiology

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Purpose:

This study explored the feasibility of a personalized, cardiac MRI (CMR)-derived, 3D electrical propagation reconstruction using conventional 12-lead ECG (Cine-ECG) in a cohort of healthy controls and patients with cardiac disease.

Methods:

Three healthy volunteers (all male age 23 ± 3 years) and four cardiac patients (one with dilated cardiomyopathy and ICD, one Fallot patient, and two patients with paroxysmal atrial fibrillation) (2 male and 2 female, age 48 ± 12 years) were studied. Conventional 12-lead ECG recording, and cardiac MRI were performed to create a patient-specific torso/heart model. The ECG electrode positions were co-registered with the thorax model. CineECG was used to visualize the mean electrical propagation (PathECG) within the personalized heart model and to quantify QRS duration, corrected-QT (QTc), initial angle of PathECG (first 25ms of QRS, dimensionless), and transcatheter ratio (TCR is the 3D distance between start- and endpoint of the PathECG during QRS, dimensionless).

Results:

QRS and QTc times were within normal limits for both controls (100 ± 7 ms and 378 ± 5 ms) and patients (96 ± 8 ms and 395 ± 29 ms). Only the patient with Fallot had a prolonged QRS duration (142 ± 6.0 ms). The initial angle of the PathECG was comparable between patients and volunteers (72.6 ± 4.7 vs. 56.1 ± 25.3). TCR was significantly higher in patients compared to the control group (45.0 ± 16.6 vs. 14.6 ± 6.7).

Conclusion:

This study presents a novel, clinically applicable approach/method to visualize and quantify personalized 3D electrical activation, based on a conventional 12-lead ECG and CMR scan. This technique allows to study noninvasively spatial electrical activation patterns and offers the prospect of advancing non-invasive screening for (subclinical) electrical diseases.

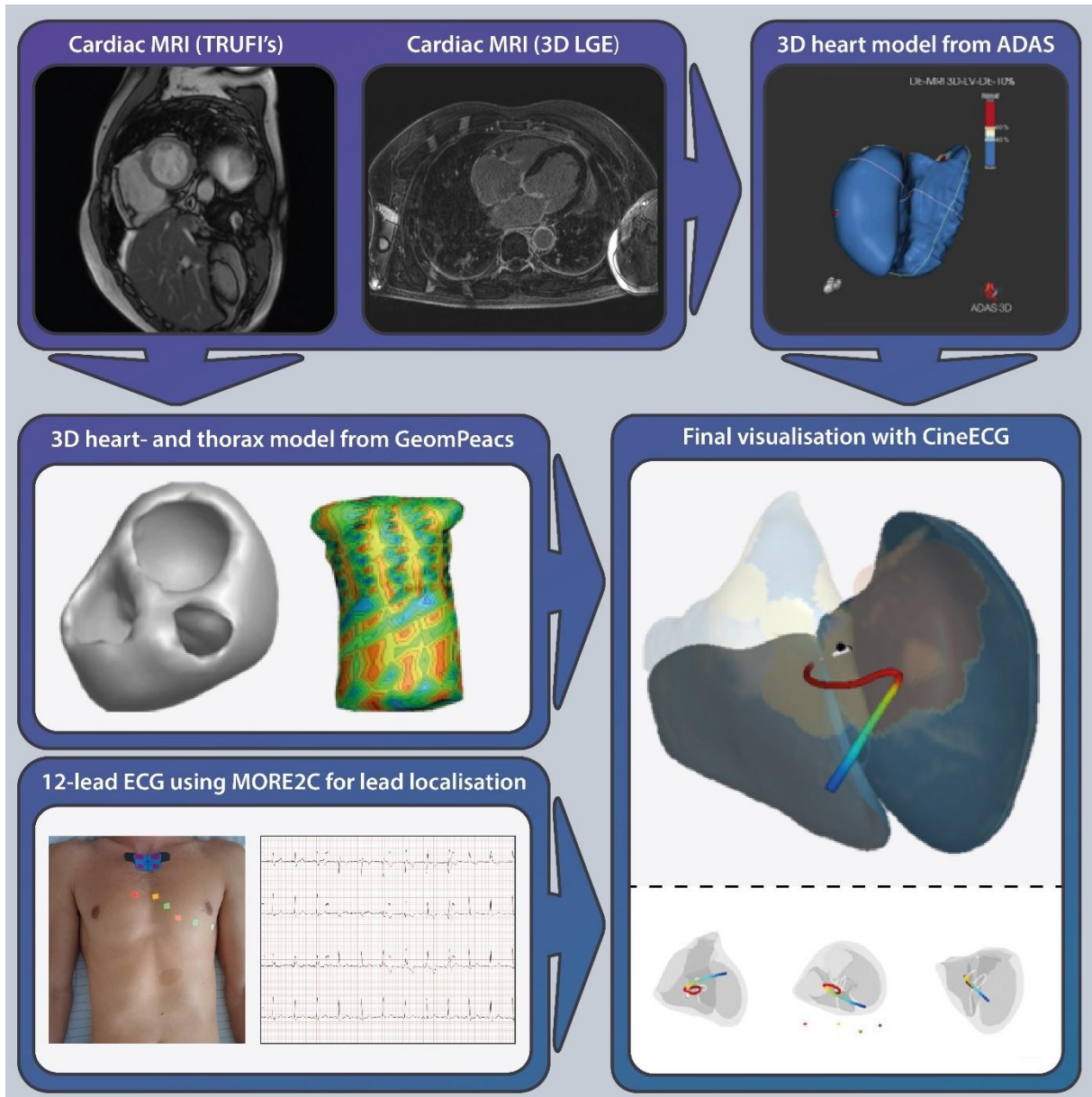
Keywords:

Cardiac MRI, CineECG, Electrophysiology



Figure:

CMR was used to generate a 3D thorax model and to create a personalized bi-ventricular cardiac model. Electrode positions were co-registered with the 3D thorax model. The lower right panel demonstrates the final computation of 3D electrical activation over time represented by PathECG visualized on the heart model.





Automated Analysis of CMR Data Bases Using Quality Controlled AI: Impact on LV Volume Quantification in a District Hospital

Presenting author: M. de Jong
Department: Cardiology

M. de Jong (Diakonessenhuis, Utrecht); F. Hersbach, Dr C.C.E. van Ofwegen-Hanekamp, Dr A. King, Prof R. Razavi, Dr B. Ruijsink

Purpose:

A fully automated, quality controlled method for analysis of cardiac function from CMR databases (AI-CMRQC) was implemented in our district hospital. This tool has previously been validated, but performance drops in new data as well as interinstitutional differences in (manual) segmentation strategies can impact volumetric assessment.

We investigate how AI-CMRQC impacts ventricular volume quantification when compared to manual assessment in our institution.

Methods:

AI-CMRQC was implemented in a Diakonessenhuis in 2021.

We automatically analysed 997 CMR exams, that were acquired between 1st January 2011 and 31st July 2021 from our PACS system. We compared the original reported values for LV ventricular assessment with the ones obtained using AI-CMRQC using Pearson's correlation and Blant-Altman plots. RV assessment was reported in <5% of the CMR cases and was therefore not included in this analysis, but a more extensive analysis is currently ongoing.

Data or reporting staff of the institution was not previously involved in the development of AI-CMRQC.

After analysis of the full cohort, we stratified data for different disease phenotypes and classes of ejection fraction. Moreover, we investigated whether additional parameters obtained with AI-CMRQC (peak systolic strain and diastolic strain rate, left atrial size and ventricular peak filling and ejection rates) were related to outcomes in this cohort.

Results:

Pearson's correlation coefficients were good for all measures of LV volume; LVEDV $r=0.92$, LVESV $r=0.93$ and LVEF $r=0.87$. Mean difference between reported values and AI-CMRQC was -13.13 mL for LVEDV, -7.21 mL for ESV and -1.76 % for LVEF. See Figure 1 for the scatter and Blant-Altman plots. Stratified analysis over different disease phenotypes (non-ischemic and ischemic, dilated and hypertrophic cardiomyopathies) and classes of ejection fraction will be presented. AI-derived parameters of systolic function (ejection fraction and strain) were well correlated with outcomes in this cohort.

Conclusion:

There was good correlation between LV volumes obtained using AI-CMRQC compared to those obtained during routine manual clinical reporting, with small mean differences between the two methods. Implementation of AI-CMRQC did not meaningfully affect LV volume quantification in this institution.

Keywords:

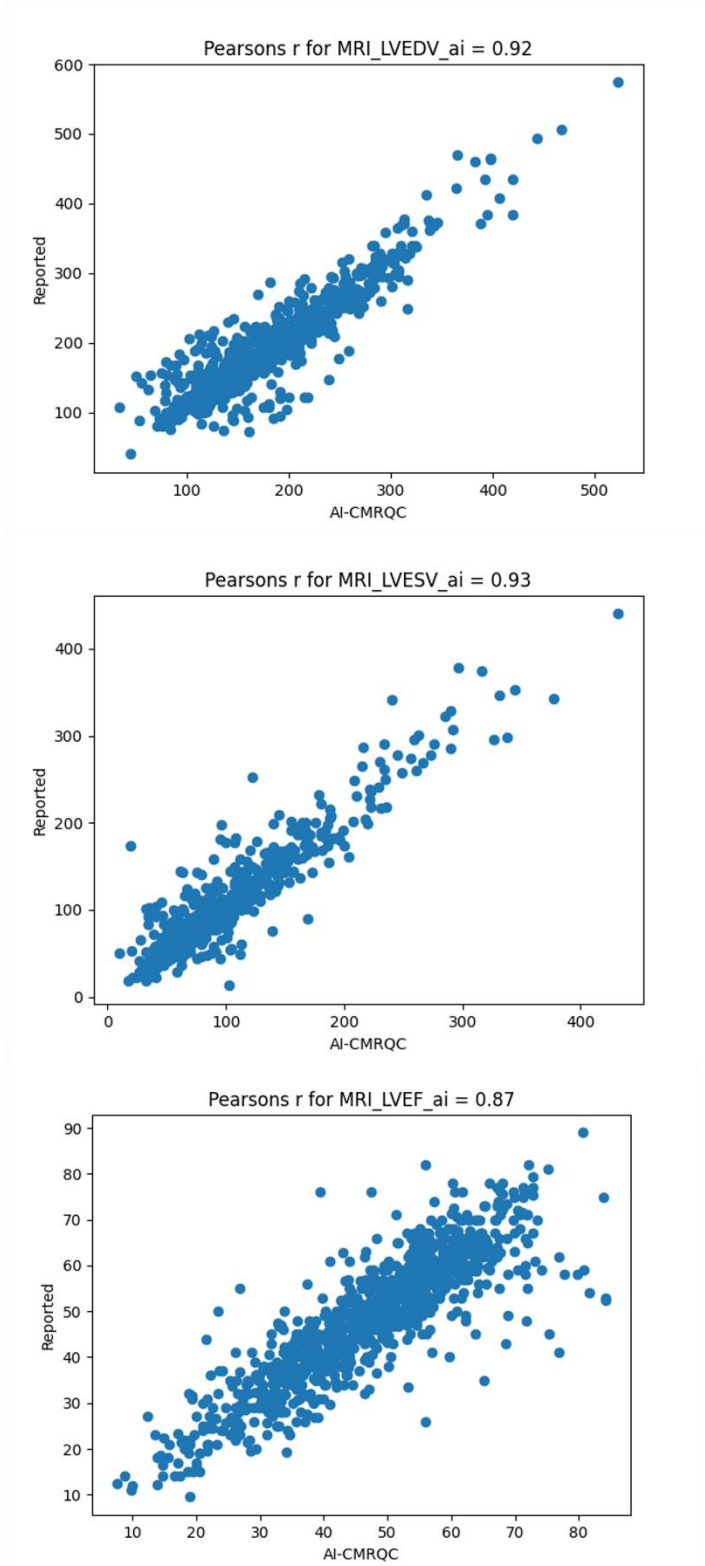
AI, CMR, Automated database analysis



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Figure:





Differences in Bi-atrial Mechanics in Elite Athletes and Paroxysmal Atrial Fibrillation Patients

Presenting author: J.J.N. Daems
Department: Cardiology

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Purpose:

To explore bi-atrial strain differences between elite athletes and PAF patients.

Methods:

In this retrospective cross-sectional study, we analysed data from two groups: elite athletes in the ELITE-cohort at Amsterdam UMC, who are over 16 and train ≥ 10 hours per week at top national or international levels, and patients with PAF awaiting pulmonary vein isolation at the same centre. All subjects underwent standardized resting transthoracic echocardiogram. We assessed left and right atrial (LA/RA) reservoir (ϵ RES), conduit (ϵ CD), and contractile (ϵ CT) strain using grey-scale-based 2D Speckle tracking software.

Results:

A total of 232 elite athletes (44.4% female, age 28 [25-32]) and 39 patients with PAF (43.6% female, age 61 [53-66]) were included. Athletes demonstrated larger indexed LA volumes (36.0 ml/m² [31.0-43.0] vs. 32.4 ml/m² [26.8-37.7], $p=0.003$). Athletes showed more deformation during the LA reservoir- (33.7% ± 5.9 vs. 27.9% ± 6.6 , $p<0.001$) and bi-atrial conduit phase (LA: -24.2% ± 4.9 vs. 14.4% ± 4.3 %, $p<0.001$; RA: -22.4% ± 6.9 vs -16.8% ± 6.2 , $p<0.001$) and showed less deformation during the bi-atrial contractile phase (LA: -9% [-12 to -7] vs. -13% [-14.5 to -11], $p<0.001$; RA: -10% [-12 to -7] vs. -13% [-16 to -9], $p<0.001$). A tangent through the two highest LA ϵ CD/ ϵ CT ratios in the AF population (LA ϵ CT, LA ϵ CD: 14%, 6%; 22%, 10%) had a sensitivity of 60% and a specificity of 100% to discriminate between athletes and patients.

Conclusion:

Athletes and PAF patients exhibit different bi-atrial contraction patterns despite their increased atrial volumes. Atrial strain could help differentiate exercise-induced atrial changes from atrial pathology.

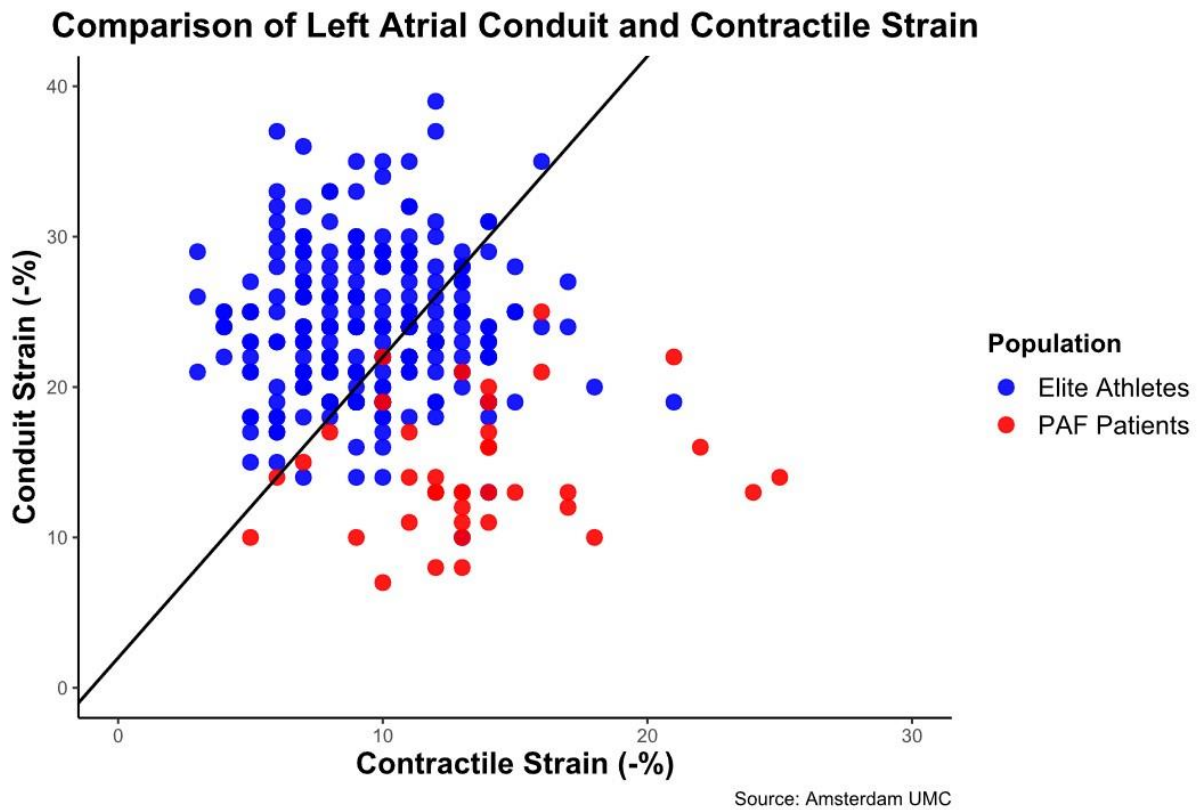
Keywords:

Atrial strain, Elite athletes, Paroxysmal atrial fibrillation



Figure:

Scatter plot of left atrial (LA) conduit and contractile strain for elite athletes and patients with paroxysmal atrial (PAF) fibrillation. A tangent is drawn through the two PAF patients with the highest left atrial conduit / contractile strain ratio (Patient A (LA ϵ CD 14%, LA ϵ CT 6%; Patient B LA ϵ CT 22%, 10%) with the following formula (LA ϵ CD - 2) / LA ϵ CT = 2. The tangent had a sensitivity of 60% and a specificity of 100% to discriminate between elite athletes and patients with PAF.





Mitral Annular Disjunction in Idiopathic Ventricular Fibrillation Patients: Just a Bystander or a Potential Cause?

Presenting author: L.M. Verheul

Department: Cardiology

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Purpose:

Our group previously showed that a higher prevalence of the structural finding inferolateral mitral annular disjunction (MAD) was found in idiopathic ventricular fibrillation (IVF) patients. We aimed to enlarge our IVF cohort to further investigate the prevalence of inferolateral MAD and provide more insight into the pro-arrhythmogenicity.

Methods:

This retrospective, multicentre study included 218 IVF patients, of which 61 IVF patients were included from the previous study. Cardiac magnetic resonance images were analysed for mitral valve abnormalities (Figure 1A) and late gadolinium enhancement (LGE). Pro-arrhythmogenicity was determined by premature ventricular complex (PVC) burden, non-sustained ventricular tachycardia (VT) and appropriate implantable cardioverter defibrillation (ICD) therapy, at baseline or during follow-up.

Results:

Inferolateral MAD was identified in 25 (13%) IVF patients (median age 31 [24, 50] years, 40% female). When comparing 218 IVF patients with or without inferolateral MAD, mitral valve prolapse (MVP) was found in 13 (7%) patients, primarily in patients with inferolateral MAD (40% vs. 2%, $p < 0.01$). Patients with inferolateral MAD had a pro-arrhythmogenic phenotype characterised by a high PVC burden (68% vs. 24%, $p < 0.01$). Non-sustained VT and appropriate ICD therapy were comparable for patients with or without inferolateral MAD ($p = 0.06$ and $p = 1.00$, respectively) and MVP ($p = 0.06$ and $p = 1.00$, respectively), Figure 1B. MAD length was not associated with arrhythmogenic factors but was higher in combination with MVP. The presence of LGE was comparable.

Conclusion:

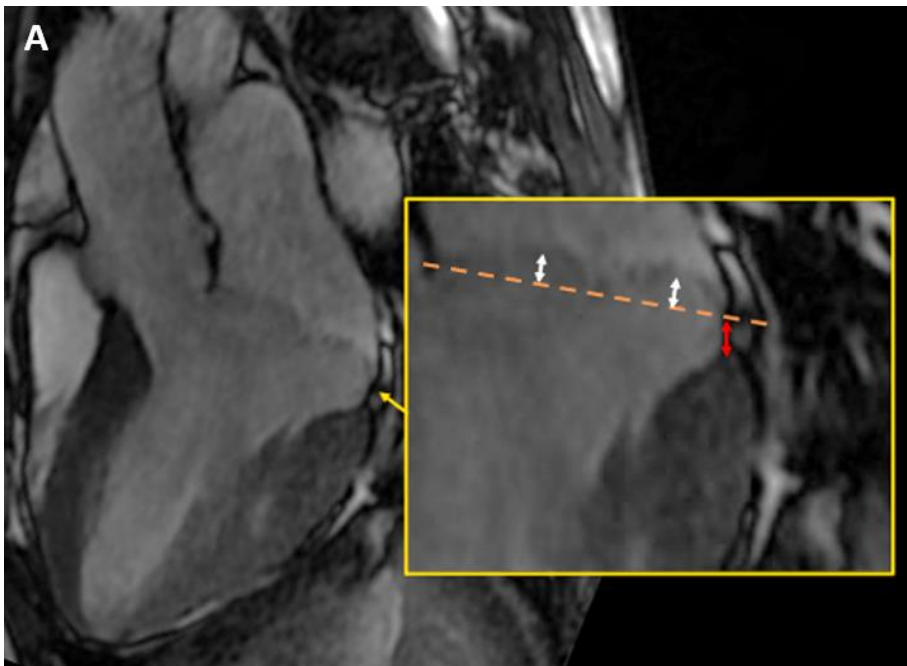
An increased prevalence of inferolateral MAD appears to be a consistent finding in IVF patients. Pro-arrhythmogenic characteristics were present.

Keywords:

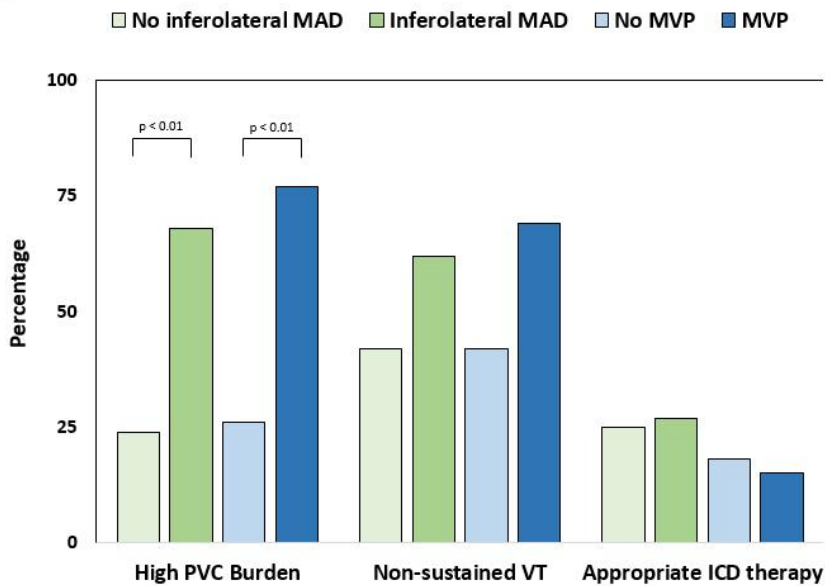
Idiopathic ventricular fibrillation, Mitral annular disjunction

Figure:

Figure 1. (A) Measurements of MAD ($\geq 1\text{mm}$) (red arrow) and MVP ($\geq 2\text{mm}$) (white arrows). (B) Patients with inferolateral MAD and MVP more often had a high PVC burden (defined as >1000 PVCs on Holter, >20 PVCs on exercise treadmill test or bigeminy/trigeminy on ECG/Holter/exercise treadmill test/telemetry); 68% vs 24% for inferolateral MAD, $p < 0.01$, 77% vs 26% for MVP, $p < 0.01$. Non-sustained VT and appropriate ICD therapy did not significantly differ. Abbreviations: ICD; implantable cardioverter defibrillator, MAD; mitral annular disjunction, MVP; mitral valve prolapse, PVC; premature ventricular complexes, VT; ventricular tachycardia.



B





Comparison Qualitative versus Fully Automated Quantitative Stress Perfusion CMR Imaging for Detection of Obstructive Coronary Artery Disease- A Retrospective Study

Presenting author: G.W. de Mooij

Department: Cardiology

G.W. de Mooij (Amsterdam UMC, Amsterdam); S. Borodzicz- Jazdyk (Amsterdam UMC, Amsterdam); M.J.W. Götte (Amsterdam UMC, Amsterdam)

Purpose:

Assessment of obstructive Coronary Artery Disease (oCAD) by Cardiac Magnetic Resonance (CMR) perfusion imaging is currently performed via Qualitative, visual assessment (VA). However, VA via CMR has limitations in the detection of multi-vessel diseases, as well as microvascular dysfunction (MVD). The newly introduced Quantitative Perfusion (QP) could prevail these limitations. This study aims to assess the diagnostic differences between VA and QP in detection of oCAD.

Methods:

In this retrospective single-center study, 29 patients (17 male [59%], mean age 62.8 ± 10 years) with suspected myocardial ischemia were included that underwent adenosine stress perfusion CMR. All scans were performed using a 3-T whole body MR scanner, by the use of a modified dual bolus protocol. VA of oCAD was performed by level 3 CMR experts. QP analysis was made using cvi42 software, equipped with fully automated pixel-wise QP module. Stress MBF in ml/g/min was measured according to the American Heart Association's 16-segment model. Segments with presence of late gadolinium enhancement were excluded from the analysis. Invasive Coronary Angiography (ICA) was used as a validation tool.

Results:

Comparison between VA and QP in the coronary regions showed only significant differences in CAD detection in the RCA ($p=0.007$) and LCx ($p<0.001$) region. Implementation of ICA showed significant difference in oCAD detection in the LCx region ($p=0.012$).

Conclusion:

The comparison between VA and QP show significant differences in the detection of oCAD, where QP shows higher ischemic burden compared to VA. This can be beneficial in clinical practice, due to the reduction of unjustly misclassified patients.

Keywords:

Quantitative Perfusion, Cardiac Magnetic Resonance, Coronary Artery Disease

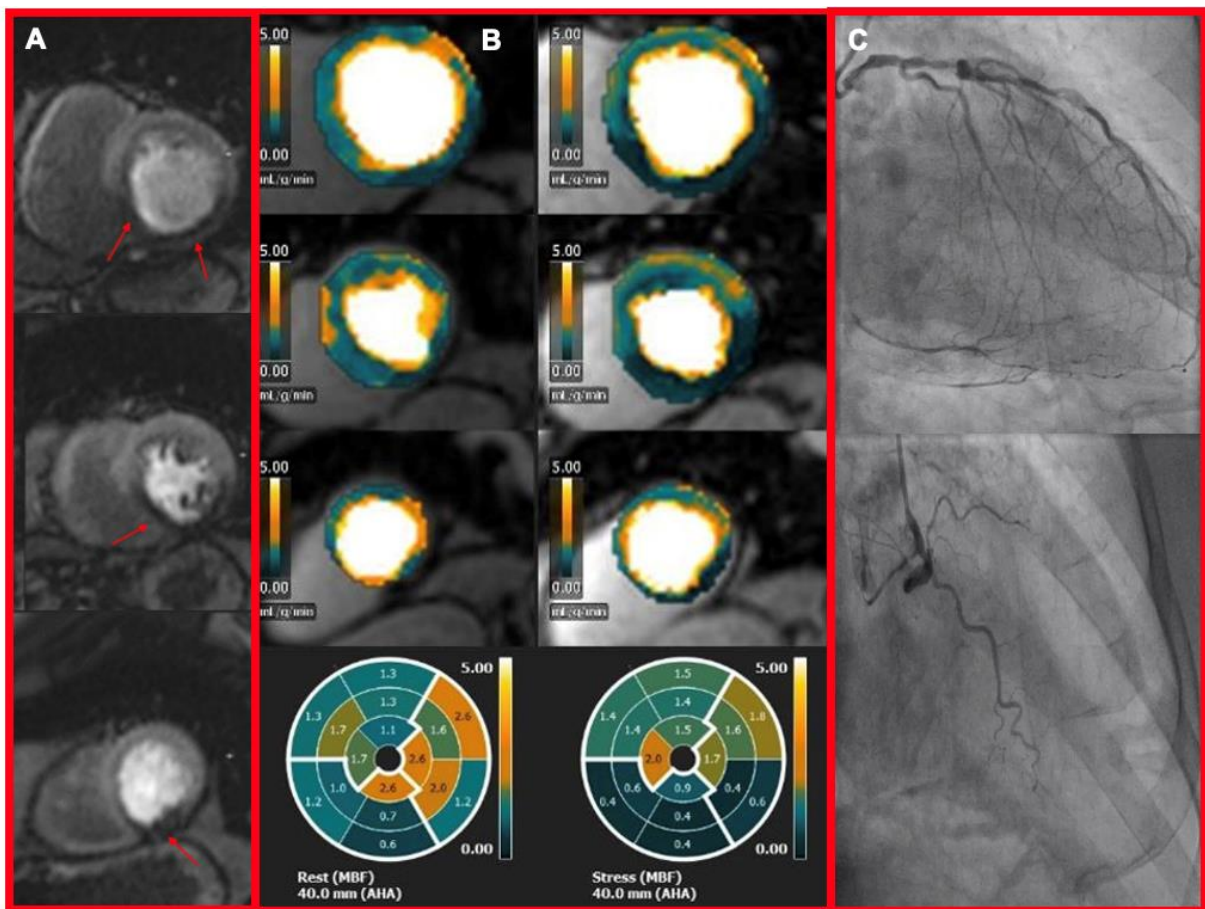


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Figure:

Figure 1: Comprehensive Cardiovascular Magnetic Resonance parameters and ICA of a 72-year-old man with typical angina. Visual assessment of ischemia showed perfusion defect in basal/apical inferior, as well as basal/mid inferoseptal in Figure A. In QP, 10 segments were considered to be ischemic, after excluding LGE regions, which is visible in Figure B. Finally, C shows the results of the ICA, with significant coronary obstructions in approximately 8 segments in the Left Artery Descending and Right Coronary Artery region.





Left Atrial Function and Fibrosis in Lifelong Endurance Athletes: a Cardiac Magnetic Resonance Imaging Study

Presenting author: L.H.G.A. Hopman

Department: Cardiology

L.H.G.A. Hopman (Amsterdam UMC, Amsterdam); L.H.G.A. Hopman (Amsterdam UMC, Amsterdam) ; M.J. Steenhoek (Amsterdam UMC, Amsterdam) ; I.M. Frenaij (Amsterdam UMC, Amsterdam) ; V. Dahya (Groote Schuur Hospital, Cape Town) ; M.J.W. Götte (Amsterdam UMC, Amsterdam) ; J.P. Smedema (Netcare Blaauwberg Hospital, Cape Town) ; J. Swart (University of Cape Town, Cape Town)

Purpose:

Participating in lifelong endurance sports is associated with an increased risk of atrial fibrillation (AF), potentially mediated through the process of left atrial (LA) remodeling that includes the development of atrial fibrosis. This cross-sectional cohort study aimed to investigate LA remodeling including the presence and localization of LA fibrosis in lifelong endurance athletes.

Methods:

42 athletes (76% male, age 54±9 years) competing in Ironman races, (ultra) marathons and Cape Epic mountain bike races underwent cardiac MRI (CMR). LA volumes and function were assessed on cine images. The extent of LA fibrosis, both global and regional, was derived from post-processed 3D late gadolinium-enhanced images using ADAS 3D.

Results:

Median LA fibrotic burden as detected by LGE-CMR was 2.5% [1.1–7.6]. The analysis of fibrosis in these participants indicated that fibrous tissue was unevenly spread across the LA wall. LA fibrotic burden was significantly higher in participants who competed in long-distance mountain bike races versus participants who did not (7.3% [4.1–9.5] vs 2.0% [0.5–5.6], $p=0.03$). No associations were found between LA fibrotic burden and volume or function parameters.

Conclusion:

This study illuminates the low presence of LA fibrosis in lifelong endurance athletes, with uneven distribution along the LA wall, notably around the posterior side of the left inferior pulmonary vein. Participants engaged in long-distance mountain bike races exhibited significantly higher LA fibrotic burden, underscoring the potential impact of specific sports disciplines on LA remodeling, which may play a role in AF development.

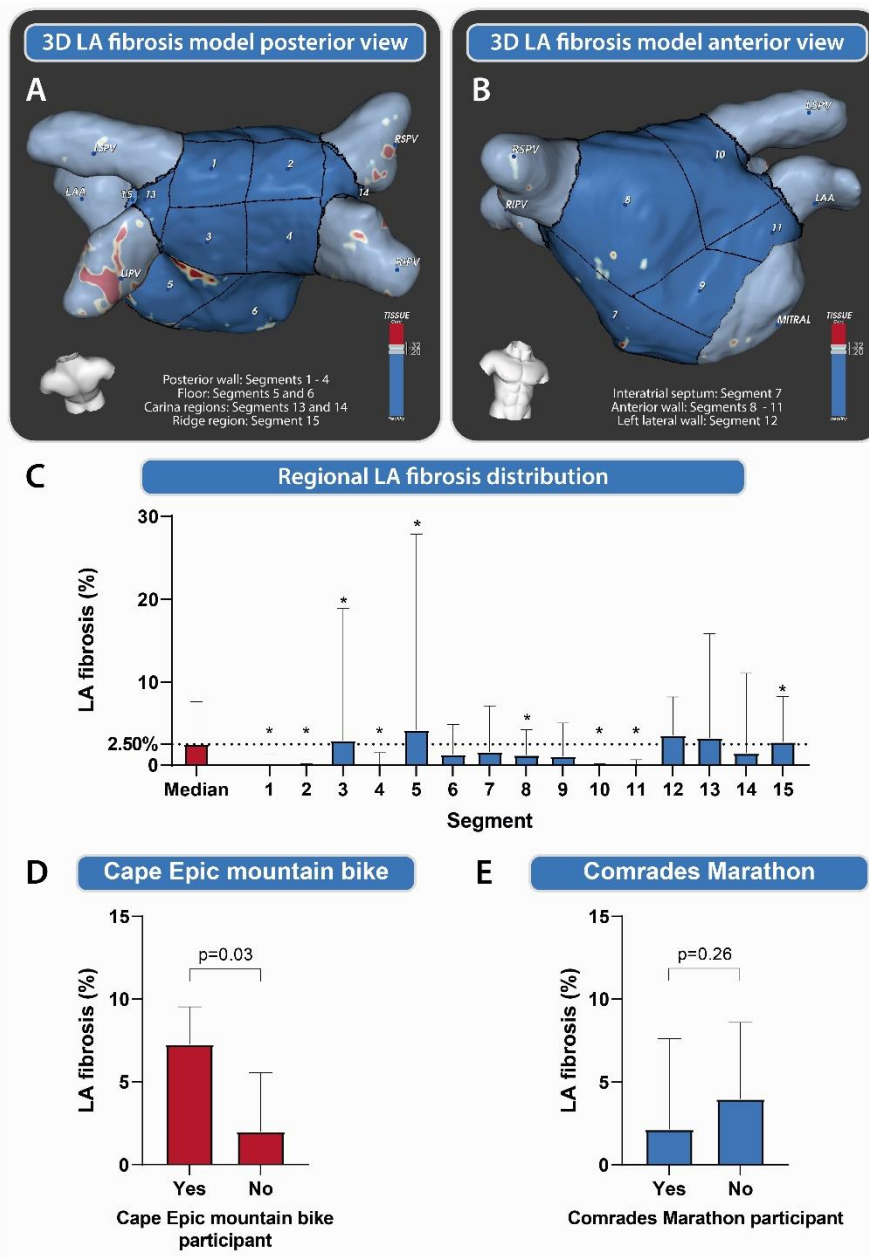
Keywords:

Atrial remodeling, Endurance athletes, Cardiac MRI



Figure:

Panel A and B show the left atrial segments 1 to 15 created through ADAS 3D in the posterior and anterior view. Red shows fibrosis (>image intensity ratio 1.2), blue is healthy left atrial tissue (<image intensity ratio 1.2) and highlighted in light blue are the pulmonary veins, left atrial appendage and mitral valve. Panel C is a boxplot describing the median fibrosis percentages for each segment. *Segment is significantly different from the median left atrial fibrosis value ($p < 0.05$). Panel D is a boxplot showing left atrial fibrosis (%) in Cape Epic mountain bike participants compared to non-participants and panel E is a boxplot showing left atrial fibrosis (%) in Comrades marathon participants compared to non-participants.





Temporal Changes in CT-Derived Fractional Flow Reserve in Patients after Heart Transplantation

Presenting author: S.P. Sharma
Department: Radiology & Cardiology

S.P. Sharma (Erasmus MC, Rotterdam); S.P. Sharma (Erasmus MC, Rotterdam); J. Sanz (Mount Sinai, New York); A. Hirsch (Erasmus MC, Rotterdam); R. Patel (Mount Sinai, New York); A.A. Constantinescu (Erasmus MC, Rotterdam); M. Barghash (Erasmus MC, Rotterdam); J.J. Brugts (Erasmus MC, Rotterdam); Y. J.H.J. Taverne (Erasmus MC, Rotterdam); O.C. Manintveld (Erasmus MC, Rotterdam); R.P.J. Budde (Erasmus MC, Rotterdam)

Purpose:

Coronary CT angiography (CCTA) is used to non-invasively detect cardiac allograft vasculopathy (CAV) after heart transplantation (HTx). Adding functional information by CT-derived fractional flow reserve (FFR_{ct}) and assessing its temporal change may potentially provide insight into the natural history and pathophysiology of CAV in HTx patients. We assessed FFR_{ct} changes as well as CAV progression over a 2-year time period in HTx patients undergoing serial CT imaging.

Methods:

HTx patients from Erasmus MC and Mount Sinai Hospital, who had consecutive CCTAs two years apart were evaluated. FFR_{ct} analysis (HeartFlow) was performed using the same software version for both scans. The FFR_{ct} values at the most distal point in the left anterior descending (LAD), left circumflex (LCX) and right coronary artery (RCA) were measured after matching the anatomical locations in both analyses (Figure). Also, the number of anatomical coronary stenoses of >30% was scored.

Results:

In total, 106 patients (median age 57 [Interquartile range 47-67] years, 67% male) at 9 [6-13] years after HTx at time of the baseline CCTA were included. The median time between both scans was 23 [22-24] months. Median distal FFR_{ct} values significantly decreased from baseline to follow-up for the LAD from 0.85 [0.79-0.90] to 0.84 [0.76-0.90] ($p=0.001$), LCX from 0.92 [0.88-0.96] to 0.91 [0.85-0.95] ($p=0.009$), and RCA from 0.92 [0.86-0.95] to 0.90 [0.86-0.94] ($p=0.004$). Of all patients, 20 (29%) had a drop in their overall distal FFR_{ct} values ≥ 0.06 (average of all three arteries). The number of focal anatomical stenoses of >30% increased from a median of 1 [0-2] at baseline to 2 [0-3] at follow-up ($p=0.009$).

Conclusion:

The distal coronary FFR_{ct} values in post-HTx patients in each of the three major coronary arteries decreased, and the number of focal coronary stenoses increased over a two-year period. The temporal FFR_{ct} change rate may become an additional parameter in the follow-up of HTx patients, but more research is needed to elucidate its role.

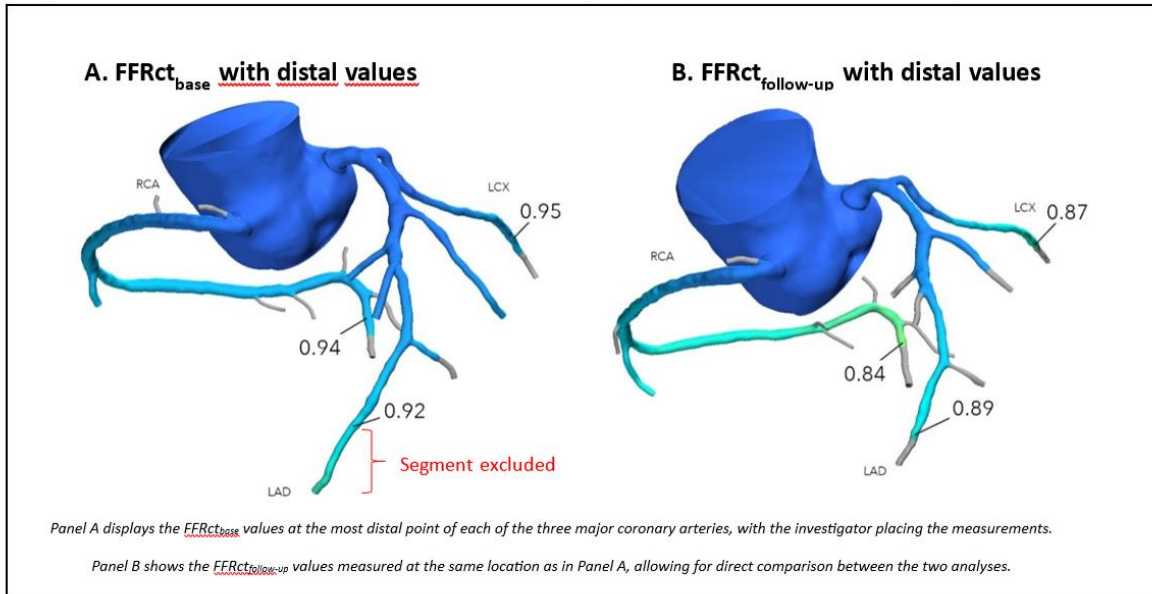
Keywords:

Computed Tomography Angiography, Heart transplantation, Fractional flow reserve myocardial



Figure:

Figure 1. Measurement of distal FFRct values in a single patient at baseline and follow-up.





Sessie 5: CORONARY ARTERY DISEASE AND PCI

Onyx versus Orsiro Drug-eluting Stents in Patients with Diabetes: a Secondary Analysis of the BIONYX Trial

Presenting author: D. van Vliet

Department: Cardiology

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Purpose:

Patients with diabetes are known to have diffuse coronary artery disease, with a higher plaque burden, smaller lumen diameters, and more complex lesions. The Onyx durable polymer-coated zotarolimus-eluting stent (ZES) is designed with a platinum-iridium core to enhance radial force and radiographic visibility, which could be beneficial for percutaneous coronary intervention (PCI) in the more challenging lesions of patients with diabetes. BIONYX is the first randomized trial to compare the safety and efficacy of PCI with Onyx ZES versus Orsiro biodegradable-polymer sirolimus-eluting stents (SES).

Methods:

We assessed the 5-year clinical outcomes of patients with medically treated diabetes, enrolled in the randomized BIONYX trial (clinicaltrials.gov: NCT02508714). The main composite endpoint was target vessel failure (TVF): cardiac death, target vessel myocardial infarction, or target vessel revascularization. Time to primary and secondary endpoints was assessed using Kaplan-Meier methods, applying the log-rank test for between-group comparison.

Results:

Of the 2.488 enrolled all-comer patients in the BIONYX trial, 510 (20.5%) were known to have medically treated diabetes. No statistically significant difference was found between diabetic patients treated with Onyx ZES versus Orsiro SES (20.6% vs. 23.1%, HR 0.89, 95% CI[0.61-1.31], plog-rank=0.56). Likewise, all other clinical endpoints showed no statistically significant between-group difference, with numerically lower event rates in those treated with Onyx ZES.

Conclusion:

Thus, in BIONYX trial participants with medically treated diabetes, the final 5-year analysis showed a similar long-term safety and efficacy of PCI with Onyx ZES and Orsiro SES.

Keywords:

Diabetes, Percutaneous coronary intervention, Drug-eluting stent



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Figure:
 5-year clinical outcomes in patients with known diabetes mellitus (n=510)

	Onyx ZES n=260	Orsiro SES n=250	Hazard ratio (95%-CI)	P_{log-rank}
Target vessel failure	51 (20.6%)	53 (23.1%)	0.89 (0.61-1.31)	0.56
Target lesion failure	44 (17.8%)	48 (21.0%)	0.85 (0.56-1.28)	0.43
Major adverse cardiac event	68 (26.7%)	75 (31.1%)	0.84 (0.60-1.16)	0.29
Any death	36 (14.2%)	41 (17.0%)	0.82 (0.52-1.28)	0.38
Cardiovascular death	21 (8.5%)	20 (8.7%)	0.98 (0.53-1.81)	0.95
Cardiac death	17 (7.0%)	16 (7.1%)	0.99 (0.50-1.96)	0.98
Vascular death	4 (1.6%)	4 (1.7%)	0.94 (0.24-3.76)	0.93
Non-cardiovascular death	15 (6.2%)	21 (9.1%)	0.67 (0.34-1.29)	0.23
Any myocardial infarction	25 (10.4%)	31 (13.7%)	0.74 (0.44-1.25)	0.26
Target vessel myocardial infarction	17 (7.0%)	23 (10.2%)	0.68 (0.37-1.28)	0.23
Any revascularization	47 (19.4%)	46 (20.4%)	0.96 (0.64-1.44)	0.83
Target vessel revascularization	30 (12.4%)	34 (15.4%)	0.82 (0.50-1.34)	0.44
Target lesion revascularization	22 (9.0%)	27 (12.3%)	0.76 (0.43-1.34)	0.34
Definite-or-probable stent thrombosis	4 (1.7%)	6 (2.6%)	0.62 (0.18-2.20)	0.45
Definite stent thrombosis	4 (1.7%)	5 (2.2%)	0.74 (0.20-2.76)	0.65



Impact of Gender on Left Ventricular Function and Long-Term Hard Clinical Endpoints after CTO PCI vs No CTO PCI: Insights from the Extended 10-Year Follow-up of the EXPLORE Trial

Presenting author: V.A. Verpalen
Department: Cardiology

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Purpose:

The EXPLORE trial compared chronic total coronary occlusion (CTO) percutaneous coronary intervention (PCI) to no CTO PCI after primary PCI for ST-segment elevation myocardial infarction (STEMI). The study found no difference between randomization groups on the primary endpoint of left ventricular function (LVF) after 4 months. In this study, we assessed the impact of gender on LVF after 4 months and we extended the EXPLORE trial until 10 years, to investigate gender differences in long-term clinical outcomes after CTO PCI.

Methods:

This study presents an extended 10-year follow-up of the EXPLORE trial focused on gender differences. In EXPLORE, 302 STEMI patients with CTO were randomized to CTO PCI or no CTO PCI. We conducted subgroup analyses to assess the impact of gender on LV ejection fraction (LVEF) after 4 months and to assess gender differences in long-term clinical outcomes.

Results:

A total of 257 men and 45 women were included. Men and women demonstrated equal LVEF at baseline (43.3% vs 39.6%, $P=0.52$) and after 4 months (45.5% vs 45.7%, $P=0.43$). In the CTO PCI arm (131 men, 17 women) the difference in LVEF after 4 months was similar between men and women (delta LVEF 4.0% vs 5.6%, $P=0.49$). Complete 10-year follow-up outcome data will be available at NVVC 2023.

Conclusion:

After 4 months the difference in LVEF between men and women is similar, indicating an equal response to CTO PCI regarding LVF. At NVVC 2023, we present complete 10-year follow-up data focused on clinical outcomes and gender differences.

Keywords:

chronic total occlusion, gender differences, percutaneous coronary intervention



Ten-Year Clinical Outcomes after PCI of a Concurrent Chronic Total Coronary Occlusion or Optimal Medical Therapy Alone in Patients with STEMI: Extended Follow-up of the EXPLORE Trial

Presenting author: C.F. Coerkamp

Department: Cardiology

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Purpose:

Percutaneous coronary intervention (PCI) for chronic total occlusions (CTO) leads to symptom relief but the effect on prognosis remains uncertain as long-term follow-up is lacking. The EXPLORE trial was the first randomized controlled trial comparing CTO PCI to no CTO PCI in a stabilized post-acute ST-segment elevation myocardial infarction (STEMI) setting. We have extended the follow up duration of EXPLORE until 10 years to investigate the long-term impact of CTO PCI versus no CTO PCI on clinical outcomes.

Methods:

EXPLORE was a multicenter randomized trial in which a total of 302 patients with STEMI and concurrent CTO were randomized to CTO PCI or no CTO PCI. Endpoints were all-cause mortality and major adverse cardiovascular events (MACE), consisting of cardiovascular mortality, coronary artery bypass grafting and myocardial infarction (MI). Patient-reported symptoms with respect to dyspnea (in terms of New York Heart Association [NYHA] Class) and angina status (using the Canadian Cardiovascular Society [CCS] scale) were also collected.

Results:

The median follow-up duration was 10 years (IQR 8-11). Only 27 patients were lost-to-follow-up (9%). All participating sites recorded mortality rates and documented the cause of death. Cardiovascular events from randomization until now have been recorded, including revascularizations (target lesion [TLR], as well as non-TLR) and MI. The most recent NYHA and CCS class were recorded.

Conclusion:

By the time of NVVC congress 2023, we will be able to present the longest follow-up currently available of a cohort of patients randomized to either CTO PCI or no-CTO PCI.

Keywords:

Chronic total occlusion, Percutaneous coronary intervention, optimal medical therapy



The Microvascular Resistance Reserve: Insights from the ILIAS Registry

Presenting author: C.K.M. Boerhout

Department: Heart center

C.K.M. Boerhout (Amsterdam UMC Heart Center); C.K.M. Boerhout (Amsterdam UMC Heart Center); J.J. Piek (Amsterdam UMC Heart Center); T.P. van de Hoef (UMC Utrecht)

Purpose:

The concept of Microvascular Resistance Reserve (MRR) was introduced as a means of invasively characterizing the vasodilator reserve capacity of the coronary microcirculation, taking into consideration the influence of concurrent epicardial disease and the effects of potent vasodilators on aortic pressure.

Our objective was to evaluate several key diagnostic and prognostic attributes associated with MRR. We assessed its general diagnostic and prognostic value, investigated the impact of sex, and examined the influence of revascularization on its determination.

Methods:

From the ILIAS registry, we included a total of 1494 patients diagnosed with chronic coronary syndrome (CCS) and who had a clinical indication for undergoing invasive coronary angiography (ICA).

Results:

The Microvascular Resistance Reserve (MRR) emerges as an independent and clinically significant predictor of Major Adverse Cardiovascular Events (MACE) with a hazard ratio (HR) of 0.78 (95% CI: 0.63 – 0.95, $p=0.024$), as well as Target Vessel Failure (TVF) with an HR of 0.83 (95% CI: 0.76 – 0.97, $p=0.047$) among patients with Chronic Coronary Syndrome (CCS). Notably, gender had no discernible impact on MRR's diagnostic and prognostic performance, indicated by a p -value of 0.430 for difference. Furthermore, percutaneous coronary intervention (PCI) did not yield a significant alteration in MRR.

Conclusion:

The Microvascular Resistance Reserve (MRR) stands as a robust and clinically valuable indicator of reduced vasodilator reserve within the coronary circulation. Given its applicability across various modalities that accurately measure coronary flow and pressure, the MRR emerges as a promising index. Future research should be pursued to fully explore its potential and implications.

Keywords:

Microvascular Resistance Reserve, Coronary microvascular dysfunction, Invasive coronary physiology

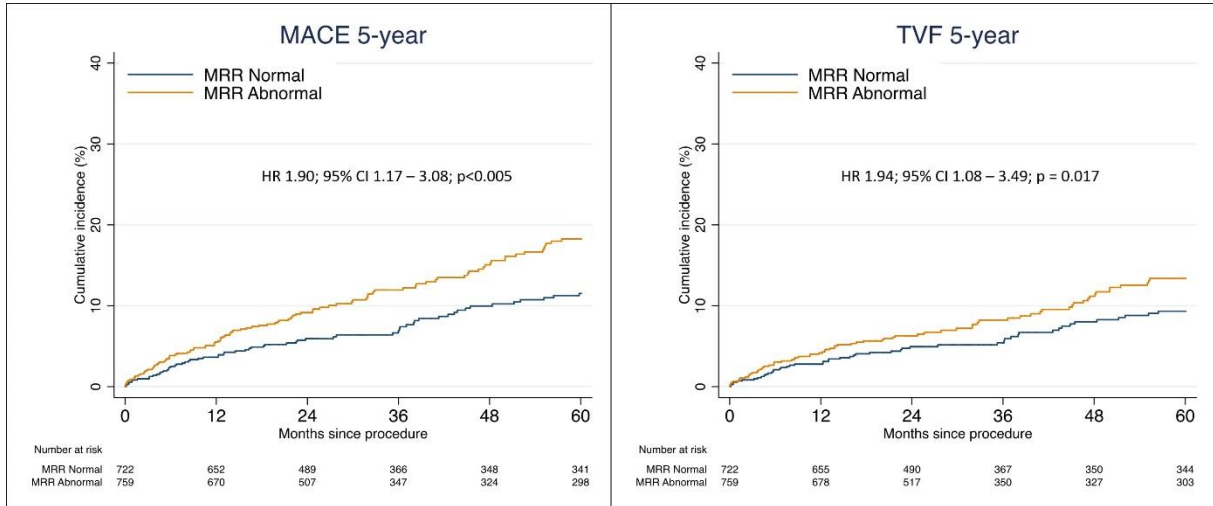


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Figure:

Kaplan-Meier estimate curves for the cumulative incidence of MACE and TVF at 5-year follow-up according to MRR (cut-off value: 3.0).





Outcomes of Octogenarians (≥ 85 year) Treated with Percutaneous Coronary Intervention. Nationwide data from the Netherlands Heart Registration

Presenting author: R. Michon

Department: Cardiology

R. Michon (Zuyderland, Heelen); R. Michon (Zuyderland, Heelen); T. F. S. Pustjens (Zuyderland, Heerlen); L. Derks; A. W. J. van 't Hof (Zuyderland, Heerlen); S. Rasoul (Zuyderland, Heerlen)

Purpose:

Background

Nowadays percutaneous coronary intervention (PCI) is routinely performed in octogenarians (≥ 85 years). However, the prognosis of the elderly patients undergoing PCI may be less favourable.

Aim

To analyse the characteristics and the outcome in octogenarians undergoing PCI compared to patients < 85 years.

Methods:

Retrospective analysis of all the patients undergo PCI for any indication from January 2017 until October 2021. Patients are stratified according to age (≥ 85 years or < 85 years). Patient characteristics, treatment and outcome are analysed.

Results:

During the study period a total of 155.683 patients underwent PCI, from which elective PCI 35.2%, acute coronary syndrome (ACS) 64.4% and in 0.4% the indication was unknown. The octogenarians had significantly more comorbidities and more often presented with an ACS (table). Reinfarction within 30-day occurred more often, however revascularization were less often performed in the in the elderly patients. Mortality was significantly higher in the elderly patients (table), and this was independent on baseline characteristics, HR 2.63 (95%CI 2.41-2.86) $P < 0.001$.

Conclusion:

Compared to patients < 85 years, octogenarians have nearly 3.5-fold mortality rate and this is independent of baseline characteristics. Therefore, age should be an important consideration for elderly patients undergoing a coronary intervention.

Keywords:

PCI, octogenarians, coronary artery diseases



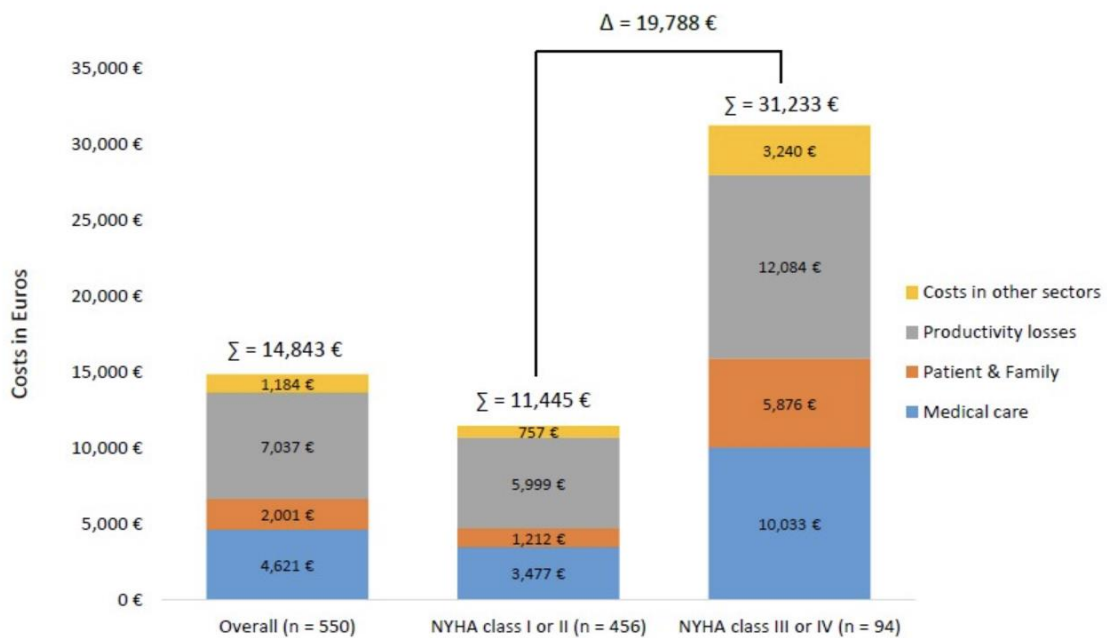
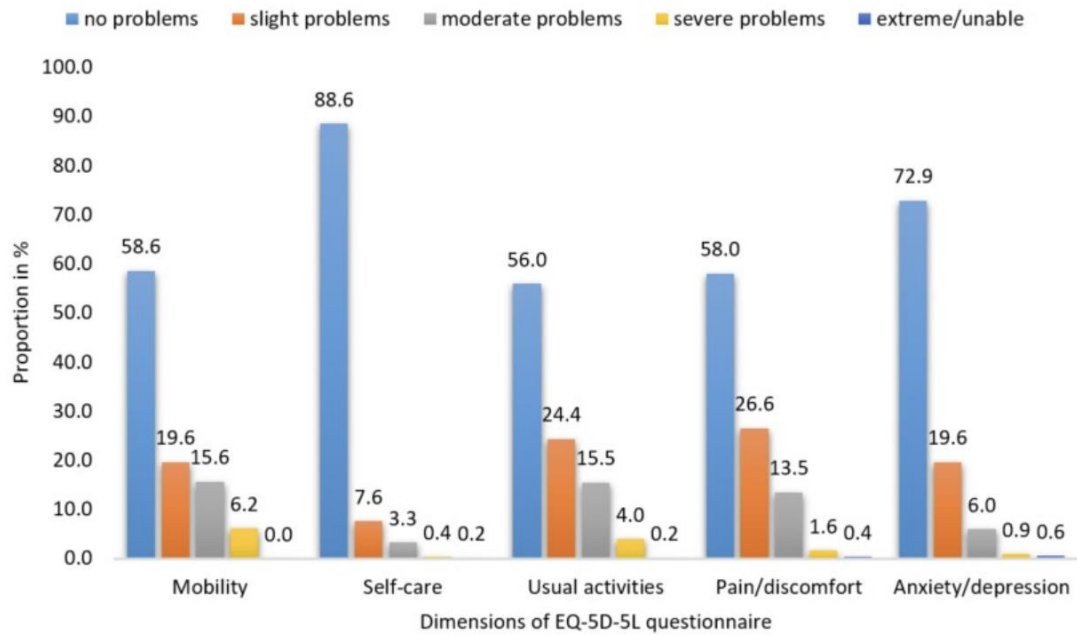
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Figure:

Values are mean \pm standard deviation, median [IQR] or n (%).

ACS, acute coronary syndrome; eGFR, estimated glomerular filtration rate; LVEF, left ventricular ejection fraction; MI, myocardial infarction





Incidence of Ventricular Arrhythmias in Patients with Chronic Total Coronary Occlusion: Results of the VACTOR Study

Presenting author: A. Assaf
Department: Cardiology

A. Assaf (Erasmus MC, Rotterdam); Amira Assaf (Erasmus MC, Rotterdam); Rafi Sakhi (Erasmus MC, Rotterdam); Roberto Diletti (Erasmus MC, Rotterdam); Alexander Hirsch (Erasmus MC, Rotterdam); Cornelis P. Allaart (Amsterdam UMC, Amsterdam); Rohit Bhagwandien (Erasmus MC, Rotterdam); Mehran Firouzi (Maasstad ziekenhuis, Rotterdam); Pieter C. Smits (Maasstad Ziekenhuis, Rotterdam); Mark G. Hoogendijk (Erasmus MC, Rotterdam); Dominic A.M.J. Theuns, (Erasmus MC, Rotterdam) Sing-Chien Yap, (Erasmus MC, Rotterdam)

Purpose:

A chronic total coronary occlusion (CTO) is associated with ventricular arrhythmias (VA) in patients with an implantable cardioverter-defibrillator (ICD). Limited data is available on the incidence of VA in CTO patients without an ICD. Our aim was to investigate the incidence of sustained VA in CTO patients after successful CTO revascularization and in patients with untreated CTO or failed CTO revascularization.

Methods:

Prospective, multicenter observational pilot study including CTO patients who were not eligible for an ICD and had a left ventricular ejection fraction >35%. We enrolled patients with a successful CTO revascularization (group A) and patients with untreated CTO or failed CTO revascularization (group B). All patients received an implantable loop recorder with remote monitoring. The primary endpoint was sustained VA.

Results:

Ninety patients were enrolled (mean age 63±10 years, 83.3% man, mean LVEF 55±8%). Group A (n=45) had a higher prevalence of CTO in the left anterior descending artery in comparison to group B (n=45) (28.9% versus 4.4%, P=0.002). Other baseline characteristics were similar. During a median follow-up time of 26 months (IQR, 19-35), five patients (5.6%) had a sustained VA. There was no difference in the incidence of sustained VA between groups (3-year cumulative event rate: 8.8% (group A) versus 4.5% (Group B), log-rank P=0.71).

Conclusion:

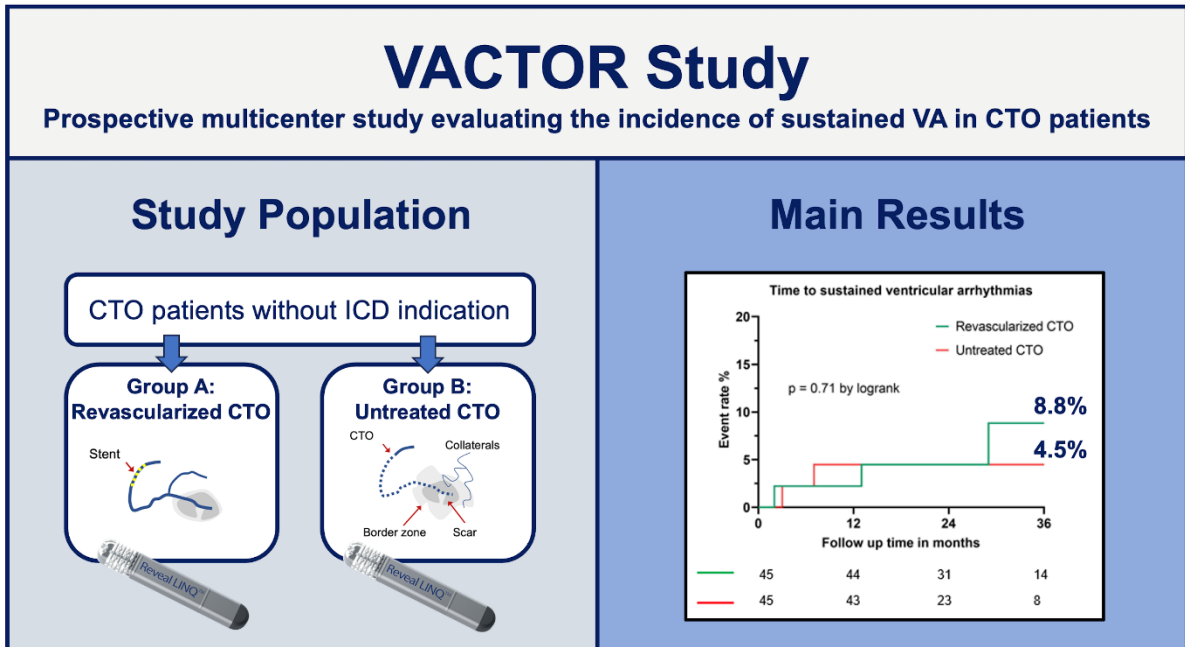
Patients with an CTO, who do not qualify for an ICD, have a substantial risk of sustained VA. The incidence of VA does not seem to be reduced after CTO revascularization.

Keywords:

Chronic Total Coronary Occlusion, Sudden Cardiac Death, Implantable Looprecorder



Figure:





Cost-effectiveness of Sequential SPECT/CT Imaging Approach for Detection of Symptomatic Coronary Artery Disease in Comparison to Standard Care: a Multi-center Study

Presenting author: M. Kamerman

Department: Cardiologie en nucleaire afdeling

M.Kamerman (Isala, Zwolle); J.D. van Dijk (Isala, Zwolle); M. Mouden (Isala, Zwolle)

Purpose:

Guidelines previously recommended functional first-line testing in patients with suspected CAD. Recently the high NPV of zero coronary calcium score (CCS) supports CCS-first strategy in selected patients. However, it is unknown whether a CCS-first strategy followed by additional Coronary CT angiography (CCTA) or PET MPI if CCS > 0 is a cost-effective and safe alternative. Our aim was to retrospectively compare the costs-effectiveness of sequential CSC-first imaging to SPECT-first imaging.

Methods:

2192 patients with CCS-first strategy were retrospectively 1:1 propensity matched with a cohort of SPECT-first strategy resulting in a total of 4384 patients. Referral to invasive coronary angiography (ICA) with obstructive coronary artery disease (CAD), major adverse cardiac events (MACE; non-fatal MI, all-cause death, and late revascularizations >90 days), total radiation, total diagnostic costs within the first year were compared.

Results:

30.3% (N=665) in the CCS-first group had CCS0 and 51.5% (N=1128) had normal stress-SPECT only. In the SPECT-first group, more ICAs were performed (14.9% vs. 11.5%, $p < 0.001$) with higher percentage of obstructive CAD (6.8% vs 8.7%, $p = 0.024$). MACE incidence was similar in both groups (2.4% vs. 2.4%, $p = 1.00$). The CSC-first group showed a significant reduction in total radiation exposure (4.57 vs. 8.84 mSv, $p = <0.001$) and total diagnostic costs (€517 vs. €788, $p < 0.001$).

Conclusion:

Sequential CCS-first protocol is more cost-effective than a SPECT-first protocol for detection of CAD and reduces referral for ICA without impact on prognosis. We therefore recommend the use of CCS-first protocol in these patients. Sequential CCS-first protocol is more cost-effective than a SPECT-first protocol for detection of CAD and reduces referral for ICA without impact on prognosis. We therefore recommend the use of CCS-first protocol in these patients.

Keywords:

coronary calcium score, CCTA, CAD



Ischemic and Bleeding Events within 3 Years after ACS: Insights from the FORCE-ACS Registry

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Department: Cardiology

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Purpose:

Patients with acute coronary syndrome (ACS) are at increased risk of ischemic and bleeding events, significantly impacting their morbidity and mortality. Balancing antithrombotic therapy to mitigate these risks is essential. However, the distribution over time of recurrent events following ACS remain unclear.

Methods:

The FORCE-ACS registry, an ongoing Dutch prospective study, enrolled ACS patients from 2015 onwards. Ischemic events (cardiac death, myocardial infarction, definite stent thrombosis) and bleeding events (BARC type 2-5) were monitored during distinct time intervals post admission (1, 12, 24 and 36 months). Average daily rates (ADR) were calculated, allowing comparisons between time intervals and event types.

Results:

This study included 5,260 ACS patients (median age 67.0 years, 28.9% women). Ischemic event rates declined significantly from the acute (day 0-1; 1.03%) to the subacute (day 1-30; 0.16%), late (day 30-365; 0.02%) and very late (day 365-1095; 0.01%) phases (Figure 1). Similarly, bleeding rates decreased from acute (1.60%) to subacute (1.03%), late (0.16%), and very late (0.06%) intervals (Figure 1). Across these intervals, mortality rates and net adverse clinical event rates also demonstrated decreasing trends.

Conclusion:

This study is the first study to shed light on the distribution over time of ischemic and bleeding events in real-world ACS patients during the three years post admission. Our findings reveal distinct patterns in event rates over time, which can be used to develop personalized antithrombotic strategies to optimize the benefit-risk ratio for these patients.

Keywords:

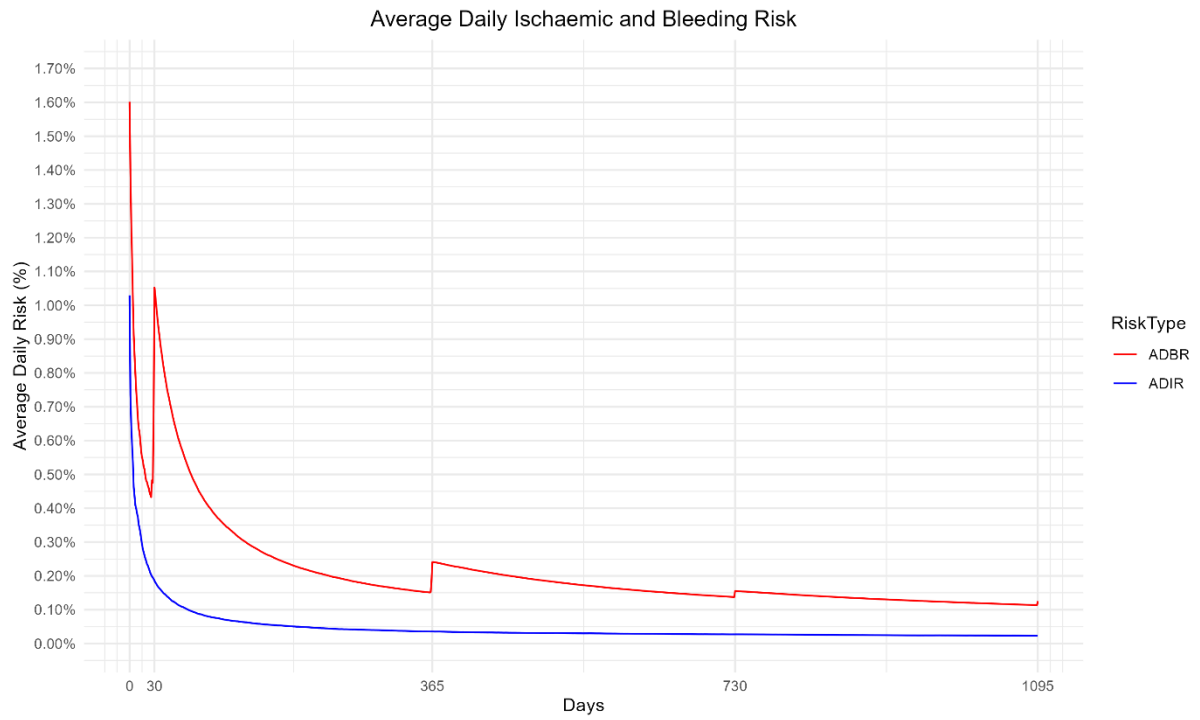
Acute coronary syndrome, ischemic events, bleeding events



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Figure:
Average daily ischaemic and bleeding rates within 3 years





Sessie 6: ACS AND CARDIOGENIC SHOCK

Does Post-dilatation during Angiography-guided Percutaneous Coronary Intervention Improve Clinical Outcomes? – Results of Systematical Patient Outcome Monitoring

Presenting author: K.A.J. van Beek

Department: Cardiologie

K.A.J. van Beek; S.R. Slingerland, D.N. Schulz, G.J. van Steenbergen, T. Brouwer, M. Stoel, P. Vlaar, P.A. Tonino, L. Dekker, L.X. van Nunen, K. Teeuwen, D. van Veghel

Purpose:

Post-dilatation after percutaneous coronary intervention (PCI) is performed to achieve optimal stent expansion and reduce complications. However, its prognostic effects are unclear and conflicting. This study evaluates clinical outcomes after implementing a liberal post-dilatation strategy during PCI.

Methods:

This study is a pre-post intervention analysis of two cohorts, before (2015-2017) and after (2018-2020) implementation of a liberal post-dilatation strategy. The primary endpoint consisted of major adverse cardiovascular events (MACE) at 30-days. Secondary endpoints consisted of the individual components of the primary endpoint as well as 1 year mortality and target vessel revascularization.

Results:

A total of 10,153 patients were included; 5,383 in the pre-cohort and 4,770 in the post-cohort. The 30-day MACE was 5.00% in the pre-cohort and 4.09% in the post-cohort ($p=0.008$; OR 0.75 (CI 0.61-0.93)). There was a significant difference between the pre- and post-cohort in 30-day mortality, respectively 2.91% and 2.25% ($p=.01$; OR 0.70 (CI 0.53-0.93)), and MI at 30 days, 1.17% versus 0.59% ($p=.003$; OR 0.49 (CI 0.31-0.78)). At 1 year, there was a significant difference in mortality between the pre-cohort, 5.84%, and post-cohort, 5.19% ($p=.02$; OR 0.79 (CI 0.66-0.96)).

Conclusion:

A liberal post-dilatation strategy after PCI was associated with a significant decrease in 30-day MACE, 30-day MI, 30-day mortality and 1-year mortality. Future studies are warranted to validate the causality between post-dilatation and improvement of clinical outcomes.

Keywords:

Post-dilatation, Percutaneous coronary intervention

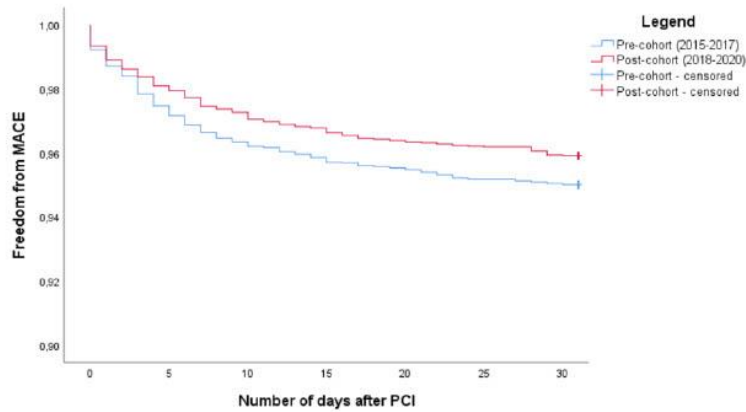


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Figure:

MACE indicates major adverse cardiovascular events, PCI; percutaneous coronary intervention.

Figure 1. Kaplan-Meier survival curves of primary endpoint at 30 days.



Numbers at risk

Pre-cohort	5,143	5,049	5,022	5,007	5,002	4,992	4,988
Post-cohort	4,569	4,518	4,500	4,487	4,478	4,473	4,463

Log-rank $p=0.032$



Clinical Outcome and Cost-effectiveness of Reduced Noradrenaline by Using a Lower Blood Pressure Target in Patients with Cardiogenic Shock from Acute Myocardial Infarction – Design Abstract of the NORshock Trial

Presenting author: S. ten Berg

Department: Cardiology

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Purpose:

In acute myocardial infarction (AMI) complicated by cardiogenic shock (CS), noradrenaline is considered the first-line vasopressor of choice to achieve hemodynamic stabilization. However, noradrenaline is also associated with decreased myocardial perfusion and increased afterload leading to infarct size expansion. Also, achieving a target mean arterial pressure (MAP) of more than 65 mmHg is based on settings of sepsis, the optimal MAP in CS patients remains a knowledge deficit. Therefore, a prospective randomized clinical trial investigating the clinical outcomes of reduced noradrenaline is needed.

Methods:

The NORshock trial is an open label, randomized, international multicenter trial in which we aim to include 776 patients presenting with CS after AMI. It is designed to investigate the (cost-)effectiveness of reduced noradrenaline in patients with CS by using a lower MAP-target of 55 mmHg, compared to standard care (target-MAP usually ≥ 65 mmHg). Patients will be randomized to one of both treatment arms. The primary composite endpoint consists of all-cause mortality and severe renal failure leading to renal replacement therapy within 30-days after randomization. Secondary outcomes include duration of catecholamine therapy, enzymatic infarct size, hemodynamic parameters and length of stay in hospital and Intensive Care Units (ICU).

Results:

-

Conclusion:

The NORshock study will address important questions regarding the frequent use of noradrenaline in excessive doses in cardiogenic shock patients after acute myocardial infarction.

Keywords:

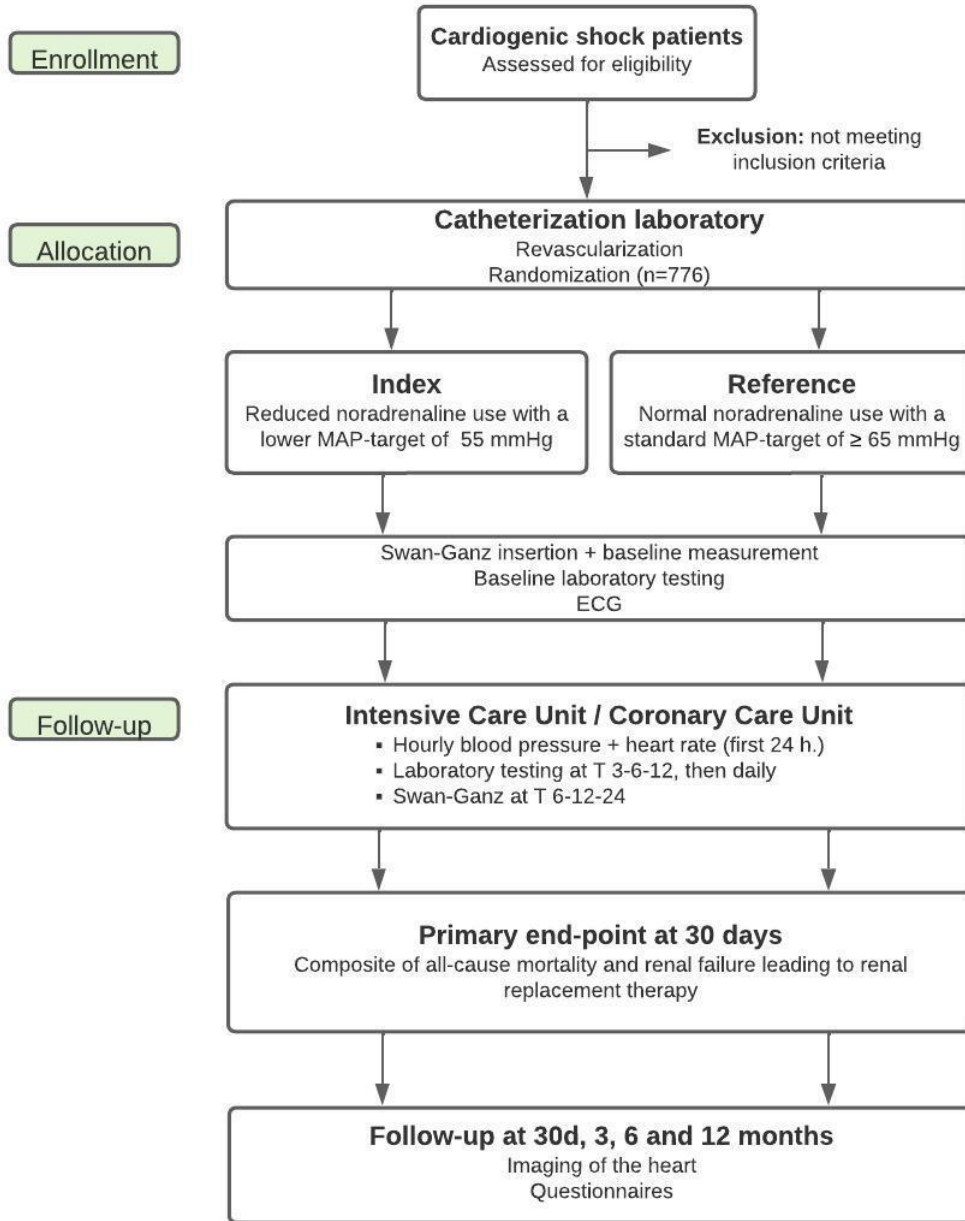
Cardiogenic shock, Acute myocardial infarction



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Figure:





Association between Sex and Clinical Presentation and Outcome in Acute Myocardial Infarction Related Cardiogenic Shock

Presenting author: E.J. Peters

Department: Cardiology

E. J. Peters (Amsterdam UMC, Amsterdam); E. J. Peters (Amsterdam UMC, Amsterdam); M. Bogerd (Amsterdam UMC Amsterdam); S. ten Berg (Amsterdam UMC Amsterdam); M.J.C. Timmermans (Nederlandse Hart Registratie, Eindhoven); A.E. Engström (Amsterdam UMC Amsterdam); L.C. Otterspoor (Catharinaziekenhuis, Eindhoven); A.P.J. Vlaar (Amsterdam UMC, Amsterdam); J.P.S. Henriques (Amsterdam UMC Amsterdam)

Purpose:

Cardiogenic shock (CS) is characterized by hypotension and hypoperfusion. The majority of the CS population is male and therefore current approaches are based on cohorts of >70% men. We aimed to investigate whether these results can be generalized to women or that a different treatment approach would be justified.

Methods:

Using the data of a nationwide registry, patients with CS undergoing percutaneous coronary intervention (PCI) between 2017 and 2021 were identified. Univariate logistic regression was performed to assess the differences between men and women in baseline characteristics and multivariate logistic regression was performed to investigate the association between sex and 30-day mortality.

Results:

Our registry included 2328 patients of whom 27% (n= 632) were female. As shown in figure 1, female patients were older (69 vs. 65 years, $p<0.001$) and more often had diabetes (24% vs 20%, $p=0.04$). Men presented with multivessel disease more frequently (62% vs. 57%, $p=0.018$), more often had a short duration of symptoms (less than 3 hours: 63% vs. 48%, $p<0.001$) and had higher blood pressures on admission (mean arterial pressure 78 vs. 75 mmHg, $p=0.002$). Increased use of inotropes and different mechanical circulatory support (MCS) devices in men was also observed. At thirty days there was no sex difference in the risk of mortality (odds ratio male sex 0.98, 95% CI 0.79 – 1.21).

Conclusion:

This study demonstrated differences in clinical presentation and comorbidities between men and women presenting with CS. Importantly, women present after significantly longer duration of symptoms. Therefore, clinicians should be more aware of symptoms of CS in women. Women were less likely to be treated with MCS devices and inotropes. Mortality in men and women was similar.

Keywords:

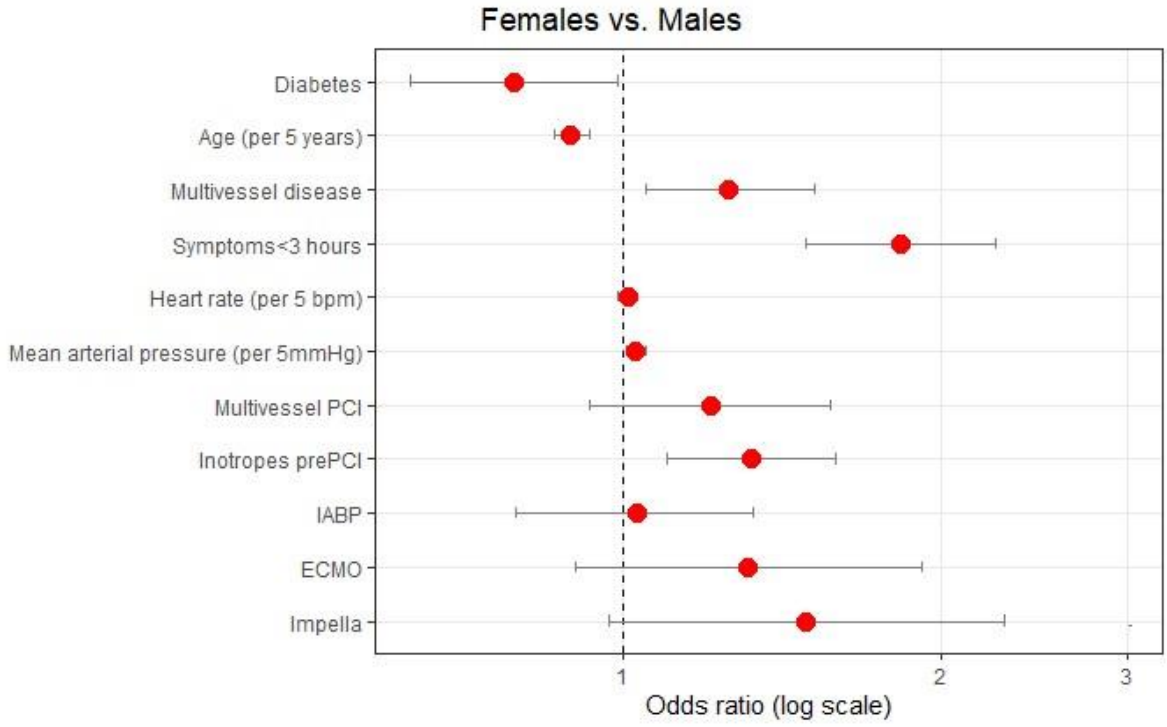
Cardiogenic Shock, Sex differences, Acute Myocardial Infarction



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Figure:
Unadjusted Odds ratios for several baseline and treatment characteristics





Treatment of ST-elevation Myocardial Infarction with Percutaneous Coronary Intervention (PCI) Performed during Regular Hours and Off-hours in the Netherlands: a Comparison of Patient-Relevant Outcomes

Presenting author: L. Derks

Department: NHR

L. Derks (Netherlands Heart Registration, Utrecht); M. Timmermans (Netherlands Heart Registration, Utrecht); H.P.A. van Veghel (Netherlands Heart Registration, Utrecht); P.W. Danse (Rijnstate Hospital, Arnhem); E.K. Arkenbout (Tergooi Medical Centre, Hilversum); D.J. van der Heijden (Isala Hospital, Zwolle)

Purpose:

Patient-relevant outcomes of ST-elevation myocardial infarction (STEMI)-patients treated with percutaneous coronary intervention (PCI) performed during on- or off-regular office hours were evaluated.

Methods:

Data for STEMI PCI performed between 2017 and October 2020 as registered within the Netherlands Heart Registration (NHR) were used for analyses. Off-hour PCI was defined as a PCI performed on Saturday or Sunday, between 00.00-08.00 hours on Mondays, or between 17.00 and 08.00 on Monday till Friday. Primary outcome was all-cause mortality within 30-days. Secondary outcome measures were all-cause mortality within 1-year, long-term survival, acute myocardial infarction within 30 days, target vessel revascularization (TVR) within 1 year, and repeat revascularization.

Results:

19,090 STEMI PCIs performed in 18 centres were included for analyses, of which 11,719 (61.4%) were performed within office hours. Thirty-day mortality rate was comparable between patients treated on or off regular office hours (5.7% versus 5.8%). The odds ratio, corrected for potential confounders, was 1.03 (95% Confidence Interval: 0.98-1.19); patients treated during regular office hours had a longer delay between start symptoms and arrival at Cathlab (>12 hours: 8.4% versus 5.8%, $P < 0.001$), and were less likely to present with OHCA (7.6% versus 9.5%, $P < 0.001$). Furthermore, no statistically significant differences in secondary outcomes between both groups were observed (Table 1).

Conclusion:

This study suggests no differences in patient-relevant outcomes depending on timing of PCI for STEMI.

Keywords:

After-Hours Care, Percutaneous Coronary Intervention (PCI), Treatment Outcome



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Figure:

PCI: percutaneous coronary intervention; CABG: coronary artery bypass grafting; OHCA: out of hospital cardiac arrest; TVR: target vessel revascularization; TLR: target lesion revascularization

*adjusted for age, gender, diabetes, renal insufficiency, previous CABG, OHCA, and cardiogenic shock.

**outcome information since 2019 available.

Table 1: Patient characteristics and risk-adjusted outcomes of PCIs for STEMI performed on or off office hours.

Patient characteristics	On regular office hours (N=7,371)	Off regular office hours (N=11,719)	P-value
Age mean (SD)	65.2 (12.3)	63.3 (12.4)	<0.001
Gender (male) n/N (%)	5,354/7,371 (72.6)	8,611/11,719 (73.5)	0.201
Diabetes n/N (%)	1,100/7,172 (15.3)	1,618/11,380 (14.2)	0.036
Multivessel disease n/N (%)	3,345/7,326 (45.7)	5,289/11,643 (45.4)	0.754
Multivessel PCI (in case of multivessel disease)			0.288
Single-vessel PCI	2,495/3,010 (82.9)	3,982/4,752 (83.8)	
LM only PCI	60/3,010 (2.0)	107/4,752 (2.3)	
Multivessel PCI	455/3,010 (15.1)	663/4,752 (14.0)	
Previous myocardial infarction n/N (%)	896/7,185 (12.5)	1,369/11,379 (12.0)	0.373
Previous PCI n/N (%)	938/6,518 (14.4)	1,456/10,426 (14.0)	0.439
Previous CABG n/N (%)	257/7,262 (3.5)	329/11,532 (2.9)	0.008
OHCA n/N (%)	560/7,358 (7.6)	1,108/11,703 (9.5)	<0.001
Cardiogenic shock n/N (%)	526/7,347 (7.2)	899/11,688 (7.7)	0.174
Risk-adjusted* outcomes			
Outcome	OR (95% CI)	P-value	
30-day mortality	1.03 (0.89-1.19)	0.727	
1-year mortality	1.04 (0.92-1.17)	0.545	
Acute myocardial infarction within 30 days	0.91 (0.64-1.28)	0.572	
TVR within one year	1.07 (0.93-1.22)	0.344	
Staged TVR procedure**	1.16 (0.92-1.46)	0.223	
TLR within one year**	0.89 (0.65-1.21)	0.440	
90-day repeat revascularisation	1.07 (0.99-1.16)	0.105	
1-year repeat revascularisation	1.07 (0.99-1.16)	0.079	



Outcome of Patients with Premature Coronary Artery Disease Treated for Their First Myocardial Infarction

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Department: Cardiologie

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Purpose:

A higher incidence of myocardial infarction (MI) has been observed in patients with premature coronary artery disease (CAD) than in older patients. This study assessed the baseline characteristics and 2-year outcome of patients undergoing percutaneous coronary intervention (PCI) for their first MI, in order to compare patients with premature and non-premature CAD.

Methods:

We pooled data of patients with a first MI and no previous coronary revascularization enrolled in four large-scale randomized PCI trials in all-comer (TWENTE I-IV). CAD was classified as premature in men <50 and women <55 years. Main composite endpoint was major adverse cardiac events (MACE): all-cause mortality, any myocardial infarction, emergent coronary artery bypass surgery, or target lesion revascularization.

Results:

A total of 582 (17.5%) of all 3,323 patients had premature CAD. The premature CAD patients showed a lower risk profile and had less complex coronary lesions than patients with non-premature CAD. After 2 years, patients with premature CAD had a significantly lower risk for mortality (0.5% vs.2.8%; adjHR:0.16,95%-CI:0.05-0.50; p=0.002), but not for MACE (3.6% vs.6.0%; adjHR:0.72,95%-CI:0.49-1.06; p=0.10), any (recurrent) MI (1.6% vs.1.9%; adjHR:1.03,95%-CI:0.56-1.87; p=0.94) or target vessel revascularization (3.5% vs.3.2%; adjHR:1.38,95%-CI:0.90-2.10; p=0.14).

Conclusion:

About one of six patients who underwent PCI for a first MI had premature CAD. Patients with premature CAD had a lower risk for 2-year all-cause mortality, which is most likely related to their young age. Yet, despite differences in baseline risk profile, there was no significant between-group difference in the risks for MACE, target vessel revascularization, and any (recurrent) MI.

Keywords:

Coronary artery disease, Percutaneous coronary intervention, Premature coronary artery disease



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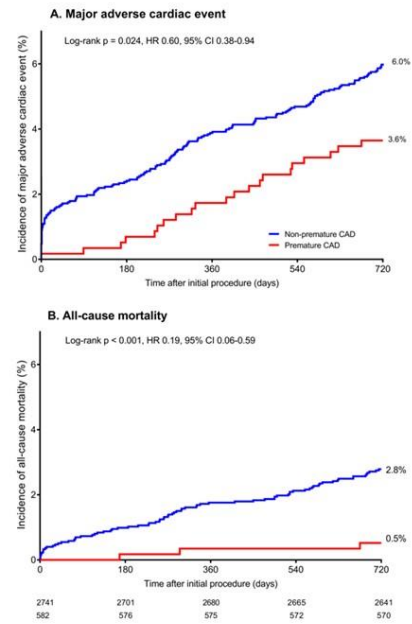
Figure:

Figure 1: Characteristics and 2-year outcome of patients with premature or non-premature coronary artery disease.

Characteristics of patients with premature (red) and non-premature CAD (blue). Kaplan-Meier cumulative event curves for major adverse cardiovascular events and all-cause mortality.

CI=confidence interval; HR=hazard ratio

	Premature coronary artery disease		p-value
	Yes (n=582)	No (n=2,741)	
General characteristics			
Age (years)	45 ± 5	65 ± 9	<0.001
Body-mass Index (kg/m ²)	28 ± 5	27 ± 4	<0.001
Smoker	70 %	34 %	<0.001
Medical history			
Diabetes mellitus	10 %	15 %	0.001
Renal failure ^a	1 %	3 %	0.005
Hypertension	26 %	44 %	<0.001
Hypercholesterolemia	28 %	30 %	0.34
Previous stroke	1 %	5 %	<0.001
PADs ^b	1 %	5 %	<0.001
Family history of coronary artery disease	56 %	41 %	<0.001
Clinical syndrome at presentation			
STEMI	62 %	53 %	
Non-STEMI	39 %	47 %	
Procedural characteristics			
Multivessel treatment	10 %	17 %	<0.001
Total stent length (mm)	32 ± 20	36 ± 24	0.001
Calcified lesion treatment	10 %	17 %	<0.001
Ostial lesion treatment	4 %	4 %	0.49
Bifurcated lesion treatment ^c	26 %	33 %	0.001
Chronic total occlusion treatment	2 %	2 %	0.20





Impact of Symptom Duration and Mechanical Circulatory Support on Prognosis in Cardiogenic Shock Complicating Acute Myocardial Infarction

Presenting author: F. Klein

Department: Cardiologie

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Purpose:

Cardiogenic shock complicating acute myocardial infarction (AMICS) is a condition associated with high mortality rates despite advancements in AMI care. Our study aimed to gain understanding of the impact of prehospital symptom duration on the prognosis of AMICS patients and those receiving mechanical circulatory support (MCS).

Methods:

We conducted a retrospective, multicenter study including 14 Dutch hospitals. Patients with cardiogenic shock undergoing percutaneous coronary intervention (PCI) between January 2017 and September 2021 were identified through the Netherlands Heart Registration and predefined variables were collected. Patients with out-of-hospital cardiac arrest (OHCA) were excluded. Patient characteristics were compared for AMICS patients stratified by symptom duration. Furthermore, patients were categorized into 4 groups according to MCS use and symptom duration less or more than 24 hours. Survival rates were then calculated using the Kaplan-Meier method.

Results:

A total of 2328 patients were enrolled, after exclusion of duplicates (n=21) and OHCA patients (n=944), 1363 cases remained. The overall 30-day mortality was 34%. Extended prehospital symptom duration correlated with elevated 30-day mortality rates (<3 hours, 26%; 3-6 hours, 29%; 6-24 hours 36%; ≥24 hours, 46%, p<0.001).

Mechanical circulatory support was used in 24% of all patients. Symptom duration ≥24 hours, in this selected population, was associated with a higher mortality compared to <24 hours (59% vs 45%, p=0.029). Mortality rates were highest in patients with MCS and ≥24h symptom duration (59%) and lowest in patients without MCS and <24 hour symptom duration (24%).

Conclusion:

In this study, prehospital symptom duration was a significant predictor of mortality in patients presenting with cardiogenic shock complicating acute myocardial infarction. In AMICS patients treated with MCS, a symptom duration of ≥24 hours was an indicator of poor survival. These results emphasize the critical role of early recognition and intervention in AMICS on prognosis.

Keywords:

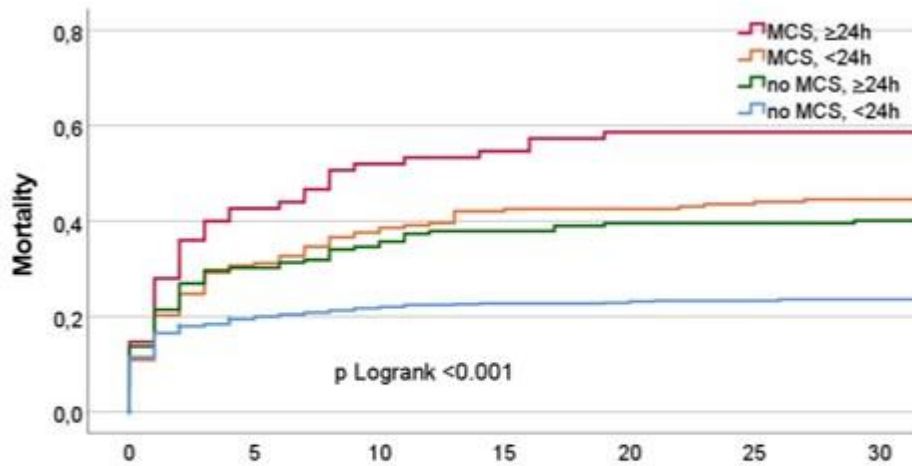
Cardiogenic shock, Symptom duration, Mortality



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Figure:

30-day mortality curves stratified for symptom duration less or more than 24 hours and use of mechanical circulatory support



	Time (days)							
Number at risk	0	5	10	15	20	25	30	
MCS, $\geq 24h$	75	43	36	34	31	31	31	
MCS, $< 24h$	202	140	126	117	116	114	112	
no MCS, $\geq 24h$	182	127	119	113	110	110	109	
no MCS, $< 24h$	696	558	542	535	534	531	529	



The Impact of Percutaneous Veno-arterial Extracorporeal Membrane Oxygenation on Hemodynamic Parameters during High-risk Percutaneous Coronary Intervention

Presenting author: A.M. Griffioen

Department: Cardiology

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Purpose:

VA-ECMO could result in increasing pressure in the left ventricle and atrium due to an increased afterload. Although hemodynamic parameters predict successful weaning from VA-ECMO in general, data regarding hemodynamic parameters in patients with ECMO-assisted high-risk PCI is limited. This study therefore aims to identify the impact of VA-ECMO on hemodynamic parameters during high-risk PCI.

Methods:

A retrospective single-centre registry was performed including patients with high-risk PCI under VA-ECMO support. Hemodynamic parameters, including pulmonary capillary wedge pressure (PCWP) and pulmonary artery pressure (PAP), were measured using a Swan-Ganz catheter.

Results:

High-risk PCI with ECMO support was performed between January 2020 and May 2023 in 28 patients. Baseline characteristics are summarized in Table 1. Although mean PCWP, measured in 13 patients, increased numerically during the procedure, the increase was not significant (12.4 at start ECMO vs. 14.4 after PCI vs. 17.0 after ECMO weaning; $p=0.14$). Neither was there a significant change in mean PAP (20.7 vs. 19.1 vs. 22.0; $p=0.85$). Successful revascularization was achieved in 27 patients (96.4%) and procedural success in 26 patients (92.9%). One patient required prolonged ECMO support and was successfully weaned after 2 days. PCWP increased only from 12 mmHg up to 15 mmHg.

Conclusion:

ECMO-assisted high-risk PCI did not have a significant impact on hemodynamic parameters. Both PCWP and PAP remained within normal limits, indicating no negative effect of peri-procedural LV afterload increase by ECMO. Almost all patients could be successfully weaned immediately after procedure. Associations between hemodynamic parameters and successful weaning should be investigated further.

Keywords:

ECMO, PCI, Hemodynamic Parameters



Figure:

CABG: Coronary Artery Bypass Graft, ECMO: Extracorporeal Membrane Oxygenation, IQR: Interquartile Ranges, LVEF: Left Ventricular Ejection Fraction, MI: Myocardial Infarction, Min: Minutes, N: Number, PCI: Percutaneous Coronary Intervention, SD: Standard Deviation

Table 1. Baseline Characteristics (n = 28)	
<i>Patient Characteristics</i>	
Age, years (\pm SD)	70.6 (\pm 10.1)
Male, n (%)	20 (71.4)
Smoking, n (%)	
Yes	5 (23.8)
Previously	14 (66.7)
Hypertension, n (%)	16 (57.1)
Diabetes, n (%)	14 (50.0)
Dyslipidaemia, n (%)	9 (32.1)
Peripheral Arterial Vessel Disease, n (%)	11 (39.3)
Previous PCI, n (%)	5 (17.9)
Previous CABG, n (%)	4 (14.3)
Previous MI, n (%)	13 (46.4)
Three-vessel Coronary Artery Disease, n (%)	18 (64.3)
Left Main Stenosis, n (%)	18 (64.3)
Chronic Total Occlusion, n (%)	18 (64.3)
Generic Bifurcation Lesion, n (%)	10 (35.7)
LVEF, % (\pm SD)	31.5 (\pm 10.7)
STS (\pm SD)	4.3 (\pm 3.0)
SYNTAX (\pm SD)	32.6 (\pm 8.1)
SYNTAX II PCI (\pm SD)	54.4 (\pm 12.4)
SYNTAX II CABG (\pm SD)	41.4 (\pm 12.7)
<i>ECMO Characteristics</i>	
Arterial ECMO Cannulation, n (%)	
Femoral	25 (89.3)
Subclavian	3 (10.7)
ECMO Time, min. (IQR)	125 (91-161)
ECMO Flow, l/min. (\pm SD)	2.1 (\pm 0.7)

Abstract sessies NVVC-NVT Najaarscongres
Donderdag 2 november 2023
16:20 – 17:50 uur

Insights from the Netherlands: A Propensity-Matched Analysis of Mechanical Circulatory Support for Cardiogenic Shock Complicating Acute Myocardial Infarction

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Purpose:

Despite limited beneficial evidence, mechanical circulatory support (MCS) use for acute myocardial infarction-related cardiogenic shock (AMICS) is increasing. This study aimed to give insight into MCS usage in the Netherlands and to assess the impact of MCS usage on 30-day mortality.

Methods:

Data from all patients undergoing percutaneous coronary intervention (PCI) in the Netherlands is prospectively registered in the Netherlands Heart Registration (NHR) database. On top of the obligatory registration, additional data were retrieved for all patients with cardiogenic shock undergoing PCI in 14 Dutch hospitals (2017-2021), including the use of different types of MCS. After multiple imputation, averaged propensity matching scores (aPS) based on 47 variables were used to match MCS and non-MCS patients. Patients without data on MCS usage or 30-day mortality, or without a (non-)STEMI were excluded from the analysis.

Results:

In total, 516/2217 patients (23.3%) received MCS. The intra-aortic balloon pump (IABP) was used most often (n=253, 11.4%). Impella, venoarterial extracorporeal membrane oxygenation (VA-ECMO) and a combination of multiple devices were used in 4.3% (n=94), 3.1% (n=68) and 4.3% (n=95) respectively. After aPS-matching, the cohorts were well balanced on all variables except for Creatinine-Kinase MB levels. In this aPS-matched analysis, MCS-supported patients had a significantly higher 30-day mortality of 54.3% vs. 40.1% (p<0.001).

Conclusion:

In the Netherlands, one in four AMICS patients receives MCS. The IABP is used most often. In this aPS-matched analysis, MCS usage was associated with an increased 30-day mortality. This study underscores the need for robust evidence regarding MCS usage.

Keywords:

Cardiogenic Shock Complicating Acute Myocardial Infarction, Mechanical Circulatory Support

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Figure:

