Abstracts of the Scientific Spring Congress of the Netherlands Society of Cardiology 16-17 April 2020

*Hoewel het NVVC voorjaarscongres door de COVID-19 crisis geen doorgang heeft kunnen vinden, hebben we gemeen de gekozen abstracts toch te publiceren op de gebruikelijk wijze.
Session 1: Non-invasive cardiology

CHARACTERISTICS AND PROGNOSIS OF SEPTAL MIDWALL LATE FADOLINIUM ENHANCEMENT IN BOTH ISCHEMIC CARDIOMYOPATHY AND NON-ISCHEMIC DILATED CARDIOMYOPATHY

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Purpose:
Septal midwall late gadolinium enhancement (LGE) is a characteristic finding on cardiac magnetic resonance imaging (CMR) in dilated cardiomyopathy (DCM) and is associated with adverse events. However, the presence and clinical implications in patients with ischemic cardiomyopathy (ICM) are unknown. Objective was to describe the presence and characteristics of septal midwall LGE and evaluate the prognostic value in both DCM and ICM.

Methods:
This retrospective, multicenter, observational study included patients with impaired left ventricular function (LVEF<50%), both DCM or ICM. Septal midwall LGE was defined as midmyocardial stripe-like or patchy LGE in septal segments. Primary endpoint was all-cause mortality and secondary endpoint was ventricular arrhythmias (VAs), including resuscitated cardiac arrest, sustained VA and appropriate ICD-therapy.

Results:
We included 1084 patients (53% ICM). Septal midwall LGE was seen in 34% of DCM-patients and 10% of ICM-patients (p<0.001) and was associated with higher NYHA functional class (p<0.001), larger LV volumes (LVEDVi 130mL/m2 vs. 108mL/m2, p<0.001) and lower LVEF (28% vs. 38%, p<0.001). Median follow-up was 2.7 years. There was a significant association between septal midwall LGE and mortality in DCM-patients (HR 1.92, p=0.03), but not in ICM-patients (HR 1.35, p=0.39). Risk of VAs was significantly higher in patients with septal midwall LGE on CMR, both in DCM (HR 2.80, p<0.01) and in ICM (HR 2.70, p<0.01).

Conclusion:
Septal midwall LGE, typically found in DCM, was also present in 10% of ICM-patients. Its presence was associated with higher NYHA class, increased LV dilation and lower LVEF, suggesting advanced ventricular remodeling. Septal midwall LGE was associated with shorter time to VAs during follow-up, irrespective of underlying etiology. In DCM-patients, septal midwall LGE was also associated with higher risk of mortality.
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**Figures:**
Figure: prognostic value of the presence of septal midwall LGE in patients with ICM and DCM
2D-ECHOCARDIOGRAPHY STRAIN IMAGING VS CARDIAC MRI STRAIN IMAGING USING DEEP LEARNING: A PROSPECTIVE STUDY IN HER2-POSITIVE BREAST CANCER PATIENTS UNDERGOING TRASTUZUMAB THERAPY

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Purpose:
Treatment with trastuzumab for HER2-positive breast cancer may lead to cardiotoxicity. Subclinical cardiotoxicity can possibly be recognized by repeated measurements of strain. While two-dimensional speckle tracking echocardiography (2D-STE) is a widely available technique to measure strain, cardiac CMR (CMR)-based strain is not yet standardized. Therefore, the correlation and association between 2D-STE and CMR was investigated.

Methods:
This prospective cohort study included HER2-positive breast cancer patients treated with trastuzumab with or without anthracyclines. 2D-STE was scheduled at baseline and after 3 and 6 months trastuzumab. CMR was scheduled at baseline and after 6 months trastuzumab. CMR analyses were performed with semi-automatic (Phillips) software and artificial intelligence-automatic (Circle) software. The correlation was assessed with a correlation coefficient and agreement with Bland-Altman analyses for repeated measurements. The association between early 2D-STE strain and later CMR-based LVEF was assessed with linear regression analysis.

Results:
In total, 47 patients were included. The correlation between 2D-STE and CMR was 0.33 (p=0.041) for GLS and 0.01 (p=0.979) for GRS. The mean difference between 2D-STE and CMR was 1.8% for GLS and -6.8% for GRS. Both GLS measured with 2D-STE after 3 months trastuzumab and an absolute change in GLS from before treatment to after 3 months trastuzumab are associated with CMR-based LVEF after 6 months trastuzumab, respectively -1.1% (p=0.018) and -1.6% (p=0.003) difference in CMR-based LVEF per unit increase.

Conclusion:
2D-STE strain and CMR strain are poorly correlated. 2D-STE-based GLS may be useful for early identification of patients at risk for cardiac dysfunction during trastuzumab.
LEFT ATRIAL FLOW CHARACTERISTICS BY 4D FLOW CMR AND STRAIN ANALYSIS IN PATIENTS WITH PAROXYSMAL ATRIAL FIBRILLATION AND HEALTHY CONTROLS

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Purpose:
Atrial fibrillation (AF) increases the risk for thromboembolic events, which is mainly attributed to embolism of thrombus from the left atrium (LA). Paroxysmal AF may induce structural and functional remodeling, possibly affecting LA global flow characteristics during sinus rhythm, as well. Using novel cardiovascular magnetic resonance (CMR) approaches (4D flow CMR and feature tracking), this study investigates differences for left atrial global flow and functional remodeling characteristics between paroxysmal AF patients compared to healthy controls.

Methods:
Ten patients with a history of paroxysmal AF (age= 61±8 years) and 5 healthy age/gender matched controls (age=56±1 years) underwent CMR examination during sinus rhythm. The imaging protocol included conventional cine imaging and 4D flow acquisition. 4D flow data was co-registered with balanced steady state free precession cine images to guide anatomic LA orientation. The following LA flow metrics were obtained: flow velocity (mean, peak), stasis defined as relative number of voxels with velocities < 10 cm/s, and kinetic energy (KE) which is a parameter correlated to the velocity field. Furthermore, LA global strain and strain rate values were derived from b-SSFP cine images using dedicated CMR feature tracking software.

Results:
Although in sinus rhythm, mean and peak velocities over the entire cardiac cycle within the LA were significantly lower in AF patients compared to controls [13.13±2.36 vs. 16.72±2.07 cm/s, p=0.01] and peak velocity [19.28±4.71 vs. 26.77±5.52 cm/s, p=0.02]. In addition, AF patients expressed more stasis of blood [43.24±10.75 vs. 27.80±7.90 % p=0.01] than controls. With respect to energetics, whilst mean and peak KE values over the entire cardiac cycle were comparable, mean and peak KE values indexed to maximum LA volume revealed lower values in patients with PAF compared to healthy controls [10.64±3.43 vs. 16.04±4.52 uJ/ml, p=0.02] and peak KE [19.92±9.54 vs. 37.50±11.71 uJ/ml, p=0.01]. No significant differences were observed regarding LA volume and function characteristics including global longitudinal strain and strain rates between the groups.

Conclusion:
Compared to healthy age/gender matched controls, paroxysmal AF patients demonstrated lower LA flow velocities, higher LA volume fraction with stasis and lower kinetic energy values indexed to the maximum LA volume, even during sinus rhythm. Of note, no significant differences were observed regarding LA volume and detailed function analysis parameters between the groups. Larger prospective studies are warranted to assess whether individual flow characteristics using 4D flow CMR may provide additional value in stroke risk assessment.
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Figures:
Comparison of mean velocity, peak velocity, and stasis fraction between patients with paroxysmal atrial fibrillation and controls. Data shown as mean and standard deviation. Abbreviations: AF: atrial fibrillation
DEFINING THE PROGNOSTIC VALUE OF [15O]H2O POSITRON EMISSION TOMOGRAPHY DERIVED MYOCARDIAL ISCHEMIC BURDEN

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Purpose:
To define a [15O]H2O positron emission tomography (PET) derived ischemic burden (IB) threshold for identifying high risk stable ischemic heart disease (SIHD) patients who might benefit from revascularization.

Methods:
623 patients who underwent [15O]H2O PET perfusion imaging because of suspected coronary artery disease and in whom follow-up was obtained were included. The endpoint was a composite of death and non-fatal MI. A hyperemic myocardial blood flow (hMBF) and coronary flow reserve (CFR) derived IB were calculated.

Results:
During a median follow-up of 6.7 years, 62 patients experienced an endpoint. A hMBF IB ≥24% and CFR IB ≥28% were found to be the optimal thresholds to discern outcome. Patients with a hMBF or CFR IB above the threshold had worse outcome compared to patients with a hMBF (annualized event rate (AER): 2.9% vs. 0.6%, p<0.001) or CFR IB (AER: 2.5% vs. 0.6%, p<0.001) below the threshold. Patients with a concordant hMBF and CFR derived IB above the threshold had the worst outcome (AER: 3.1%). Whereas patients with a concordant IB below the threshold or discordant IB result had low AERs of 0.5% and 0.9% (p=0.953), respectively. A concordant IB above the threshold was an independent predictor of adverse outcome beyond clinical characteristics (hazard ratio: 3.30, p<0.001).

Conclusion:
A hMBF IB ≥24% and CFR IB ≥28% were found to be the optimal thresholds to discern adverse outcome in terms of death and MI. Combining hMBF and CFR IB results allows for the stratification of high and low risk SIHD patients.
THE ASSOCIATION BETWEEN BODY TEMPERATURE AND ELECTROCARDIOGRAPHIC PARAMETERS IN NORMOTHERMIC HEALTHY VOLUNTEERS

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Purpose:
Previous studies have observed that hypo- and hyperthermia are associated with several atrial and ventricular electrocardiographical parameters, including the corrected QT interval. Preclinical studies have shown that drugs that exert an effect on body temperature also exert an effect on the corrected QT interval. Therefore, increased characterization in healthy humans of the association between the corrected QT interval and body temperature within the normal body temperature range aids in understanding the mechanism behind drug induced corrected QT interval effects. The objective of this analysis was to evaluate the association between body temperature and electrocardiographical parameters in normothermic healthy volunteers.

Methods:
Data from 3023 volunteers collected at our center were analyzed. Only subjects considered healthy after review of collected data by a physician, including a normal tympanic body temperature (35.5-37.5 °C) and in sinus rhythm, were included in the analysis. Subjects were divided into body temperature quartiles for analysis and a linear multivariate model with body temperature as a continuous was performed. Another multivariate analysis was performed with only the QT subintervals as independent variables and body temperature as dependent variable.

Results:
Mean age was 33.8±17.5 years and mean body temperature was 36.6±0.4 °C. Body temperature was independently associated with age (standardized coefficient (SC)=−0.252, P<0.001), gender (SC=+0.208, P<0.001), heart rate (SC=+0.230, P<0.001), J-point elevation in lead V4 (SC=−0.118, P<0.001), and Fridericia corrected QT interval (SC=−0.061, P=0.002). Atrial and AV nodal parameters were not independently associated with body temperature. The effects of temperature on the surface ECG are displayed in figure 1. QT subinterval analysis revealed that only QRS duration (SC=−0.121, P<0.001) was independently associated with body temperature.

Conclusion:
Body temperature in normothermic healthy volunteers was associated with heart rate, J-point amplitude in lead V4 and ventricular conductivity, primarily through a prolongation of the QRS duration. In contrast, atrial and AV nodal ECG parameters were not independently associated with body temperature.
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Figures:
Overview of significant changes of electrographic parameters to body temperature in normothermic healthy volunteers aged 18 years or older (n=3023) with a tympanically measured body temperature between 35.5 - 36.3 °C (red lining) and 37.0 - 37.5 °C (black lining). Results were based on Analysis of Variance (ANOVA) test between body temperature groups, and expressed as difference in the electrocardiographic parameter (with 95% confidence interval) per body temperature groups using a post hoc Tukey analysis. µV = microvolt, ms = milliseconds, mm = millimeters
ASSESSMENT OF ABDERRANT HEMODYNAMICS IN PATIENTS WITH DEGENERATIVE ASCENDING AORTIC ANEURYSMS: A 4D FLOW MRI STUDY

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Purpose:
The link between aortic diameter and severe complications of thoracic aortic aneurysms (TAA) has been well recognized. Guidelines recommend preventative aortic replacement if the maximal diameter exceeds 55mm. However, the majority of dissections occur in TAA’s below this threshold (the so-called aortic size paradox). Besides dilatation, changes in hemodynamics and mechanical properties of the compliant aortic wall may deteriorate outcome. This study aims to describe 4D-flow-MRI parameters in patients with TAA compared to healthy individuals.

Methods:
22 volunteers and 25 TAA patients were prospectively included in this observational study. All participants underwent MRI at 3T. Hemodynamic parameters including flow velocity, vorticity and wall shear stress (WSS) were assessed from the acquired 4D-flow datasets.

Results:
Patients with TAA show an aberrant distribution of WSS, with significant higher values in the outer curvature of the proximal ascending aorta as compared to controls, and significant lower WSS in the inner curvature (1202mPa vs. 943mPa, p=0.025; 836mPa vs. 1001mPa, p=0.022). Larger aortic volume was associated with higher grades of vorticity (Spearman’s rho =0.841, p<0.001). TAA-patients showed a positive wall shear stress gradient from sinotubular junction to proximal ascending aorta (747mPa to 1017mPa, p<0.001).

Conclusion:
TAA-patients exhibit significant differences in MRI-derived blood flow patterns and quantitative flow parameters when compared to controls. Future studies are needed to assess the impact of these disturbed flow parameters on aneurysm growth rate and complications. By doing this, we eventually hope to reduce the incidence of fatal complications of aortic aneurysms.
Figures:
Distribution of wall shear stress (WSS) in different regions of the aorta (inner curvature anterior and posterior, and outer curvature anterior and posterior) at different levels (ST-junction, proximal- and distal ascending aorta) during the heart cycle.
ASSOCIATION BETWEEN CORONARY ARTERY CALCIUM SCORE AND ABSOLUTE MYOCARDIAL PERFUSION ASSESSED BY HYBRID [15O]H2O PET/CT IMAGING DURING 3 YEARS SERIAL FOLLOW-UP AFTER PERCUTANEOUS REVASCULARIZATION

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Purpose:
The value of coronary artery calcium score (CACS) to predict quantitative myocardial perfusion in patients after coronary stenting is poorly documented. Aim of the present study was to establish the association between progress of CACS and quantitative myocardial blood flow (MBF) measured with hybrid [15O]H2O Positron Emission Tomography/Computed Tomography (PET/CT) imaging during follow-up.

Methods:
Sixty patients with single vessel disease and type A or B1 lesions were randomized in a 1:1 fashion to either bioresorbable scaffold or drug eluting stent implantation. Patients underwent [15O]H2O PET/CT at 1 month (n=59), 1 year (n=55) and 3-years (n=53) after revascularization. Global quantitative MBF (mL/min/g) was measured during adenosine and cold pressor testing (CPT) induced hyperemia. Overall CACS was calculated excluding stented segments. Groups were defined as below or above the median CACS at 1 month.

Results:
Median overall CACS was 105 at 1 month. Comparing patients with low vs high CACS, the increase of CACS between 1 month and 3 years was significantly higher in the patients with a CACS above the median at 1 month (38 IQR [5-82] vs. 195 [101-372]; p<0.01). Adenosine-induced hyperemic MBF (hMBF) was higher in the low CACS group at 1 month (3.39 ± 0.65 vs. 2.85 ± 0.82; p=0.007), at 1 year (3.48 ± 0.94 vs. 3.0 ± 0.97; p=0.06) and at 3 years (3.24 ± 0.77 vs. 2.72 ± 0.76 p=0.02) compared to the high CACS group. In addition, we studied MBF during CPT at 1 month (low vs. high CACS: 1.14 ± 0.28 vs. 1.07 ± 0.30; p=0.335), at 1 year (1.16 ± 0.29 vs. 1.00 ± 0.23; p = 0.03) and at 3 years (1.26 ± 0.31 vs. 1.08 ± 0.26; p = 0.02). Furthermore, the change in hMBF over time was not different between patients with low or high CACS at 1 month (-0.17 ± 0.92 vs. -0.19 ± 0.55; p=0.93 during adenosine-induced hyperemia and 0.1 ± 0.29 vs. -0.02 ± 0.21; p=0.09 during CPT).

Conclusion:
A low CACS at 1 month was associated with significantly less CACS increase during 3 years follow-up. Furthermore, high CACS at 1 month identified patients with lower overall hMBF measured with serial hybrid [15O]H2O PET/CT. However, CACS at 1 month may be a poor clinical substitute for hMBF assessment in patients with documented coronary artery disease.
Session 2: Anticoagulation and interventional cardiology

ANTICOAGULATION USE AND TATTOOING

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Purpose:
Nowadays, tattooing is increasing in popularity. In the general population, a prevalence of 10% of having a tattoo is described. In the Netherlands, the number of tattoo shops has almost tripled in the last 8 years. Medical advice on the risk of tattooing in cardiovascular patients with regard to medication (i.e. anticoagulation) and the risk of endocarditis will increase.

Methods:
Literature search using Pubmed and open source data on the internet.

Results:
There are no guidelines for tattoo artists with regard to the risk in cardiovascular patients or patients taking anticoagulation therapy in general. We found 25 articles on tattooing and cardiovascular patients, and only 2 are relevant with regard to the use of anticoagulants. None of the studies gives a clear advice in cardiovascular patients with regard to the use of anticoagulation therapy, but refer to the responsible physician for individual advice. Tattooing while on anticoagulation therapy has a low risk of bleeding, but gives a possible worse outcome of the quality of the tattoo. Because of the increased risk for bacteremia, there is an increased risk of endocarditis in high risk subjects

Conclusion:
The potential risks of tattooing in cardiovascular patients should be discussed individually. In general, local guidelines on perioperative advise on anticoagulation use in low-risk bleeding procedures and endocarditis prophylaxis apply.
NON-VITAMIN K ANTAGONIST ORAL ANTICOAGULANTS IN ADULTS WITH CONGENITAL HEART DISEASE, ARE THEY SAFE?

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Purpose:
Numerous adults with congenital heart disease (ACHD) are prone to thromboembolic events. Non-vitamin K antagonist oral anticoagulants (NOACs) have established benefits compared to Vitamin K Antagonist (VKA) in patients with acquired cardiac disease and atrial arrhythmias (AA). To date, few data have been published regarding the safety and efficacy of NOACs in ACHD patients with AA. The objectives were to evaluate safety and efficacy of NOACs in adult CHD patients.

Methods:
The NOTE registry, initiated in April 2014, is an open international prospective observational study in adult CHD patients prescribed NOACs. Follow-up took place at six months and yearly thereafter. Primary endpoints were thromboembolisms (TE) and major bleeding (MB) complications.

Results:
In total, 648 adults with CHD (mean age of 33±16 years; 54% male) were enrolled with predominantly moderate (43%) or complex cardiac defects (39%) including a Fontan circulation (13%). Over a median follow-up of 1.8 [IQR: 1.0-2.7] years, annualized event rate was 0.9% [95% CI: 0.5-1.9, n=9] for TE and 0.9% [95% CI: 0.5-1.8, n=9] for MB. Thrombotic events occurred typically in young men, while most major bleeds occurred in relatively older females. The majority (44%) of events occurred in Fontan patients, whereas the annualized event rate accounted 3.4% [95% CI: 1.3-8.4, n=4] for TE and 3.1% [95% CI: 1.2-7.8, n=4] for MB. In patients previously treated with VKA, annual event rate under VKA treatment accounted 1.2% [95% CI: 0.7-2.1, n=13] for TE and 1.0% [95% CI: 0.5-1.8, n=10] for MB.

Conclusion:
Compared to VKA, NOACs appeared to be equally safe and effective for thromboprophylaxis. Fontan patients were particularly prone to both thrombus formation and bleeds. The NOTE-registry continues to provide information on adverse events in all ACHD patients and subgroups using NOACs.
FAVORABLE COURSE OF TRICUSPID REGURGITATION AFTER PERCUTANEOUS MITRAL VALVE REPAIR IS ASSOCIATED WITH IMPROVED SURVIVAL AND CLINICAL OUTCOME

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Purpose:
Tricuspid Regurgitation (TR) is often present in patients with mitral regurgitation (MR) and is associated with increased mortality and morbidity after percutaneous mitral valve repair (PMVR) using the MitraClip. It is unclear to what extent TR is reduced after PMVR and whether the reduction of TR is related to survival and functional outcome. The aim of this study was to determine (1) the TR course after PMVR and (2) if this was related to survival and clinical outcome.

Methods:
Patients who underwent PMVR and had complete echocardiographic data at baseline and follow-up were included. TR severity was graded as none, mild, moderate or severe (according to current guidelines) and was determined before treatment and at 6-months of follow up. Favorable TR course was defined as improvement of ≥ 1 grade or ≤ mild TR at 6-months. Clinical endpoints were all-cause mortality during 1-year of follow-up and improvement in New York Heart Association (NYHA) functional class after 6 months.

Results:
A total of 67 patients were included (mean age 76 years, 57% male, 81% NYHA class ≥ 3 and 69% baseline TR ≥ moderate). Favorable TR course was achieved in 31 patients (46%)(figure 1A). All-cause mortality at 1 year was 7.5%, and was lower in the favorable TR course group (0% vs. 13.9%, p=0.057)(figure 1B). Improvement in NYHA class at 6-months was seen in 45% of patients without vs. 81% of patients with favorable TR course (p=0.01) (figure 1C).

Conclusion:
A favorable TR course is achieved in 46% of PMVR patients and is associated with improved survival and improvement of NYHA class. The relatively high rate of an unfavorable TR course at 6-months, indicates that interventional treatment of the tricuspid valve might benefit these patients.
Figures:
Course of TR after percutaneous mitral valve repair (A) and association with survival (B) and clinical outcome (C).

A: Course of TR after percutaneous mitral valve repair (PMVR).

B: 1-year survival.

C: Improvement in NYHA class at 6 months.
EPINEPHRINE STRESS TESTING DURING CARDIAC CATHETERIZATION IN PATIENTS WITH AORTIC COARCTATION

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Purpose:
The severity of aortic coarctation (CoA) may be underestimated during cardiac catheterization. We aimed to investigate whether epinephrine stress testing improves clinical decision making and outcome in CoA.

Methods:
We retrospectively evaluated CoA patients >50 kg with a peak systolic gradient (PSG) ≤20 mmHg during cardiac catheterization, who underwent epinephrine stress testing. Subsequent interventional management (stenting or balloon dilatation), complications, and medium-term clinical outcome were assessed.

Results:
Fifty CoA patients underwent cardiac catheterization with epinephrine stress testing. Patients with a high epinephrine PSG (>20 mmHg; n=24) were younger and more likely to have a hypertensive response to exercise compared to patients with a low epinephrine PSG (≤20 mmHg; n=26). In total, 21 patients (88%) with a high epinephrine PSG underwent intervention and 20 patients (77%) with a low epinephrine PSG were treated conservatively. After a mean follow-up of 25 ± 18 months, there was a lower prevalence of hypertension in patients with a high epinephrine PSG who underwent intervention compared to patients with a low epinephrine PSG treated conservatively (19% vs. 77%; p=0.001). In a multivariate model, intervention was independently associated with a 14.3 mmHg reduction in systolic blood pressure (p=0.001) and a decrease in the use of antihypertensive agents.

Conclusion:
In CoA patients with a low baseline PSG but high epinephrine PSG, percutaneous intervention is associated with a substantial reduction in systemic blood pressure and the use of antihypertensive medication. Accordingly, epinephrine stress testing may be a useful addition in the evaluation of CoA.

Figures:
ANTICOAGULATION WITH OR WITHOUT CLOPIDOGREL AFTER TRANSCATHETER AORTIC VALVE IMPLANTATION

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Purpose:
Antithrombotic therapy following transcatheter aortic valve implantation (TAVI) has not been well studied. We performed a randomized trial of adding or omitting clopidogrel in patients undergoing TAVI who were on indicated oral anticoagulation.

Methods:
Patients who were on oral anticoagulation were randomly assigned prior to TAVI in a 1:1 ratio to clopidogrel or no clopidogrel for three months. The primary outcomes were all bleeding and non-procedural bleeding over 12 months. The secondary outcomes were a composite of cardiovascular mortality, non-procedural related bleeding, all cause stroke and myocardial infarction at 12 months, and the composite of cardiovascular mortality, ischemic stroke, and myocardial infarction, excluding bleeding.

Results:
A total of 313 patients were enrolled; 157 assigned to no clopidogrel and 156 to clopidogrel. All bleeding occurred in 34 patients (21.7%) with oral anticoagulation alone versus 54 patients (34.6%) with oral anticoagulation plus clopidogrel (hazard ratio [HR], 0.56: 95% confidence interval [CI], 0.36 to 0.86; P=0.007). Non-procedural bleeding occurred in 24 patients (21.7%) versus 53 patients (34%) (HR, 0.57; 95% CI, 0.37 to 0.88; p=0.010). The first secondary composite outcome occurred in 49 (31.2%) versus 71 patients (45.5%), respectively (difference, -14.3 percentage points; unadjusted 95% CI, -25.0 to -3.6, p<0.001 for noninferiority, p=0.005 for superiority). The second secondary composite outcome occurred in 21 (13.4%) versus 27 patients (17.3%), respectively (difference, 3.9 percentage points; unadjusted 95% CI, -1.9 to 4.0, p=0.001 for noninferiority). The individual components cardiovascular mortality (13 [8.3%] versus 20 patients [12.8%]), stroke (9 [5.7%] versus 9 patients [5.8%]) or myocardial infarction (1 [0.6%] versus 1 patient [0.6%]) were not significantly different.
Conclusion:
In patients undergoing TAVI who were on indicated for oral anticoagulation, antithrombotic treatment consisting of oral anticoagulation alone was associated with a lower rate of bleeding over 1 year compared to oral anticoagulation with clopidogrel. Composite outcomes of cardiovascular mortality, myocardial infarction and stroke, with and without bleeding, were in the same direction as the primary outcomes.
A PROSPECTIVE COHORT STUDY TO THE OPTIMAL RADIAL CLOSURE DEVICE DURATION WITH OR WITHOUT STATSEAL

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Purpose:
The purpose of our study was to compare the influence of the different radial band deflation protocols on radial occlusion, bleeding events, hematomas, pain and discomfort in patients.

Methods:
A single centre prospective study was set up to compare 3 different types of radial band deflation protocols. A total of four hundred and twenty patients undergoing transradial coronary intervention were included. Group 1 (n=120) patients followed the standard (4 hour) radial band deflation protocol, group 2 (n=120) patients followed the 2 hour radial band deflation protocol and group 3 (n=120) patients followed the one hour deflation protocol with StatSeal. Baseline characteristics and procedural variables were registered. Also all radial occlusions, bleeding complications, hematomas, pain and discomfort in patients were registered.

Results:
Radial occlusion was observed in only patient in group 1. The most bleeding events occurred in group 2 and the least in group 3. The most hematomas occurred in group 3. No intervention was needed. Pain and discomfort was seen in group 3 right after a procedure, but was less after one hour compared to the other two groups.

Conclusion:
Considering radial occlusion, bleeding events, hematomas, pain and discomfort in patients, the one hour protocol could be safe and comfortable for the patient.
MINOCA: THE CAVEAT OF ABSENCE OF CORONARY OBSTRUCTION IN MYOCARDIAL INFARCTION

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Purpose:
Although some studies suggest that patients with myocardial infarction with non-obstructive coronary arteries (MINOCA) have better clinical outcomes than patients with coronary artery disease, contradictions remain to exist. The current study aimed to provide insight in the patient profile and prognosis of MINOCA.

Methods:
A pre-existing database was consulted containing data of patients with acute coronary syndrome (ACS) treated at the Isala hospital in Zwolle, the Netherlands, between 2006 and 2014. Patients were divided into three groups: MINOCA, single vessel obstructive ACS (SV-ACS), and multivessel obstructive ACS (MV-ACS).

Results:
Data of 7714 adult patients were assessed. The proportion prevalence of MINOCA was 5.5% (n=423). MINOCA patients were more often female than SV-ACS and MV-ACS patients (50.6% vs. 30.3% and 26.0% respectively, P<0.001). The prevalence of risk factors including hypertension, hypercholesterolemia, and diabetes mellitus in the MINOCA group concerned values in between those of both ACS groups. The same trend applied to all-cause mortality rates within 1 year of discharge; MINOCA: 4.9%, SV-ACS: 4.4%, MV-ACS: 8.6% (P<0.001), which translated to significantly different survival times at maximum follow-up (Figure 1). Logistic regression analysis revealed an odds of dying lower in SV-ACS compared to MINOCA: odds ratio=0.694 (P=0.020) when corrected for age, current smoking, diabetes mellitus, and type of ACS.

Conclusion:
Patients with MINOCA make up a significant proportion of patients presenting with ACS and show an ‘intermediate’ risk profile with significantly higher mortality rates than SV-ACS patients. Hence, MINOCA should be recognized as a risk factor for mortality, requiring adequate follow-up.
Figures:
Figure 1. Cumulative crude all-cause mortality across groups at maximum follow-up time. MINOCA: myocardial infarction with non-obstructive coronary arteries, single vessel obstructive acute coronary syndrome (SV-ACS) and multivessel obstructive acute coronary syndrome (MV-ACS).
Session 3: Electrophysiology

CHANGE IN QRS AREA AFTER CARDIAC RESYNCHRONIZATION THERAPY IS ASSOCIATED WITH CLINICAL RESPONSE

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Purpose:
Cardiac Resynchronization Therapy (CRT) is the cornerstone of treatment in patients with dyssynchronous heart failure. Recently, baseline QRS area derived from vectorcardiography, proved to predict outcome in CRT better than QRS duration and morphology. Here, we aim to investigate whether the change in QRS area ($\Delta$QRS area) with CRT-pacing further improves the prediction of CRT outcomes.

Methods:
We conducted a retrospective analysis on 1,299 patients, included in a CRT-registry from three Dutch University hospitals with both pre- (baseline) and post-implantation 12-lead ECGs. $\Delta$QRS area and $\Delta$QRS duration were defined as the change in their respective values after CRT. Highest sensitivity and specificity in relation to primary endpoint was found to be 62µVs for $\Delta$QRS area and -11ms for $\Delta$QRS duration. Primary endpoint was a combination of all-cause mortality, heart transplantation, and left ventricular assist device implantation. Secondary endpoints were percentage of left ventricular end-systolic volume (LVESV) reduction, and echocardiographic response defined as ≥15% LVESV reduction.

Results:
The primary endpoint occurred in 408 patients (31%). $\Delta$QRS area was superior to $\Delta$QRS duration for the primary and secondary endpoints. Survival analyses showed a relative risk reduction of 57% in the $\Delta$QRS area ≥ 62 µVs group vs. the < 62 µVs group (HR 0.43; 0.33-0.56, p<0.001). In a multivariable analysis, both baseline- and $\Delta$QRS area remained significantly associated with both primary- and secondary endpoints. The study cohort was then divided in three groups: the first two groups with baseline QRS area ≥ 109 µVs in combination with either $\Delta$QRS area ≥ or < 62 µVs, and the third group with baseline QRS area < 109 µVs. A significantly better outcome was seen in patients with both high baseline QRS area and high $\Delta$QRS area; followed by patients with high baseline QRS area and low $\Delta$QRS area (figure). Additionally, combination of baseline QRS area ≥109 µVs and $\Delta$QRS area of ≥62 mVs also had the best echocardiographic outcomes (figure).

Conclusion:
The combination of baseline- and $\Delta$QRS area provides a stronger prediction of CRT effect than QRS area alone, and ($\Delta$)QRS duration. Implications of this finding are that baseline QRS area may be used for CRT patient selection, while an early $\Delta$QRS area determination may be used to identify patients that may benefit from CRT-optimization.
Figures:
Left: Kaplan – Meier survival curves and hazard ratios for groups combining high baseline QRS area with either high or low ∆QRS area. Right: Boxplot and odds ratios for groups combining high baseline QRS area with either high or low ∆QRS area.
Survival = free from combined primary endpoint; HR = hazard ratio; CI = confidence interval; OR = odds ratio; LVESV = left ventricular end-systolic volume.
LONG-TERM FOLLOW-UP OF THORACOSCOPIC ABLATION FOR LONG-STANDING PERSISTENT ATRIAL FIBRILLATION

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Purpose:
Catheter ablation in patients with long-standing persistent AF (LSPAF) remains challenging and often requires repeated procedures with variable results. We report long-term outcomes of a bipolar thoracoscopic pulmonary vein and left atrial posterior wall ablation for LSPAF, and compare continuous and interval rhythm monitoring.

Methods:
Seventy-seven LSPAF patients who underwent thoracoscopic pulmonary vein and box isolation between 2009-2017 in two Dutch centers were included. Follow-up consisted of continuous rhythm monitoring using an implanted loop recorder or 24-h Holter at 3/6/12/24/60 months.

Results:
Mean age was 59±8 years with a median AF duration of 3.8 [1.2-6.3] years. In the total cohort, at 2-year follow-up, 86.0% of patients were in sinus rhythm, 12.3% were in paroxysmal AF and 1.6% in persistent AF. At 5 years, 62.9% of patients were in sinus rhythm, 20.0% in paroxysmal AF, 14.3% in persistent AF and 2.9% was experiencing atrial flutter. Continuous rhythm monitoring was performed in 46% of patients. Comparing continuous and interval rhythm monitoring, freedom from any atrial arrhythmia episode at 2- and 5 years was 60.0% and 49.9% in the continuous group and 93.8% and 51.9% in the interval monitoring group, respectively (p=0.02, Breslow-Wilcoxon test).

Conclusion:
Thoracoscopic box ablation is highly effective in restoring sinus rhythm at medium term follow-up. However, it is not a curative treatment as demonstrated by the 50% arrhythmia-free survival at long-term follow-up. Whether this is due to the progressive nature of AF needs further investigation. Continuous rhythm monitoring shows earlier recurrence detection with a potential early treatment adaptation.
IMPACT OF LOCAL LEFT ATRIAL WALL THICKNESS ON THE INCIDENCE OF ACUTE PULMONARY VEIN RECONNECTION AFTER ABLATION INDEX-GUIDED ATRIAL FIBRILLATION ABLATION

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Purpose:
Ablation Index (AI)-guided ablation allows for creation of ablation lesions of consistent depth and may reduce the incidence of pulmonary vein (PV) reconnection after pulmonary vein isolation (PVI). The present study aimed to investigate the impact of local left atrial wall thickness on the incidence of acute pulmonary vein reconnection after AI-guided atrial fibrillation (AF) ablation.

Methods:
Consecutive patients who underwent cardiac computed tomography (CT) imaging prior to AI-guided AF ablation between December 2017 and September 2019 were studied. AI targets were 500 for anterior/roof and 380 for posterior/inferior segments with maximum interlesion distance of 6 mm. Occurrence of acute PV reconnection after initial PVI was assessed after a 30-minute waiting period. Ablation procedures were analyzed to determine minimum AI, force-time integral, contact force, ablation duration, power, impedance drop and maximum interlesion distance for each segment according to a 16-segment model. PV antrum wall thickness was assessed for each segment on reconstructed CT images based on patient-specific thresholds in Hounsfield Units.

Results:
Seventy patients (63% paroxysmal AF, 67% male, mean age 63±8 years) who underwent preprocedural CT imaging and AI-guided AF ablation were studied. Acute reconnection occurred in 27/1120 segments (2%, 15 anterior/roof, 12 posterior/inferior) in 19/140 ablation circles (14%). Anterior/roof segments were thicker than posterior/inferior segments (1.48 [1.23-1.80] vs. 1.13 [1.00-1.30] mm; p<0.01). Reconnected segments were characterized by a greater local atrial wall thickness, both in anterior/roof (1.83 [1.60-2.00] vs. 1.47 [1.20-1.80] mm; p<0.01) and posterior/inferior (1.38 [1.25-1.50] vs. 1.13 [1.00-1.27] mm; p<0.01) segments. Minimum AI, force-time integral, contact force, ablation duration, power, impedance drop and maximum interlesion distance were not associated with acute reconnection.

Conclusion:
Local atrial wall thickness is associated with acute pulmonary vein reconnection after AI-guided PVI. Individualized AI targets based on local wall thickness may be of use to create transmural ablation lesions and prevent PV reconnection after PVI.
Abstract sessies NVVC Voorjaarscongres
Donderdag 16 april 2020
16.45 – 18.00 uur

Figures:
Comparison of local atrial wall thickness between segments with and without acute pulmonary vein reconnection.

**Anterior/roof segments**

![Box plot showing wall thickness comparison](image)

**Posterior/inferior segments**

![Box plot showing wall thickness comparison](image)
**EPICARDIAL MAPPING OF SPONTANEOUS ATRIAL EXTRASYSTOLES**

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**Purpose:**
Atrial extrasystoles (AES) may trigger episodes of atrial fibrillation (AF) and provoke conduction disorders. However, the impact of AES on epicardial unipolar electrogram (EGM) characteristics and morphology is unknown. Therefore, the goal of this study was to examine the impact of spontaneous AES on potential amplitude, -type (single-, double-, fractionated), relative R- and S-wave amplitudes, conduction velocity and conduction disorders, and to correlate these differences with mapping locations and type of AES.

**Methods:**
Intra-operative epicardial mapping (interelectrode distance 2mm) of the right and left atrium (RA, LA), Bachmann's Bundle (BB) and pulmonary vein area (PVA) was performed during sinus rhythm (SR) in 34 patients (26 male, 66±11 years). AES were classified as premature, aberrant or prematurely aberrant. EGM characteristics were quantified during SR and AES, and subsequently compared.

**Results:**
During 67 AES (17 premature, 26 aberrant and 24 prematurely aberrant), potential amplitudes and conduction velocity decreased (5.51 [2.96–8.96] mV vs. 4.05 [2.12–7.16] mV, p<0.001; 94.4 [72.1–114.5] cm/s vs. 86.1 [58.6–111.8] cm/s, p<0.001; respectively), whereas the amount of fractionation, low voltage area and conduction delay and -block increased compared to SR (12.2 [3.7–22.7] % vs. 28.3 [13.9–44.2] %, p<0.001; 1.60 [0.00–4.79] % vs. 4.24 [1.24–11.41] %, p<0.001; 2.34 [0.39–3.78] % vs. 4.40 [2.63–7.74] %, p<0.001; 0.68 [0.00–2.80] % vs. 3.13 [0.92–6.14] %, p<0.001; respectively). Relative R- and S-wave amplitudes decreased (2.11 [1.00–3.61] mV vs. 1.44 [0.53–2.94] mV, p<0.001; 3.51 [1.72–5.68] mV vs. 3.30 [1.70–5.40] mV, p<0.001; respectively) resulting in an increased S-predominancy. The most pronounced differences were found at BB and PVA. In addition, the effect of the types of AES differed (prematurely aberrant>aberrant>premature), although the impact of prematurely aberrant AES was larger compared to the others.

**Conclusion:**
Intra-operative high-resolution epicardial mapping demonstrated that EGM characteristics are mainly affected by prematurely aberrant AES, particularly at BB and the PVA.
DIFFERENCES IN TREATMENT AND OUTCOMES IN RECENTLY DIAGNOSED ATRIAL FIBRILLATION BETWEEN THE NETHERLANDS AND BELGIUM: RESULTS FROM THE GARFIELD-AF REGISTRY.

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Purpose:
The uptake rate of non-vitamin K oral anticoagulants (NOAC) for the treatment of non-valvular atrial fibrillation (AF) differed greatly between the Netherlands (NL) and Belgium (BE). The effect of these differences on thromboembolism (TE) and bleeding are yet to be explored.

Methods:
Dutch and Belgian data from the worldwide GARFIELD-AF registry was used. Patients with new-onset AF and at least one investigator-determined risk factor for stroke were included between 2010-2016. Event rates from two years of follow-up were used.

Results:
In total, 1186 and 1705 patients were included in NL and BE, respectively. Female sex (42.3% vs 42.2%), mean age (70.7 vs 71.3 years), CHA2DS2-VASc (3.1 vs 3.1) and HAS-BLED score (1.4 vs 1.5) were comparable between NL and BE, respectively. In NL and BE, mean INR was 2.9 (±1.0) and 2.4 (±1.0), respectively. Overall, at diagnosis in NL vs BE 72.1% vs 14.6% received vitamin K antagonists (VKA), 17.8% vs 65.5% NOACs and 4.8% vs 10.6% antiplatelet monotherapy, varying across cohorts (Figure 1).

Event rates per 100 patient-years in NL and BE, respectively, of all-cause mortality (3.38 vs 3.90; hazard ratio (HR) 0.86 [0.65-1.15]), ischemic stroke/TE (0.82 vs 0.72; HR 1.14 [0.62-2.11]) and major bleeding (2.06 vs 1.54; HR 1.33 [0.89-1.99]) did not differ significantly.

Conclusion:
In GARFIELD-AF, despite similar characteristics, patients were treated distinctly different with predominantly VKA vs NOAC in NL and BE, respectively. Although the rate of major bleeding was 33% higher in NL, variations in bleeding, mortality and TE rates were not statistically significant.
Figures:
Figure 1 Changes in oral anticoagulation (OAC) in NL and BE.
THE PULMONARY VEIN ABLATION VERSUS AMIODARONE IN THE ELDERLY (PAVANE) RANDOMIZED CONTROLLED TRIAL

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Purpose:
Despite the age-dependency, elderly atrial fibrillation (AF) patients have been excluded from catheter ablation trials thus far. The purpose is to determine short- and long-term outcomes of Pulmonary Vein Isolation (PVI) compared to amiodarone in patients ≥70 years with symptomatic, paroxysmal AF.

Methods:
Two-center, prospective, randomized, open-label trial, with follow-up after 1 and 5 years. The intervention-group (n=24) underwent point-by-point PVI. The control-group (n=21) received amiodarone 200 mg dd after a loading regime. Intention-to-treat (ITT) and per-protocol (PP) analyses were conducted. The primary endpoint is AF-recurrence. Secondary endpoints are a composite safety endpoint and difference in EHRA-class after treatment.

Results:
Patients (mean age 77 years) were enrolled from August 2011 to October 2014, of which 43 were included in the 1-year and 40 in the 5-year follow-up. Due to side effects, 29% and 48% stopped amiodarone within 1 and 5 years, respectively. The 1-year AF-free survival rate (ITT) was 74% in the amiodarone and 62% in the PVI group (HR 1.29 [95%CI:0.56-2.95]). The 5-year AF free survival after the last PVI was 62%, compared to 42% in the amiodarone-group (HR 0.66 [95%CI:0.27-1.66]). Two subjects in the amiodarone and 6 in the PVI-group encountered the safety endpoint (PP) (HR 0.72 [95%CI:0.33-1.56]). Median EHRA-class (PP) equally decreased after treatment (p<0.05).

Conclusion:
Contrary to data from trials in young patients, long- and short-term outcomes after PVI or amiodarone-treatment do not differ among elderly. The amiodarone stopping rate due to side effects is high; however, when endured, it is equally effective as PVI.
OUTCOMES FOR EDOXABAN- USERS WITH ATRIAL FIBRILLATION IN BELGIAN AND DUTCH CLINICAL PRACTICE: THE FIRST YEAR OF FOLLOW-UP OF ETNA-AF-EUROPE

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Purpose:
Previous analyses of Edoxaban Treatment in routiNe clinical prActice for patients with Atrial Fibrillation in Europe (ETNA-AF-Europe) show that the patients from Belgium and the Netherlands (BeNe) were less often (1) initiated on 30 mg edoxaban, and (2) previously diagnosed with hypertension and/or diabetes mellitus than those from the other European countries. It is unclear how these baseline differences affect thromboembolism and bleeding rates during follow-up.

Methods:
With data from the first of four years follow-up from ETNA-AF-Europe, a large prospective observational study, we compared rates of bleeding, thromboembolism, and death of patients from BeNe with those from the entire European ETNA-AF cohort (EC).

Results:
Of all 13092 (93.6% of all enrolled patients) with a complete dataset, 2533 were from BeNe. In total, 70 (2.9%/year) patients in BeNe experienced a major or clinically relevant non-major bleed compared with 293 (2.4%/year) in EC, 12 (0.5%/year) and 30 (0.2%/year) of which were intracranial haemorrhages, respectively. In BeNe, 26 (1.1%/year) patients developed a stroke or systemic embolism vs. 103 (0.8%/year) in EC. Seventy-one (2.9%/year) patients died during follow-up in BeNe, compared with 442 (3.4%/year) in EC.

Conclusion:
Rates of thromboembolism, bleeding, and death were low in unselected patients with atrial fibrillation on edoxaban. Thromboembolisms and bleeds, but not all-cause deaths, were numerically more often reported in BeNe than in EC. Therefore, the differences in baseline characteristics between both regions had a limited effect on clinical outcomes.
Figures:
Title: Outcomes during the first year of follow-up in ETNA-AF-Europe
Subtext: CRNM clinically relevant non-major; ICH intracranial haemorrhage; GI gastrointestinal; S/SE composite of any stroke and systemic embolism; MI myocardial infarction; CHF congestive heart failure

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Belgium and the Netherlands</th>
<th>Europe</th>
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<tbody>
<tr>
<td></td>
<td>Any dose</td>
<td>60 mg</td>
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<tr>
<td>No. of patients</td>
<td>(N %)</td>
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</tr>
<tr>
<td>Major</td>
<td>25 (1.0)</td>
<td>22 (1.1)</td>
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<tr>
<td>Major:CRNM</td>
<td>70 (2.9)</td>
<td>58 (2.8)</td>
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<tr>
<td>ICH</td>
<td>12 (0.5)</td>
<td>10 (0.5)</td>
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<tr>
<td>Major:CRNM GI</td>
<td>28 (1.2)</td>
<td>24 (1.2)</td>
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<tr>
<td>Thromboembolism - N (%/year)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S/SE</td>
<td>26 (1.1)</td>
<td>23 (1.1)</td>
</tr>
<tr>
<td>Any stroke</td>
<td>25 (1.0)</td>
<td>22 (1.1)</td>
</tr>
<tr>
<td>Ischemic stroke</td>
<td>17 (0.7)</td>
<td>15 (0.7)</td>
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<tr>
<td>Any MI</td>
<td>15 (0.6)</td>
<td>12 (0.6)</td>
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<tr>
<td>Death - N (%/year)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All cause</td>
<td>71 (2.9)</td>
<td>50 (2.4)</td>
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<tr>
<td>Cardiovascular</td>
<td>12 (0.5)</td>
<td>10 (0.5)</td>
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<tr>
<td>Other - N (%/year)</td>
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<tr>
<td>Hospitalisation</td>
<td>442 (20.3)</td>
<td>377 (20.4)</td>
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<tr>
<td>CHF</td>
<td>41 (1.7)</td>
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Session 4: General cardiology

SEDENTARY BEHAVIOUR IN CARDIOVASCULAR DISEASE PATIENTS: RISK FACTOR IDENTIFICATION AND THE IMPACT OF CARDIAC REHABILITATION

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Purpose:
Cardiovascular disease (CVD) patients typically report low physical activity levels. Therefore sedentary behaviour (SB) is potentially an important target to improve survival and to reduce recurrence risk. In this study we (1) compared SB between CVD patients and age-matched controls, (2) identified characteristics associated with high levels of SB, and (3) determined impact of cardiac rehabilitation on SB.

Methods:
131 CVD patients and 117 healthy controls were recruited to compare objectively measured SB characteristics. Subsequently, 2,584 patients completed a questionnaire to identify determinants of high SB (>8 hrs/day). Ultimately, SB was examined before, after and 2-months after cardiac rehab among 131 CVD patients using an accelerometer.

Results:
First, patients spent 10.4 hrs/day (Q25 9.5; Q75 11.2) sedentary which was higher compared to controls (9.4 hrs/day, Q25 8.4; Q75 10.3, P<0.001). Second, a greater odds for large amounts of sedentary time was found in patients being male, single or divorced, employed, physically inactive, reporting high alcohol consumption, and living in an urban environment. Finally cardiac rehab significantly reduced sedentary time (-0.4 hrs/day [95%CI -0.7; -0.1], P=0.005), but the magnitude of the effect attenuated 2-months after rehab (-0.3 hrs/day [95%CI -0.6; -0.03], P=0.03).

Conclusion:
CVD patients had greater amounts of objectively measured sedentary time compared to healthy controls. Sedentarism was associated with several personal- and lifestyle characteristics, but was independent of disease characteristics. Finally, participation in cardiac rehab only slightly reduced sedentary time. These data will contribute to tailored interventions targeting sedentary time in CVD patients, thereby leading to a lower risk for adverse outcomes.
LONG-TERM MONITORING OF ARRHYTHMIAS IN CARDIAC SARCOIDOSIS

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Purpose:
Cardiac sarcoidosis (CS) can lead to ventricular arrhythmias (VA), atrioventricular conduction block (AVB) and sudden cardiac death (SCD), but risk stratification is challenging. This study reports the incidence of arrhythmias and mortality in CS patients.

Methods:
A retrospective cohort study was performed in patients with extra-cardiac sarcoidosis diagnosed with CS in the St. Antonius Hospital, a tertiary referral center. After risk assessment for sudden cardiac death (SCD) (figure 1) an implantable cardioverter defibrillator (ICD) was implanted in patients considered to have a high risk for SCD and an internal loop recorder (ILR) or no device in patients with a low risk for SCD. Chart review was performed to assess the occurrence of VA, AVB, death, ICD therapy and device related complications.

Results:
From 108 of 115 patients diagnosed with CS between January 2014 and January 2019 complete follow-up was available. Sixteen high-risk patients received an ICD, in two patients because of secondary prevention based on VA. In 80 of 92 low risk patients, an ILR was implanted. During a mean follow-up of 31 ± 15 months, 9 out of 80 ILR patients (11.3%) received an ICD of whom 7 (8.8%) due to arrhythmias: VA in 5 patients, AVB in 2 patients. Five out of 25 ICD patients (20%) experienced sustained VT: spontaneous termination in 3 patients and successfully treated with anti-tachycardia pacing in 2 patients (8%). Two ICD patients experienced a mild pocket infection. Two deaths occurred in the low-risk patients: 1 non-cardiac death and 1 SCD due to asystole.

Conclusion:
Sustained VT occurred in 20% of high-risk CS patients and 8% received appropriate ICD therapy. In low-risk ILR patients 9% developed an indication for ICD implantation due to detection of arrhythmias.
Figures:
Flowchart for risk stratification for SCD
A NEW PREDICTION MODEL FOR SUDDEN CARDIAC DEATH (SCD) IN ARRHYTHMOGENIC RIGHT VENTRICULAR CARDIOMYOPATHY (ARVC)

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Purpose:
ARVC is one of the most common causes of SCD in young people. A recently published model predicts incident sustained ventricular arrhythmia (VA) in ARVC patients but this surrogate outcome overestimates the risk of SCD. The purpose of this study was to specifically predict life-threatening VA (LTVA: SCD, aborted SCD, sustained or ICD treated VT>250 bpm or VF).

Methods:
In a retrospective cohort of definite ARVC patients from 13 centers in North America and Europe we tested the association between 8 candidate predictors at diagnosis [sex, age, prior sustained VA (≥30s, hemodynamically unstable or ICD treated VT; or aborted SCD), syncope, 24-hour premature ventricular contractions (PVC) count, number of anterior and inferior leads with T-wave inversion (TWI), left and right ventricular ejection fraction] and LTVA in follow-up by Cox regression. The model was internally validated using bootstrapping.

Results:
We included 864 definite ARVC patients (40±16 years; 53% male). Over 5.75 years [IQR 2.77, 10.58] of follow-up, 93 (10.8%) patients experienced LTVA. Of the 8 predictors, only 4 were associated with LTVA (Figure 1, Panel A). Notably, prior sustained VA did not predict subsequent LTVA (p=0.850). The model had an optimism-corrected C-index of 0.74 (95%CI:0.69-0.80) and calibration slope of 0.95 (95%CI:0.94-0.98) with good concordance between predictions and observations (Figure 1 Panel B). Setting an ICD implantation threshold at 4% risk per the model would result in a number of ICD needed to treat one patient with LTVA of 7 at 5-years.
Conclusion:
LTVA events can be accurately predicted by a novel prediction model using only 4 clinical predictors that can be used in all definite ARVC patients to facilitate shared decision-making for ICD implantation.

Figures:
IMPROVING HEART FAILURE PATIENTS’ VALUE BY IMPLEMENTING VALUE BASED HEALTHCARE PRINCIPLES IN THE FULL CYCLE OF CARE

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Purpose:
Heart Failure (HF) is a global epidemic with a high impact on both patient relevant outcomes and healthcare costs. Based on Value Based Healthcare (VBHC) principles, collaboration in the full cycle of care is expected to improve patient relevant outcomes and reduce healthcare costs. This study aims to assess the added value of collaboration (ie. shared care pathways, shared outcome measures, and shared protocols) between healthcare providers in the total HF-care delivery value chain on both outcomes and costs.

Methods:
This study assesses outcomes (ie. NYHA class, (re)admissions, left ventricle ejection fraction (LVEF) and cardiovascular death) and healthcare costs (ie. specialist care, pharmacy, and primary care) in hospitals within the Netherlands Heart Network. Data was collected at baseline and 12 months in a retrospective cohort (2013-2015) and a prospective cohort (2018-onwards) by HF-nurses and insurance company CZ. Regression analyses were performed to assess differences between the retrospective and prospective cohorts on outcomes and costs.

Results:
A total of 398 HF-patients were included in the retrospective cohort, and 525 in the prospective cohort. After 12 months of follow-up HF-patients in the prospective cohort indicated better NYHA class ($B=-0.28; p=0.03$), better LVEF ($B=4.65; p=0.01$) and less deceased HF-patients ($B=0.31; p<0.01$), compared to the retrospective cohort. Due to decreased (re)admission rates, healthcare costs were lower in the prospective cohort in comparison to the retrospective cohort.

Conclusion:
The applied VBHC-strategy in the total HF-care delivery value chain seems a (cost-)effective approach in the field of HF-care. However, further research is advised to assess long-term outcomes and healthcare costs.
MODIFIED ESC/ERS GUIDELINES RISK ASSESSMENT IMPROVES MORTALITY PREDICTION IN PATIENTS WITH PULMONARY ARTERIAL HYPERTENSION AND CONGENITAL HEART DISEASE

A.C. van Dissel (Amsterdam UMC locatie AMC, Amsterdam); M. D’Alto (Monaldi Hospital, Naples), A. Farro (Monaldi Hospital, Naples), H. Mathijssen (St. Antonius Hospital, Nieuwegein), M. Post (St. Antonius Hospital, Nieuwegein), Pier P. Bassareo4, A.P.J. Van Dijk (RadboudUMC, Nijmegen); A.L. Duijnhouwer (RadboudUMC, Nijmegen); B.J.M. Mulder (AmsterdamUMC - location AMC, Amsterdam); B.J. Bouma (AmsterdamUMC - location AMC, Amsterdam)

Purpose:
Current European pulmonary arterial hypertension(PAH) guidelines advocate a goal-oriented treatment approach based on a comprehensive risk assessment. We investigated the discriminatory ability of this risk assessment instrument and explored to improve its predictability for the PAH-CHD population.

Methods:
233 patients (41±16 years, 66% female, 26% pretricuspid-, 31% posttricuspid- and 43% complex shunt) were enrolled from five PAH-CHD expert centres. Patients were classified as ‘Low’, ‘Intermediate’, or ‘High’ risk at baseline visit and follow-up within 6-12 months, using N-terminal pro-brain natriuretic peptide (NT-proBNP), 6-minute walk distance (6MWD), functional class and imaging parameters.

Results:
Using the guidelines instrument, survival did not differ between the three risk groups (P=n.s.). This was mostly due to skewed risk group distribution. A modified instrument based on tertiles and logistic regression analysis included different cut-off values for ‘Lower risk’ of NT-proBNP and 6MWD (i.e., ‘Low’, ‘Intermediate’, ‘High’ as <500, 500-1400, >1400 ng/l and >400m, 165-400m and <165m, respectively) and use of tricuspid annular plane systolic excursion (TAPSE; ‘Low’, ‘Intermediate’, ‘High’ as >2.0, 1.6-2.0 and <1.6cm) instead of right atrial area. The modified instrument reclassified 58 (25%) patients and significantly improved discrimination between the risk groups (Figure 1A, P<0.01). Improvement to a ‘Low risk’ profile at follow-up provided improved survival comparable to survival of patients who remained in the ‘Low risk’ group (Figure 1B).

Conclusion:
We propose a modified version of the guidelines risk assessment instrument, with different NT-proBNP and 6MWD cut-offs and TAPSE, with improved discrimination in PAH-CHD. Our findings support the aim of reaching a Low risk profile.
Figures:
Survival using the new proposed risk instrument,
(A) survival at baseline,
(B) difference in risk group change from baseline to follow-up.

![Graph A: Survival rates over follow-up years](image1)

![Graph B: Number at risk over follow-up years](image2)
IMPACT OF COMORBIDITIES, MEDICATION ADHERENCE AND SEX DIFFERENCES ON OUTCOME IN 25,776 HEART FAILURE PATIENTS: A HEALTH INSURANCE CLAIMS DATABASE STUDY.

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Purpose:
Clinical trials in chronic heart failure (CHF) usually include a selected group of patients, which are predominantly male. In contrast, health insurance claims databases might capture the unselected population of patients. We aimed to study the relationship between comorbidities, medication adherence and sex differences on prognosis in a claims database.

Methods:
The Achmea health insurance claims database covers ~30% of the Dutch population. We analysed patients aged 18-85 years with CHF between 2012-2014 using multivariable cox regression. Primary endpoint (PE) was all-cause mortality or HF hospitalisation after 2015.

Results:
We analysed 25,776 CHF patients. Median follow-up time was ~3.3 years (Interquartile Range[IQR] 2.2-3.3). Median age was 74 years (IQR 66-80) and 44% were women. Women had a better prognosis in relation to the PE than men (31.8% vs. 35.1%; adjusted Hazard Ratio[aHR] 0.80, 95% Confidence Interval: 0.77-0.84). Figure shows most relevant predictors. Certain comorbidities had a stronger association in women than in men: renal insufficiency (aHR 1.61 vs. 1.41, P=0.018), chronic obstructive pulmonary disease/asthma (aHR 1.58 vs. 1.39, P=0.011) and diabetes mellitus 1/2 (aHR 1.44 vs. 1.26, P=0.004). Overall, non-adherence to disease modifying drugs (except beta-blockers) was associated with increased incidence of the PE, although not different between sexes.

Conclusion:
In a large population-based CHF cohort with a high percentage of females, we demonstrated that men had a higher incidence of mortality and HF hospitalisation during a 3 year follow-up. Comorbidities seem to have a greater impact on prognosis in women. Medication adherence in relation to the PE was not different between sexes.
Figures:
Coefficient plot of hazard ratio's with corresponding 95% confidence intervals. Overall results are based on a single multivariable cox regression analysis with 27 variables (including sex) in relation to the primary endpoint. Potential effect modification by sex was assessed by including an interaction term between sex and the variable of interest in separate multivariable cox regression analyses.
ACE-i, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; COPD, chronic obstructive pulmonary disease; MRA, mineralocorticoid receptor antagonist. Significant P-values are in bold.
22Q11.2 DELETION SYNDROME IN ADULT PATIENTS WITH TETRALOGY OF FALLOT OR PULMONARY ATRESIA WITH VENTRICULAR SEPTAL DEFECT: LONG-TERM FOLLOW-UP SHOWS INCREASED MORTALITY

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Purpose:
22q11.2 Deletion syndrome (22q11.2DS) is common in patients with tetralogy of Fallot (TOF) or pulmonary atresia with ventricular septal defect (PA/VSD) and is associated with worse outcomes in children. Whether this impaired prognosis also translates into adulthood is unknown, as data in adult patients with 22q11.2DS are limited. We aimed to compare long-term outcomes in adults with TOF or PA/VSD both with and without 22q11.2DS.

Methods:
This study prospectively followed a nationwide multicenter cohort of TOF or PA/VSD patients from inclusion in the Dutch national CONCOR registry for adults with congenital heart disease (CHD) onward. The presence or absence of 22q11.2DS was genetically confirmed in all patients. Outcome measures included all-cause mortality, cardiac mortality, need for pulmonary valve replacement (PVR), ventricular arrhythmias (VA), pacemaker implantation, and ICD implantation.

Results:
In total, 479 patients were included (277 (58%) male, median age 28[IQR;21-37] years, 62(13%) with PA/VSD, 34(7%) with 22q11.2DS). During a median follow-up of 11[IQR;6-13] years, 52(11%) patients died (8 with 22q11.2DS and 44 without 22q11.2DS). Patients with 22q11.2DS had significantly worse survival after 12 years (76%) compared to patients without 22q11.2DS (89%, p=0.008, Figure 1). 22q11.2DS was associated with increased risk for all-cause mortality and cardiac-mortality, independent of age, sex, and PA/VSD. No association was found between 22q11.2DS and late complications including PVR, VA, pacemaker or ICD implantation.

Conclusion:
Adults with TOF or PA/VSD with 22q11.2DS have a significantly worse survival than adults without this deletion. In patients with TOF or PA/VSD, genetic analysis for the presence of 22q11.2DS is important for risk stratification and genetic counseling.
Figures:
Figure 1: All-cause mortality in patients with and without 22q11.2DS

![Survival curve](image)

- No 22q11.2DS
- 22q11.2DS

\[ p = 0.0082 \]
Session 5: Interventional cardiology

SAFETY AND EFFICACY OF THE STARSYSTEM™ TO REDUCE RADIATION EXPOSURE DURING CORONARY ANGIOGRAPHY FOR THE CARDIOLOGIST AND NURSING STAFF.

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Purpose:
With an increase of cardiac procedures on cardiac catheterization laboratories (CCL) it is important to reduce the amount of radiation exposure to cardiologists, cardiac catheterization nurses (CCL-nurses) and other personnel. One of the possible ways to reduce radiation exposure is the STARSystem™ from Adept Medical. This system has a layer of lead incorporated in the system (STARTable Shield™) meant to reduce radiation exposure to the caregivers. There is no research to support this claim in daily operations on the CCL. Independent of the manufacturer we measured the radiation exposure (µGy/h) in four different configurations to examine this claim.

Methods:
Using a X-Ray system from Philips (Allura Clarity™) we have simulated a patient situation with a ct-torso-fantoom-ctu-41. We have set up two dosimeters (at eye-level) at the locations where the cardiologist and the CCL-nurse stand during the examination/intervention. We removed all other protective measures so we only measured the effect of the STARSystem™. We measured the radiation dose from seven different angles (field of view 20 cm, normal quality, 15 FPS) during ten seconds, resembling a diagnostic coronary angiography. The measurement was repeated five times in four different configurations: without protective measures (1), RADPAD™ (2), STARSystem™ (3) and a combination of RADPAD™ and STARSystem™ (4).

Results:
Using the STARTable Shield™ reduced the radiation exposure with 31% for the cardiologist and with 36% for the CCL-nurse. While using the RADPAD™ the radiation exposure reduced with 21% for the cardiologist and 13% for the CCL-nurse. Combining both products gave a total reduction of 47% and 43% for the cardiologist and CCL-nurse.

Conclusion:
Both the RADPAD™ and the STARSystem™ gave a reduction in radiation exposure. Using both systems simultaneous gave an even greater reduction but less than the sum of both parts. It can also be appreciated that the RADPAD™ seems to protect the cardiologist a bit more and the STARTable™ appears to protect the CCL-nurse more. Although using both is definitely generating the greatest protection.

Further research is needed to verify these finding in more real life applications, such as during percutaneous coronary interventions of chronic total occlusions. Or perhaps even during implantations of cardiac resynchronisation devices, because of the increased fluoroscopy time during these procedures.
Figures:
Measurements total radiation dose during four configurations for cardiologist and CCL-nurse (µGy/h).
AGING INCREASES THE PLAQUE INSTABILITY IN NON-ISCHEMIC NON-CULPRIT LESIONS OF DIABETIC PATIENTS – DATA FROM COMBINE OCT-FFR STUDY

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Purpose:
The aim of this study was to investigate the age-related occurrence of vulnerable and unstable plaques within non-ischaemic, non-culprit coronary arteries in diabetes mellitus (DM) patients.

Methods:
All patients of the COMBINE (FFR-OCT) trial underwent fractional flow reserve (FFR) measurement. OCT (optical coherence tomography) analysis of the FFR-negative lesions identifies plaque morphology: the presence of thin-cap fibroatheroma (TCFA), plaque erosion (PE), plaque rupture (PR) and calcified nodule (CN). The present analysis reports the plaque morphology respectively in young (≤75 years) vs. old (>75 years) DM patients.

Results:
OCT was performed in 463 lesions of 391 patients, of which 100 lesions assessed in young and 363 lesions in old DM patients. The median FFR value was 0.88 in both groups (p=0.448). There were no significant differences in quantitative parameters. The patients >75 years have wider calcium arc 174 (98-284)° vs. 133 (77-225)°, p=0.004 and a higher rate of protruding calcium plaque 52 (52%) vs. 147 (41%), p=0.040 than patients ≤75 years, respectively. The frequency of PR and thrombotic CN was higher among old vs. young patients: 17 (17%) vs. 34 (9%) p=0.031 and 14 (14%) vs. 22 (6.1%) p=0.009, respectively. However, the prevalence of TCFA and PE did not differ between old vs. young subgroup: 26 (26%) vs. 69 (19%), p=0.125 and 5 (5%) vs 15 (4.1%) p=0.705, respectively.

Conclusion:
Non-ischemic lesions in elderly (>75 years) DM patients present larger and more protruding calcified plaques including more thrombotic CN and PR than in the young subgroup. The prevalence of vulnerable and eroded plaques was the same.
TIMING OF PERCUTANEOUS CORONARY INTERVENTION IN RELATION TO MORTALITY IN A SINGLE CENTER COHORT OF PATIENTS WITH NON-ST-ELEVATION MYOCARDIAL INFARCTION

N.D. Fagel (OLVG Amsterdam); F. Gescher (OLVG Amsterdam); T. Rabbering (OLVG Amsterdam); E.C. Verbeek (OLVG Amsterdam); M.A. Vink (OLVG Amsterdam); T. Slagboom (OLVG Amsterdam); R.J. van der Schaaf (OLVG Amsterdam); J.P.R. Herrman (OLVG Amsterdam); M.S. Patterson (OLVG Amsterdam); N.S. Vos (OLVG Amsterdam); R.K. Riezebos (OLVG Amsterdam); G. Amoroso (OLVG Amsterdam)

Purpose:
For intermediate and high risk non-ST-elevation myocardial infarction (NSTEMI) patients, an early invasive strategy is advised. For most patients percutaneous coronary intervention (PCI) is the preferred revascularization strategy. However, the optimal timing of invasive treatment is still matter of debate.

Methods:
This retrospective cohort study was performed in a single high-volume PCI center in Amsterdam, The Netherlands, with support from NHR (Nederlandse Hart Registratie). Intermediate to high risk NSTEMI patients that were admitted between January 2016 and December 2017 and underwent PCI treatment during hospitalization were included in the analysis. Global Registry of Acute Coronary Events (GRACE)-risk score was calculated for all patients. The main determinant was timing of PCI, categorized in different time windows (<24 hours, 24-72 hours, 72 hours-7 days or >7 days). Primary outcome was 1-year mortality and secondary outcome was admission-to-death time.

Results:
A total of 848 patients were included for analysis. The admission to PCI time was <24 hours in 145 (17%) patients, 24-72 hours in 192 (23%) patients, 72 hours-7 days in 275 (32%) patients and >7 days in 236 (28%) patients. Compared to the >7 days category, the 1-year mortality was significantly lower in the 24-72 hours category (OR=0.36; 95% CI=0.14-0.90) and admission-to-death time was significantly longer in the 24-72 hours and 72 hours-7 days categories (HR=0.40; 95% CI=0.20-0.79, HR=0.59; 95% CI=0.35-0.97). For the group of high-risk patients 1-year mortality rate was similar across all time intervals.

Conclusion:
In this study, PCI within 24-72 hours shows to be superior compared to PCI performed >7 days after admission in terms of 1-year mortality and survival in the total study population. PCI was performed >72 hours after admittance in 60% of this study cohort.
Abstract sessies NVVC Voorjaarscongres
Donderdag 16 april 2020
16.45 – 18.00 uur

Figures:
*N.A. = not applicable. The 1-year mortality for this category was zero, thus no reliable odds ratio could be estimated.
1=adjusted for age, sex, left ventricular ejection fraction (LVEF), chronic kidney disease (CKD), GRACE risk score and transfer status.
2=adjusted for age, sex, left ventricular ejection fraction (LVEF), chronic kidney disease (CKD), GRACE risk score, transfer status and diabetes mellitus.

<table>
<thead>
<tr>
<th>Category</th>
<th>Total No (%)</th>
<th>Deceased No (%)</th>
<th>Total Crude OR (95% CI)</th>
<th>Adjusted OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total population</strong></td>
<td>848 (17.1)</td>
<td>56 (6.6)</td>
<td>0.27 (0.10-0.70)</td>
<td>0.37 (0.12-1.11)</td>
</tr>
<tr>
<td>&lt;24 hours</td>
<td>145 (17.1)</td>
<td>5 (3.4)</td>
<td>0.27 (0.10-0.70)</td>
<td>0.37 (0.12-1.11)</td>
</tr>
<tr>
<td>24-72 hours</td>
<td>192 (22.6)</td>
<td>8 (4.2)</td>
<td>0.32 (0.14-0.73)</td>
<td>0.36 (0.14-0.90)</td>
</tr>
<tr>
<td>72 hours-7 days</td>
<td>275 (32.4)</td>
<td>15 (5.5)</td>
<td>0.43 (0.22-0.82)</td>
<td>0.55 (0.27-1.11)</td>
</tr>
<tr>
<td>&gt;7 days*</td>
<td>236 (27.8)</td>
<td>28 (11.9)</td>
<td>1 (Ref)</td>
<td>1 (Ref)</td>
</tr>
<tr>
<td><strong>Intermediate risk</strong></td>
<td>480 (10.0)</td>
<td>12 (2.5)</td>
<td>N.a.*</td>
<td>N.a.*</td>
</tr>
<tr>
<td>&lt;24 hours</td>
<td>100 (20.8)</td>
<td>0 (0.0)</td>
<td>N.a.*</td>
<td>N.a.*</td>
</tr>
<tr>
<td>24-72 hours</td>
<td>125 (26.0)</td>
<td>2 (1.6)</td>
<td>0.27 (0.05-1.38)</td>
<td>0.23 (0.03-1.54)</td>
</tr>
<tr>
<td>72 hours-7 days</td>
<td>164 (34.2)</td>
<td>5 (3.0)</td>
<td>0.57 (0.16-1.98)</td>
<td>0.51 (0.13-1.99)</td>
</tr>
<tr>
<td>&gt;7 days</td>
<td>91 (19.0)</td>
<td>5 (5.5)</td>
<td>1 (Ref)</td>
<td>1 (Ref)</td>
</tr>
<tr>
<td><strong>High risk</strong></td>
<td>318 (12.9)</td>
<td>41 (13.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;24 hours</td>
<td>42 (13.2)</td>
<td>5 (11.9)</td>
<td>0.64 (0.23-1.80)</td>
<td>0.69 (0.20-2.36)</td>
</tr>
<tr>
<td>24-72 hours</td>
<td>64 (20.1)</td>
<td>6 (9.4)</td>
<td>0.51 (0.19-1.32)</td>
<td>0.45 (0.15-1.31)</td>
</tr>
<tr>
<td>72 hours-7 days</td>
<td>92 (28.9)</td>
<td>9 (9.8)</td>
<td>0.51 (0.22-1.19)</td>
<td>0.45 (0.22-1.31)</td>
</tr>
<tr>
<td>&gt;7 days</td>
<td>120 (37.7)</td>
<td>21 (17.5)</td>
<td>1 (Ref)</td>
<td>1 (Ref)</td>
</tr>
</tbody>
</table>

(OR = odds ratio, CI = confidence interval, Ref = reference category)
IMPORTANCE OF CONFIRMING THE UNDERLYING DIAGNOSIS IN PATIENTS WITH MYOCARDIAL INFARCTION AND NON-OBSTRUCTIVE CORONARY ARTERIES (MINOCA): A SINGLE-CENTRE EXPERIENCE

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Purpose:
Many patients with myocardial infarction with non-obstructive coronary arteries (MINOCA) are discharged without a clear aetiology for their clinical presentation. This study sought to assess the influence of ‘Indeterminate MINOCA’ on future cardiovascular events and recurrent presentations at the cardiac emergency department (CED).

Methods:
We retrospectively analysed all MINOCA patients that were hospitalised from January 2017 until April 2019 and met the diagnostic criteria of MINOCA. They were divided into the 1) ‘Indeterminate MINOCA’, and 2) ‘MINOCA with diagnosis’ group.

Results:
In 63 (31.8%) of the 198 MINOCA patients, a conclusive diagnosis was found (confirmed myocardial infarction, (peri)myocarditis, cardiomyopathy, or miscellaneous). MINOCA patients with diagnosis were younger (56.8 vs. 62.3 years, p<0.001), had higher maximum troponin-T [243ng/L vs. 68ng/L, p<0.001] and creatine kinase (CK) [214U/L vs. 150U/L, p=0.005], and presented more frequently with electrographic signs of ischaemia (71.4% vs. 46.7%, p=0.001). Indeterminate MINOCA patients had more recurrent CED presentations (36.3% vs. 21.2%, p=0.045). After survival analysis, only a trend was observed (Figure 1). The occurrence of cardiovascular events was not different (7.9% vs. 8.1%, p=0.96). Lower age, the absence of previous acute myocardial infarction, ST-segment changes, reduced ejection fraction, higher CK and troponin-T levels, and performing additional non-invasive imaging were significant predictive factors for finding an underlying cause for the MINOCA event.

Conclusion:
In only a quarter of the MINOCA patients, a conclusive diagnosis for the acute presentation was found. If the underlying diagnosis was unknown, significantly more recurrent presentations at the CED were observed. This might negatively influence quality-of-life in these patients.
Figures:
Figure 1. Survival curve of recurrent presentations at the Cardiac Emergency Room.
GENDER DISPARITIES IN PATIENTS WITH OHCA WITHOUT ST-SEGMENT ELEVATION: A SUBSTUDY OF THE COACT TRIAL

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Purpose:
Gender disparities in a population of OHCA remains rather unclear. The aim of this study is to evaluate coronary angiography treatment strategy and survival after one-year survival.

Methods:
Using the randomized-controlled COACT-database, we evaluated gender differences in a population of patients successfully resuscitated after OHCA without STEMI and the effect of immediate coronary angiography on survival at one year.

Results:
In total, 522 patients were included in the current analysis, of whom 413 (79%) were men. Among patients who underwent coronary angiography, men had more frequent significant CAD (37.0% vs. 71.3%; p<0.001) and more severe (1-vessel disease 18.5% vs. 29.8%; 2-vessel disease 9.9% vs. 23.1%; 3-vessel disease 8.6% vs. 18.4%; p<0.001) compared to women. Additionally, revascularization was more often performed in men (14.6% vs. 38.0%; p<0.001). Overall, one-year survival rate was 59.6% in women and 63.4% in men (HR 0.85; 95% confidence interval [CI]: 0.55-1.31; p=0.47). In the immediate strategy, survival was 59.2% in women vs. 61.9% in men. In the delayed strategy, survival was 60.0% in women vs. 65.2% in men. In both men and women, immediate coronary angiography did not improve 1-year survival when compared to delayed angiography (OR 0.87; 95% CI 0.58-1.30; p=0.49; vs. OR 0.97; 95% CI 0.45-2.09; p=0.93; p-value for interaction=0.81).
Conclusion:
In patients with OHCA without STEMI, men were more likely to have significant CAD and undergo revascularization than their female counterparts, however both males and females did not benefit from a strategy of immediate coronary angiography strategy as compared to delayed angiography.

Figures:
Kaplan Meier estimates on survival for men and women

Hazard ratio 0.85 (95% CI 0.55-1.31); P=0.47
ONE-YEAR CLINICAL OUTCOMES OF POLYMER-FREE AMPHILIMUS-ELUTING STENT IMPLANTATION IN PATIENTS WITH DIABETES MELLITUS: THE RECRE8 DIABETES SUBSTUDY.

P.R. Stella (University Medical Center Utrecht, Utrecht); N.D. van Hemert (University Medical Center Utrecht, Utrecht); R. Rozemeijer (University Medical Center Utrecht, Utrecht); M. Voskuil (University Medical Center Utrecht, Utrecht); M. Stein (Zuyderland Medical Center, Heerlen); P. Frambach (National Institute of Cardiac Surgery and Interventional Cardiology, Luxembourg); Z.H. Rittersma (University Medical Center Utrecht, Utrecht); A.O. Kraaijeveld (University Medical Center Utrecht, Utrecht); K. Tandjung (University Medical Center Utrecht, Utrecht); P. Agostoni (Hospital Network Antwerp Middelheim, Antwerp);

Purpose:
The number of patients with diabetes undergoing coronary stenting increases together with the incidence of diabetes. Still, there is no improvement of clinical outcomes in diabetic patients treated with new-generation drug-eluting stents. Debate remains whether diabetics require a specific stent-design. The polymer-free amphilimus-eluting stent represents a novel elution-technology with potentially enhanced clinical performance in diabetics. This sub-analysis of the ReCre8 trial assesses target-lesion failure (TLF) of a permanent-polymer compared to a polymer-free stent in a diabetic patient cohort.

Methods:
In this multicenter trial, patients were randomised to a permanent-polymer zotarolimus-eluting stent or polymer-free amphilimus-eluting stent after stratification for troponin-status and diabetes. The primary endpoint was one-year TLF.

Results:
20.4% (304) of 1491 randomised patients were diabetics. Overall, TLF was numerically higher in diabetics as compared to non-diabetics (5.6% vs. 3.5%; p=0.084) and insulin-dependent diabetics as compared to non-insulin-dependent diabetics (8.4% vs. 4.3%; p=0.14). Among the diabetic population, a higher rate of TLF (7.2% vs. 4.0%; p=0.21) and statistically significantly higher rate of net adverse clinical events (15.7% vs. 8.0%; p=0.035) was seen in patients with a permanent-polymer stent as compared to a polymer-free stent. Among insulin-treated diabetics, patients with the permanent-polymer as compared to the polymer-free stent had a higher incidence of TLF (14.9% vs. 2.1%; p=0.022) and net adverse clinical events (29.8% vs. 8.3%; p=0.009).

Conclusion:
Based on this analysis, diabetics could potentially benefit from a dedicated stent, especially in the subgroup of insulin-treated diabetics. Future larger sized trials should evaluate the potential benefit of a polymer-free stent in this patient population.
Abstract sessies NVVC Voorjaarscongres
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16.45 – 18.00 uur

Figures:
Figure 1: Target-lesion failure for PP-ZES and PF-AES in insulin-dependent diabetic patients; p=0.022. Abbreviations: PF-AES, polymer-free amohilimus-eluting stent; PP-ZES, permanent-polymer zotarolimus-eluting stent. Target-lesion failure was defined as a composite of cardiac death, target-vessel myocardial infarction and target-lesion revascularization.
CLINICAL OUTCOMES AFTER DUAL ANTIPLATELET THERAPY CESSION AT ONE MONTH AMONG TROPONIN NEGATIVE PATIENTS UNDERGOING PERCUTANEOUS CORONARY INTERVENTION: A SUBANALYSIS OF THE RECRE8 TRIAL.

M. Voskuil (University Medical Center Utrecht, Utrecht); N.D. van Hemert (University Medical Center Utrecht, Utrecht); M. Stein (Zuyderland Medical Center, Heerlen); P. Frambach (National Institute of Cardiac Surgery and Interventional Cardiology, Luxembourg); G.E.H. Leenders (University Medical Center Utrecht, Utrecht); Z.H. Rittersma (University Medical Center Utrecht, Utrecht); A.O. Kraaijeveld (University Medical Center Utrecht, Utrecht); K. Tandjung (University Medical Center Utrecht, Utrecht); P. Agostoni (Hospital Network Antwerp Middelheim, Antwerp); P.R. Stella (University Medical Center Utrecht, Utrecht).

Purpose:
Current guidelines recommend six months of dual antiplatelet therapy (DAPT) for patients undergoing elective percutaneous coronary intervention (PCI). This can be shortened or prolonged depending on individual patient characteristics. This subanalysis of the ReCre8 trial assessed the performance of a permanent polymer and polymer-free drug-eluting stent in troponin negative patients after DAPT cessation at one month.

Methods:
In the ReCre8 trial, patients undergoing PCI were stratified for troponin and diabetic status and randomised to receive a permanent polymer or polymer-free drug-eluting stent. Troponin negative patients were treated with one month of DAPT after which they continued with aspirin monotherapy. Endpoints included target-lesion failure, a composite of all net adverse clinical events and individual components of the endpoints and were assessed after DAPT cessation.

Results:
A total of 1491 patients were randomised of which 892 (59.8%) patients were troponin negative. Target-lesion failure between one and twelve months follow-up occurred in 4.1% in the permanent polymer stent group vs 4.7% in the polymer-free group (p=0.65). Stent thrombosis (definite or probable) occurred in 4 patients (0.9%) in the permanent polymer stent group and in 2 patients (0.4%) in the polymer-free group (p=0.40). There were no differences observed between the two stents for the separate endpoint components.

Conclusion:
Based on the results of this subanalysis, a short period of DAPT of only one month in troponin negative patients seems safe with a low rate of stent thrombosis in both study arms.
Figures:
Figure 1: Target-lesion failure for PP-ZES and PF-AES in troponin-negative patients; p=0.65. Abbreviations: PF-AES, polymer-free amohilimus-eluting stent; PP-ZES, permanent-polymer zotarolimus-eluting stent. Target-lesion failure was defined as a composite of cardiac death, target-vessel myocardial infarction and target-lesion revascularization.
Session 6: Heart failure

CLINICAL VALUE OF TUBULAR MAXIMUM PHOSPHATE REABSORPTION CAPACITY, A FUNCTIONAL PROXIMAL TUBULAR PARAMETER IN HEART FAILURE

J.E. Emmens (University Medical Center Groningen, Groningen); M.H. de Borst (University Medical Center Groningen, Groningen); Kevin Damman (University Medical Center Groningen, Groningen); A.A. Voors (University Medical Center Groningen, Groningen); J.M. ter Maaten (University Medical Center Groningen, Groningen)

Purpose:
Proximal tubular function plays a key role in sodium handling. Tubular maximum phosphate reabsorption capacity (TmP/GFR) has been proposed as a marker of proximal tubular function. We therefore studied the clinical value of TmP/GFR in patients with heart failure.

Methods:
We established TmP/GFR (Bijvoet-formula) in 2,085 heart failure patients from BIOSTAT-CHF and studied its association with worsening renal function (>25% eGFR decrease), development of tubular damage (plasma Neutrophil Gelatinase-Associated Lipocalin doubling between baseline–9 months), and clinical outcomes.

Results:
Low TmP/GFR (<0.80 mmol/L) was observed in 1,392 (67%) patients. Patients with lower TmP/GFR had more advanced heart failure, lower eGFR, and signs of increased tubular damage. Main determinants of lower TmP/GFR were higher fractional urea excretion and urea (P<0.001). In hierarchical cluster analysis, TmP/GFR was positioned with fractional sodium excretion. Reduced TmP/GFR was independently associated with increased risk of development of tubular damage (OR 2.20[1.05–4.66], P=0.038 per log decrease), but not with a decrease in eGFR (P=0.064). Lower TmP/GFR was associated with increased risk of all-cause mortality (HR 3.05[1.52–6.13], P=0.002), heart failure hospitalization (HR 2.17[1.05–4.50], P=0.036), and the combined endpoint (HR 1.83[1.04–3.22], P=0.035; HRs per log decrease) after adjustment for outcome-specific BIOSTAT risk models, serum phosphate, and eGFR.

Conclusion:
Lower TmP/GFR is associated with more severe heart failure, lower eGFR, and increased levels of markers of tubular damage and function. TmP/GFR furthermore predicts the development of tubular damage and poor outcome. TmP/GFR might be a suitable, clinically relevant, novel proximal tubular parameter in heart failure, potentially enabling detection of early kidney injury.
Abstract sessies NVVC Voorjaarscongres
Donderdag 16 april 2020
16.45 – 18.00 uur

**Figures:**
Figure 1. Correlation plots of TmP/GFR with glomerular and tubular parameters
Correlation coefficients: eGFR, 0.287; FEUrea, -0.146; serum urea, -0.125; plasma NGAL, - 0.099
Abbreviations: eGFR, estimated glomerular filtration rate; FEUrea, fractional excretion of urea; NGAL, Neutrophil Gelatinase-Associated Lipocalin
REDUCTION IN HOSPITAL STAY IN A HOSPITAL@HOME MODEL

M. Feijen (Noordwest Ziekenhuis, Alkmaar); V.A.W.M. Umans (Noordwest Ziekenhuis, Alkmaar); A.J.C.M. Bos-Schaap (Noordwest Ziekenhuis, Alkmaar); M.A.M. Wit (Noordwest Ziekenhuis, Alkmaar); S. Walburg (Noordwest Ziekenhuis, Alkmaar); S.P.M. de Boer (Noordwest Ziekenhuis, Alkmaar); J. van Ramshorst (Noordwest Ziekenhuis, Alkmaar)

Purpose:
Hospitalizations for heart failure (HF) pose a major burden on Dutch healthcare. Additionally, the hospital environment may be disadvantageous for older persons, who commonly experience adverse events. Therefore, in a proof of concept, we currently explore a new Hospital@Home (H@H) model, combining hospital cure and home-care budgets. The objective of the present study was to explore the potential reduction of length of stay with early transfers to home.

Methods:
We conducted a retrospective analysis of 92 consecutive acute HF patients admitted in a 2-month period. Eligibility criteria for home treatment are: Heart rate <100/min and SBP>100 mmHg, absence of ventricular arrhythmias, hemodynamic or oxygen support. All charts were reviewed for eligibility and timing of hypothetical inclusion in the H@H program.

Results:
Patients (n=92) were 78.2 yrs (28-102), 51% male and 56% had a reduced LV function. Mean length of hospital stay was 7.1 days (0-28), resulting in 329 HF hospital days monthly. Patients appeared to be eligible for H@H after 3.0 (0-22) days, leaving a potential 4.1 (0-19) days per patient for home treatment. This results in a potential reduction of 190.5 hospital days/month which may be transferred to home-care by cardiology nurse practitioner and day-care nursing under auspices of the cardiologist.

Conclusion:
Theoretically, starting a H2H-program for the treatment of decompensated HF has a huge potential for reducing length of hospital stay, on top of other possible advantages. Introduction of H@H programs should be accompanied by thoroughly conducted research to evaluate these potential gains in relation to the costs.

Figures:
HOW TO IMPROVE IMPLEMENTATION OF GUIDLINE ADJUSTED MEDICAL THERAPY. LESSONS LEARNED FROM SACUBITRIL/VALSARTAN

D.J.A. Lok (Deventer Hospital, Deventer); J.v.Wijngaarden (Deventer Ziekenhuis, Deventer); A.v.d.Sluis (Deventer Ziekenhuis, Deventer); M.K.Hart (Deventer Ziekenhuis, Deventer); E.Badings (Deventer Ziekenhuis, Deventer)

Purpose:
In chronic heart failure research, multiple studies have shown the beneficial outcomes of guideline-directed therapy. Implementation of changes in these guidelines is difficult for several reasons. We investigated if changes in the HF guidelines in 2016 were implemented in daily practice.

Methods:
In our outpatient clinic, we searched, using CTcue's intelligent search engine, for current medical HF treatment and those who could qualify for treatment with sacubitril/valsartan according to the HF guidelines of 2016. Additionally, patients needed to fulfill major in- and exclusion criteria according the Paradigm trial.

Results:
CTcue identified 1654 patients with HFrEF and EF < 35%. After excluding patients without RAAS inhibition and BB agents, low eGFR, low NT-proBNP levels, history of angioneurotic edema, high potassium and deceased patients, 302 potential candidates for treatment with the new drug remained. After review by a cardiologist, 115 patients were found unsuitable, 49 doubtful and 138 suitable for treatment. Of these 138 patients, 56 (40%) were already on treatment with sacubitril/valsartan.

Conclusion:
More than 3 years after publication of the new HF guidelines in 2016, in which sacubitril/valsartan received a class IB indication, prescription was administered to only 40% of the patients qualified for treatment. A tool like CTcue is capable of safely identifying potential patients for receiving life-saving new treatments. Changes in guidelines and new insights in medical treatments could be implemented more securely and easily.
Abstract sessies NVVC Voorjaarscongres
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Figures:
Table 1

1654 Patients with HFrEF and EF <35 % found using CTcue

302 Potential patients reviewed by cardiologist

1352 Patients excluded
  966 Without RAAS inh and BB agents
  152 With eGFR <30
  223 With proBNP >71
  3 With angioneurotic edema
  8 Died

115 Patients found unsuitable for treatment
49 Patients found possibly suitable for treatment
138 Patients found suitable for treatment
  56 Had already received treatment sacubitril/valsartan (40%)
IMPROVED LONG-TERM OUTCOME IN PATIENTS WITH LEFT VENTRICULAR ASSIST DEVICES DESPITE OLDER AGE AND HIGHER RISK PROFILE: DUTCH SINGLE CENTER EXPERIENCE EXCEEDING A DECADE.

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Purpose:
Over the last one and half decade, left ventricular assist devices are increasingly used in the treatment of end-stage heart failure patients. The aim of this study was to evaluate our single-centre clinical experience with the continuous flow LVADs over the years 2006-2018.

Methods:
Baseline characteristics and clinical outcomes of 107 consecutive patients undergoing either HeartMate II (HMII) or HeartMate 3 (HM3) LVAD implantation from December 2006 until December 2015 and from January 2016 until January 2018, respectively, were evaluated in a retrospective cohort study.

Results:
In total, 107 patients underwent implantation of whom 64 (59.8%) received the HMII and 43 (40.2%) received the HM3. Overall, the mean age was 52 ± 12 years, 81 (75.7%) patients were male. Ischemic heart disease was present in 51 (48%) patients. In the comparison between HMII and HM3, the latter had a higher median age (52 vs. 57 years, p=0.006), body mass index (22.8 vs. 25.8 kg/m2, p=0.003), pre-existing diabetes (9.4% vs. 25.6%, p=0.03), pre-existing hypertension (15.6% vs. 44.2%, p=0.03), serum creatinine levels (122 vs. 146mmol/L, p=0.003) and included more destination therapy patients (1.6% vs. 37.2%, p<0.001). On long-term follow-up, HM3 patients had a lower incidence rate of stroke (18.8% vs. 7.0% p=0.09), infection (34.9% vs. 20.9%, p=0.12), and bleeding events within the first year (45.3% vs. 15.8%, p=0.002). The early (<90 days) and late (>90 days) survival did not significant differ between the HMII (85.9% vs 82.8%) and HM3 patients (93.0% vs 76.5%), (p=0.90) (Figure).

Conclusion:
Although, the risk profiles of patients that received LVAD therapy have increased over time, the post-operative survival has improved, the survival remains good and less complications are observed. Therefore, LVAD therapy remains an excellent life prolonging treatment for patients with end-stage heart failure.
Figures:
Figure: Survival estimates of patients that received the HeartMate II (green) and the HeartMate3(red).
CLINICAL PROFILE & CONTEMPORARY MANAGEMENT OF DUTCH HEART FAILURE PATIENTS WITH PRESERVED EJECTION FRACTION

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Purpose:
The exact clinical profile and medical management of heart failure (HF) patients with preserved ejection fraction (HFpEF) remains unclear, due to a lack of data on HFpEF patients in contemporary HF registries. The aim of this comprehensive HF registry was to gain more insight into the clinical profile and contemporary management of Dutch HFpEF patients.

Methods:
A total of 2,153 chronic HFpEF patients from 34 Dutch outpatient clinics in the period of 2013 until 2016 were included in this analysis, and detailed information on patient characteristics, comorbidities and medical treatment were collected. The median age was 77 [IQR 15] years and 55% were women.

Results:
The most frequent comorbidities were atrial fibrillation (AF, 38%), hypertension (HT, 51%) and renal insufficiency (59%). Patients between 60 – 75 years and ≥75 years had on average more comorbidities, than patients <60 (p-value < 0.001), and female patients had more comorbidities compared to men (p-value < 0.001, Figure). Although no specific treatment recommendations are available for HFpEF, treating comorbidities is advised. Beta-blockers were most frequently prescribed (78%) suggesting treatment for AF and HT, followed by loop diuretics (74%) for congestion, RAS-inhibitors (67%) and MRAs (39%) for HT. Strongest predictors for loop diuretic use were older age, higher NYHA class, and AF.

Conclusion:
The clinical HFpEF profile is determined by the underlying comorbidities, sex and age. Comorbidities are highly prevalent in Dutch HFpEF patients, especially in elderly HFpEF patients. Despite the lack of evidence, many Dutch HFpEF patients receive regular HFrEF medication.
Figures:
Figure. Percentages of patients per category of number of comorbidities, stratified by A age categories (<60 years, 60-75 years and > 75 years) and B sex.
UNSUPERVISED CLUSTERING METHODS IDENTIFY DILATED CARDIOMYOPATHY SUBGROUPS IMPROVING PATIENT RISK STRATIFICATION

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Purpose:
Despite the heterogenic nature of dilated cardiomyopathy (DCM), all patients are treated the same. Fifty percent does not respond. A better understanding of the DCM phenotype is necessary to improve risk prediction and targeted treatment. We aim to identify DCM phenogroups by performing unsupervised clustering followed by supervised decision tree modelling in an index and external validation cohort.

Methods:
We enrolled 795 consecutive DCM patients who underwent in-depth phenotyping comprising 47 clinical variables in a Dutch hospital. Unsupervised and supervised machine learning was used to detect clusters of patients within the cohort. Event-free survival was determined for the created subgroups.

Results:
Four clinically distinct phenogroups were identified within our DCM cohort based upon unsupervised hierarchical clustering of principal components: [1] patients with mild systolic dysfunction, no adverse remodelling and mainly NYHA class I-II; [2] DCM related to autoimmune disease, predominantly female; [3] cardiac arrhythmias, fibrosis and prevalent genetic variants, mainly males; and [4] patients with severe systolic dysfunction, increased cardiac volumes, and mainly NYHA class III-IV. Next, supervised decision tree modelling identified the associated four key parameters: autoimmune disease, atrial fibrillation, ejection fraction and serum creatinine stratified the DCM patients in these phenogroups with an accuracy of 71%. Outcome varied significantly between phenogroups. The supervised model was validated in an two independent, external cohorts of 352 and 384 DCM patients in Spain and Italy. In all three cohorts, the supervised model was predictive for mortality and heart transplantation.

Conclusion:
The present study identified four different DCM phenogroups based upon four clinical parameters, using unsupervised clustering followed by supervised tree modelling. Subgrouping based upon those four parameters help to better predict outcome in our discovery and validation cohorts, and thereby may also help design and conduct future clinical trials to better identify responders to therapies.
Abstract sessies NVVC Voorjaarscongres
Donderdag 16 april 2020
16.45 – 18.00 uur

Figures:

- **PHENOGROUP 1**: Mild systolic dysfunction
  - Moderate ejection fraction (>40%)
  - Low creatinine
  - No adverse remodelling
  - NYHA class I or II
  - Low NT-proBNP

- **PHENOGROUP 2**: Auto-immune
  - Auto-immune disease
  - High creatinine
  - Female
  - Low body mass index

- **PHENOGROUP 3**: Cardiac arrhythmias
  - Atrial fibrillation
  - Non-sustained VT
  - Pathogenic gene variants
  - Males
  - LGE positive

- **PHENOGROUP 4**: Severe systolic dysfunction
  - Low ejection fraction (<25%)
  - Increased cardiac volumes
  - NYHA III or IV
  - Diastolic dysfunction

5-year event risk (%)
- 8%
- 24.5%
- 32.5%
- 29.5%
CLINICAL COURSE LONG AFTER ATRIAL SWITCH: A NOVEL RISK SCORE FOR SERIOUS CLINICAL EVENTS

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Purpose:
We assessed the risk for events during the clinical course in adulthood of patients after atrial switch surgery for transposition of the great arteries(TGA-AtrSO), and provided a novel risk score for event-free survival.

Methods:
We reviewed medical records of TGA-AtrSO patients included in the CONCOR-registry from five hospitals. Endpoints were all-cause mortality, heart failure(HF), defined as HF hospitalizations, heart transplantation, ventricular assist device implantation, or HF-related death, and symptomatic ventricular arrhythmias(VA). Predictors for event-free survival were examined to construct a prediction model using bootstrapping techniques.

Results:
We followed 169 TGA-AtrSO patients (60% Mustard, age 28[IQR 24-36]years) for 13[IQR 9-16]years, during which 17(10%) died, 34(20%) had HF events, and 15(9%) had VA events. Five-year risk of mortality, first HF event, and first VA increased from 1% each at age 25, to 7%(95%CI 4-10%), 17%(95%CI 10-25%), and 4%(95%CI 2-8%), respectively, at age 50. A prediction model combining age >30, prior VA, age >1year at AtrSO, QRS duration >120ms, ≥mild LV dysfunction, and severe tricuspid regurgitation discriminated well between patients at low(<5%), medium(5-20%) and high(>20%) 5-year risk(optimism corrected C-statistic=0.84). Observed 5- and 10-year survival in low-risk patients were 100% and 99%, compared to only 45% and 19% in high-risk patients.

Conclusion:
The clinical course of atrial switch patients increasingly consists of serious clinical events, especially heart failure. A novel risk score stratifying patients in low, medium, and high risk for event-free survival is presented, providing information on absolute individual risks which may support management decisions.
Figures:
Observed survival by predicted risk category. A: Score points of the risk model. B: Predicted risk based on risk scores. C: Observed event-free survival of patients with predicted low risk (<5% in 5 years), medium risk (5-20% in 5 years) and high risk (>20% in 5 years).

<table>
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<tr>
<th>Predictor</th>
<th>Points</th>
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<tbody>
<tr>
<td>Age &gt; 30 years</td>
<td>2</td>
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<tr>
<td>Repair at &gt; 1 year</td>
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<tr>
<td>Prior VA</td>
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<tr>
<td>QRS &gt; 120 ms</td>
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<tr>
<td>Severe TR</td>
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<td>LV dysfunction</td>
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<tr>
<th>Risk score</th>
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<td>0 - 2</td>
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<td>3 - 6</td>
<td>5 - 20</td>
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<tr>
<td>6 - 9</td>
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<thead>
<tr>
<th>N at risk</th>
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<tbody>
<tr>
<td>Low risk</td>
<td>86 79 66 31 1</td>
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<tr>
<td>Medium risk</td>
<td>66 53 32 10 0</td>
</tr>
<tr>
<td>High risk</td>
<td>17 7 3 0 0</td>
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