Abstracts of the Scientific Autumn Congress of the Netherlands Society of Cardiology 1-2 November 2018

Heel het hart

Conference Center Papendal - Arnhem
Dear reader,

We are pleased to present here the abstracts of the Scientific Autumn Congress of the Netherlands Society of Cardiology which will be held on 1 and 2 November 2018 in Conference Center Papendal in Arnhem.

We hope that you will enjoy reading the abstracts.

On behalf of the Chief Editorial Board,
Prof. dr. J.J. Piek
Editor in Chief Netherland Heart Journal
Session I: Imaging and congenital heart disease

REFERENCE VALUES OF THORACIC AORTIC GROWTH. THE DANISH LUNG CANCER SCREENING TRIAL.

L.R. Bons; L.R. Bons (Erasmus MC, Rotterdam); Z. Sedghi Gamechi (Erasmus MC, Rotterdam); R.P.J. Budde (Erasmus MC, Rotterdam); K.F. Kofoed (Copenhagen University Hospital, Copenhagen, Denmark); J. Holst Pedersen (Copenhagen University Hospital, Copenhagen, Denmark); M. de Bruijne (Erasmus MC, Rotterdam; University of Copenhagen, Denmark); J.W. Roos-Hesselink (Erasmus MC, Rotterdam)

Purpose:
Longitudinal information about individual aortic growth in the general population is scarce. The aim of this study is to present reference-values for thoracic aortic growth among men and women.

Methods:
Participants of the Danish Lung Cancer Screening Trial who underwent non-contrast computed tomography (CT) at baseline (2004-2007) and at least 12 months follow-up were included. The study consisted of current and former smokers aged 50-70 years. The diameters of the ascending aorta (AA) and descending aorta (DA) at the pulmonary bifurcation level were measured perpendicular to the aortic centerline with an automatic tool. Aortic growth per year was calculated by the difference in aortic diameter between the first and last CT scan divided by the follow-up time. Factors associated with aortic growth were detected with multivariable linear regression analysis.

Results:
A total of 1947 participants (1075 men, mean age 57.3±4.8 years) were included. During a median follow-up of 4.0 years, the AA showed a yearly growth of 0.13±0.3 mm in men and 0.11±0.3 mm in women. Height was positively associated (β=0.004, p<0.001) with AA growth, while weight and AA diameter at baseline were negatively associated (respectively β=-0.002, p=0.003 and β=-0.012, p<0.001). The DA increased per year with 0.11±0.3 mm in men and 0.12±0.3 mm in women. Growth of the DA was positively associated with height (β=0.003, p=0.013) and negatively with antihypertensive medication use and DA diameter at baseline use (β=-0.039, p=0.031 and β=-0.018, p<0.001).

Conclusion:
Ascending and descending aortic growth in a general smoking population is approximately 0.1 mm per year and is associated with increased height, lower weight, smaller baseline diameter and absence of antihypertensive medication use.
**Figure:**
Yearly growth of the ascending and descending aorta.
IMPLEMENTATION OF ECHOCARDIOGRAPHIC DEFORMATION IMAGING FOR OPTIMAL ASSESSMENT OF DISEASE PROGRESSION IN EARLY ARRHYTHMOGENIC RIGHT VENTRICULAR CARDIOMYOPATHY

K. Taha; K. Taha (Netherlands Heart Institute, Utrecht); T.P. Mast (Catharina Hospital, Eindhoven); M.J.M. Cramer (University Medical Center Utrecht, Utrecht); J.F. van der Heijden (University Medical Center Utrecht, Utrecht); F.W. Asselbergs (University Medical Center Utrecht, Utrecht); P.A. Doevendans (University Medical Center Utrecht, Utrecht); A.J. Teske (University Medical Center Utrecht, Utrecht)

Purpose:
Arrhythmogenic right ventricular cardiomyopathy (ARVC) is an inherited cardiomyopathy characterized by both electrical and structural cardiac disease. Remarkably, progression of structural disease is uncommon during the early stages of ARVC, while progression of electrical disease is seen frequently. We hypothesize that this discrepancy is caused by inability of conventional imaging modalities to detect subtle abnormalities. We aimed to study the incremental value of echocardiographic deformation imaging over conventional imaging modalities for detection of disease progression during the early stages of ARVC.

Methods:
Patients who fulfilled diagnostic criteria for ARVC (i.e. definite ARVC) and their first-degree relatives (i.e. early ARVC) were included in the study. All study participants underwent serial evaluation including echocardiography and/or magnetic resonance imaging. Assessment of structural disease progression was performed by conventional measurements and by echocardiographic deformation imaging.

Results:
Eighty-four subjects underwent serial evaluation (at baseline 50 subjects with definite ARVC and 34 subjects with early ARVC) with a mean follow-up of 4.7±2.5 years. In definite ARVC, conventional imaging and deformation imaging both showed signs of disease progression. In early ARVC, conventional imaging did not show signs of disease progression, while deformation imaging did show progressive mechanical dysfunction in the right ventricular (RV) free wall: electromechanical delay increased from 40 [IQR 39] to 55 [IQR 38] msec (P=.004) and the amount of post-systolic shortening increased from 1 [IQR 13] to 8 [IQR 14] percent (P=.049).

Conclusion:
Echocardiographic deformation imaging reveals progressive RV mechanical dysfunction during the early stages of ARVC, while conventional imaging approaches lack sensitivity to detect subtle signs of disease progression. Serial evaluation by echocardiographic deformation imaging may potentially be helpful in risk stratification of patients during the early stages of ARVC.
**Figure:**
Echocardiographic deformation imaging reveals subtle signs of disease progression in early ARVC.

Baseline:
- **ECG:** Normal depolarization/repolarization
- **Holter:** 80 PVC/24h, no VTs
- **Echo:** Normal wall motion, PLAX-RVOT = 13 mm/m2, RV-FAC = 45%, LVEF = 58%
- **CMR:** Normal wall motion, RV-EDV = 89 ml/m2, RVEF = 52%, LVEF = 62%

Follow-up:
- **ECG:** Normal depolarization/repolarization
- **Holter:** >1000 PVC/24h, 2x non-sustained VT
- **Echo:** Normal wall motion, PLAX-RVOT = 15 mm/m2, RV-FAC = 44%, LVEF = 56%
- **CMR:** Normal wall motion, RV-EDV = 92 ml/m2, RVEF = 50%, LVEF = 58%
DIAGNOSTIC VALUE OF NATIVE T1 MAPPING IN ARRHYTHMOGENIC RIGHT VENTRICULAR CARDIOMYOPATHY

M. Bourfiss; M. Bourfiss (University Medical Center Utrecht, Utrecht); N.H.J. Prakken (University Medical Center Groningen, Groningen); J.F. van der Heijden (University Medical Center Utrecht, Utrecht); I. Kamel (Johns Hopkins Hospital, Baltimore); S.L. Zimmerman (Johns Hopkins Hospital, Baltimore); F.W. Asselbergs (University Medical Center Utrecht, Utrecht; Netherlands Heart Institute, Utrecht; University College London, London): T. Leiner (University Medical Center Utrecht, Utrecht); B.K. Velthuis (University Medical Center Utrecht, Utrecht); A.S.J.M. te Riele (University Medical Center Utrecht, Utrecht; Netherlands Heart Institute, Utrecht).

Purpose:
Early detection of Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC) is pertinent as life-threatening ventricular arrhythmias (VA) can occur. VAs are associated with myocardial replacement by fibrosis. Native T1 mapping is a promising technique to quantify early changes in cardiac microstructure on cardiac magnetic resonance imaging (CMR). We aimed to analyze the diagnostic value of native T1 mapping in ARVC.

Methods:
We analyzed short-axis cine 1.5 Tesla CMR images obtained using a MOLLI sequence in 43 subjects (13 overt ARVC patients [mutation+/phenotype+], 17 at-risk ARVC relatives [mutation+/phenotype-], and 13 controls with right ventricular outflow tract ventricular tachycardia [RVOT-VT]). Global and regional fibrosis of the left ventricle were measured using T1 times. Native T1 dispersion, defined as the standard deviation of regional T1 times, was assessed per patient over all analyzed segments.

Results:
Mean age was 37±17 years and 51% were female. Mean T1 times increased from controls (1038±27ms) to at-risk relatives (1055±38ms) to overt ARVC patients (1067±41ms), reaching significance between ARVC patients and controls (p=0.04). Both ARVC patients (93±33ms) and at-risk relatives (79±15ms) had an elevated T1 dispersion compared to controls (67±12ms, p=0.03), indicating a higher heterogeneity of the cardiac microstructure. More specifically, ARVC patients had elevated T1 times in the posterolateral (p=0.02) and inferior (p=0.01) regions, whereas the posterolateral (p=0.01) and inferior (p=0.01) region were affected in at-risk relatives.

Conclusion:
Native T1 mapping differentiates overt ARVC patients and at-risk relatives from controls with RVOT-VT. When incorporated into the current diagnostic pathways, T1 mapping may have potential to detect early ARVC.
Figure:
Bullseyes of native T1 times of at-risk relatives vs. controls and ARVC patients vs. controls. Yellow indicates no significant difference compared to RVOT-VT control subjects and orange indicates a significant difference compared to RVOT-VT control subjects.
PREGNANCY OUTCOMES IN WOMEN WITH CARDIOVASCULAR DISEASE: EVOLVING TRENDS OVER 10 YEARS IN THE ESC REGISTRY OF PREGNANCY AND CARDIAC DISEASE (ROPAC)

L. Baris; Jolien Roos-Hesselink (Erasmus MC, Rotterdam); Lucia Baris (Erasmus MC, Rotterdam); Mark Johnson (Imperial College, London); Julie De Backer (University Hospital Ghent, Gent); Catherine Otto (UW School of Medicine, Seattle); Ariane Marelli (McGill University, Montreal); Guillaume Jondeau (Bichat Hospital, Paris); Werner Budts (University Hospital, Leuven); Jasmine Grewal (University of British Colombia, Vancouver); Karen Sliwa (Hatter Institute for Cardiovascular Research in Africa, Cape Town); William Parsonage (Royal Brisbane and Women's Hospital, Herston); Aldo P Maggioni (Research Center of the Italian Association of Hospital Cardiologists, Florence); Iris van Hagen (Erasmus MC, Rotterdam); Alec Vahanian (Bichet Hospital, Paris); Luigi Tavazzi (Maria Cecilia Hospital, Cotignola); Uri Elkayam (University of Southern California, Los Angeles); Eric Boersma (Erasmus MC); Roger Hall (University of East Anglia, Norwich)

Purpose:
Maternal mortality is a major global health issue, and while deaths due to hemorrhage and infection are declining, those related to heart disease are rising and are now the most important cause in western countries.

Methods:
From 2007-2018 pregnant women with heart disease were prospectively enrolled in the Registry Of Pregnancy And Cardiac disease (ROPAC), a worldwide registry established by the ESC. The primary outcome was maternal outcome (mortality or heart failure), predictors were identified using univariable and multivariable logistic regression.

Results:
We enrolled 5739 pregnancies; the mean maternal age was 29.5 years and 45% nulliparous. The most prevalent diagnoses were congenital (57%) and valvular heart disease (29%). Maternal mortality (34 patients, 0.6%) was highest in the pulmonary arterial hypertension group (9%). Heart failure, supraventricular and ventricular arrhythmias occurred in 11%, 2% and 2% respectively. Delivery was by Caesarean section in 44%, in 16% for cardiac reasons. Both fetal and neonatal mortality were 1%. Clinical determinants for an adverse maternal outcome were pre-pregnancy heart failure or NYHA class > II, a systemic ventricular ejection fraction < 40%, modified World Health Organization class 4 and the use of anticoagulants. After an initial increase, rates of maternal mortality and heart failure fell from 2010.

Conclusion:
Over the period of the study, rates of maternal mortality and/or heart failure were high in women with pre-existing heart disease. However, from 2010, maternal outcomes tended to improve despite the inclusion of more women with very high-risk pregnancies.
ADVANCED ECHOCARDIOGRAPHIC SCREENING FOR CHEMOTHERAPY-RELATED CARDIAC DYSFUNCTION IN BREAST CANCER PATIENTS IN CLINICAL PRACTICE.

N.J. Raaijmakers; N.J. Raaijmakers (Amphia, Breda); A.M. Stevense-Den Boer (Amphia, Breda); D. Segers (Amphia, Breda); J.B. Heijns (Amphia, Breda); J. Schaap (Amphia, Breda)

Purpose:
Recent literature describes an incidence of ~10% of chemotherapy-related cardiac dysfunction (CTRCD) in patients receiving anticancer treatment. Echocardiography including strain imaging is proposed as first-choice screening method for CTRCD. The aim of this study was to evaluate the feasibility of an echocardiographic screening protocol for CTRCD in breast cancer patients in a large referral hospital.

Methods:
We prospectively included all consecutive patients with chemotherapeutically treated breast cancer in our center from October 2016 until September 2017. From these patients the cardiotoxicity risk score (CRS) was calculated. Patients with a CRS > 4 underwent baseline echocardiography including strain imaging. Left ventricular ejection fraction (LVEF) was assessed by 2D and 3D echocardiography. Echocardiography was repeated 3-monthly up to one year after initiation cancer therapy. CTRCD was defined as an LVEF <50% or >10% decrease from baseline, resulting in an LVEF <50% at one year.

Results:
In total 117 patients were included. 68% received anthracyclines, 38% of patients received trastuzumab. Assessment of LVEF by 2D and 3D echocardiography was successful in 90% and 76% of the acquisitions respectively. Strain imaging was successful in 77% of the acquisitions. At one year 5 patients (4.5%) had persistent CTRCD. 5 patients (4.5%) had a temporary decrease of LVEF of >10% below 50%. Only one patient (0.9%) developed symptomatic heart failure.

Conclusion:
Routine biplane evaluation of LVEF is a reliable screening tool for CTRCD. 3D-echocardiography and strain imaging are challenging and not applicable in a subset of patients. 3-monthly echocardiographic screening is redundant given the low incidence of CTRCD in non-trastuzumab treated breast cancer patients.
EFFECTS OF LOSARTAN AND BETA-BLOCKERS ON AORTIC ROOT DILATATION IN PATIENTS WITH MARFAN SYNDROME - RESULTS OF THE EXTENDED COMPARE TRIAL

M.M. van Andel; H. Jalalzadeh (AMC, Amsterdam); R. Indrakusuma (AMC, Amsterdam); R. Balm (AMC, Amsterdam); J. Timmermans (Radboud UMC, Nijmegen); M.P. van de Berg (UMCG, Groningen); A.J.H.A. Scholte (LUMC, Leiden); V. de Waard (AMC, Amsterdam); A.H. Zwinderman (AMC, Amsterdam); B.J.M. Mulder (AMC, Amsterdam); M. Groenink (AMC, Amsterdam)

Purpose:
Beneficial effects of Losartan and β-blockers in adults with Marfan syndrome (MFS) are not entirely clear. The COMPARE trial showed a small but significant beneficial effect of Losartan on aortic root dilatation rate. Yet, this effect was not reproduced by other trials. Therefore, we extended the follow-up period up to 10 years to assess the clinical outcomes. Moreover, we aimed to assess the effect of medication regimes on aortic root dilatation rates in patients with a native aortic root at initial randomization.

Methods:
Patients enrolled in the COMPARE trial were retrospectively analyzed. Cardiovascular events and all-cause mortality were assessed. Individual aortic root dilatation rates were estimated in patients with a native aortic root at time of randomization on the basis of multiple transthoracic echocardiograms (TTE). Correlations between aortic root dilatation rates and cumulative Losartan or β-blocker treatment days were assessed with Spearman's ρ.

Results:
During a median follow-up of 8.0 years, 15 dissections, two aortic ruptures and five deaths occurred in 208 patients. Patients with a native root at time of randomization underwent a median of 6 TTEs during follow-up. The median aortic root dilatation rate in these patients was 0.28 (IQR:0.09-0.59) millimeter/year. Aortic root dilatation rate was negatively correlated with the number of Losartan treatment days (ρ=-0.272, P=.003), β-blocker treatment days (ρ=-0.21, P=0.017) and duration of follow-up (ρ=-0.43, P<.001).

Conclusion:
MFS patients experienced low aortic root dilatation rates, few aortic dissections and even less ruptures. This may be the result of an aggressive prophylactic surgical regime and mildly affected study population. We further provided indirect evidence of the potentially beneficial effect of Losartan and β-blocker during longer follow-up.
WILL TELEMONITORING BY MHEALTH PROGRAM BE COST-EFFECTIVE IN ADULTS WITH CONGENITAL HEART DISEASE?

M.A.C. Koole; M.A.C. Koole (Rode Kruis Ziekenhuis, Beverwijk); I.I. Tulevski (Cardiologie Centra Nederland, Amsterdam); G.A. Somsen (Cardiologie Centra Nederland, Amsterdam); D. Kauw (Amsterdam UMC, UvA, Amsterdam); M.M. Winter (Amsterdam UMC, UvA, Amsterdam); D.A.J. Dohmen (FocusCura, Driebergen-Rijsenburg); B.J. Mulder (Amsterdam UMC, UvA, Amsterdam); B.J. Bouma (Amsterdam UMC, UvA, Amsterdam); M.J. Schuuring (Amsterdam UMC, UvA, Amsterdam)

Purpose:
In several heart failure studies telemonitoring has shown major healthcare costs reductions and better patient outcomes compared to standard care. Our study aims to determine if telemonitoring using mHealth is cost-effective in adult patients with congenital heart disease (CHD).

Methods:
110 symptomatic adult patients with CHD were enrolled in an ongoing mHealth telemonitoring program. Blood pressure, weight and single lead EKG were routinely evaluated with aid of a smartphone and a remote telemonitoring center facilitates care. If necessary the treating physician could optimize treatment. We determined historical routine healthcare costs, which were obtained from the last year before inclusion and compare these results with costs made during participation in our study.

Results:
Historical routine healthcare data demonstrated that symptomatic adult CHD patients visit the outpatient clinic at least once a year, visit the emergency department approximately 0.6 times per year and are discussed in a multi-disciplinary team once a year. This results in total costs of € 855,- per year per patient exclusive costs of hospital admissions.
We anticipate a structural decrease of 33% in healthcare costs due to the use of mHealth by decrease of visits to outpatient clinic, the emergency department and hospital admissions. Furthermore we calculate the reduction of patient costs due to not travelling to the clinic and taking a day off.

Conclusion:
Unique data on cost-effectiveness of mHealth in adults with CHD are obtained in our ongoing study, and it is expected to demonstrate a major cost reduction. This will be applicable to approximately 4000 symptomatic adult CHD patients in the Netherlands.
PROGNOSIS OF THE SYSTEMIC RIGHT VENTRICLE FURTHER REFINED

O.I. Woudstra; O.I. Woudstra (Amsterdam UMC - AMC, Amsterdam); A.C. van Dissel (Amsterdam UMC - AMC, Amsterdam); T. van der Bom (Amsterdam UMC - AMC, Amsterdam); H.A.C.M. De Bruin-Bon (Amsterdam UMC - AMC, Amsterdam); J.P. van Melle (UMCG, Groningen); A.P. van Dijk (Radboud MC, Nijmegen); H.W. Vliegen (LUMC, Leiden); B.J.M. Mulder (Amsterdam UMC - AMC, Amsterdam); F.J. Meijboom (UMCU, Utrecht); B.J. Bouma (Amsterdam UMC - AMC, Amsterdam)

Purpose:
Predicting heart failure in patients a with systemic right ventricle (sRV) due to transposition of the great arteries(TGA) is difficult. Longitudinal strain (LS) parameters are easily available and detect early myocardial damage. This study aims to determine the value of LS parameters as predictors for heart failure-free survival in patients with an sRV.

Methods:
In participants of a multicenter prospective trial, LS was assessed on echocardiography using speckle tracking. Cox regression was used to determine the association of sRV global LS and postsystolic shortening, defined as >20% of myocardial contraction appearing after aortic valve closure, with the combined endpoint of progression of heart failure and death, compared to cardiovascular magnetic resonance derived parameters.

Results:
Echocardiograms of 61/88 participants were analyzed (age 34±11 years, 66% male, 34% congenitally corrected TGA). Mean global LS was -13.5±2.9% and 13 (21%) patients had postsystolic shortening. During 8[7-9]years, 15 (23%) patients met the composite endpoint. sRV ejection fraction (mean 39±9%, HR=0.93[95%CI 0.87-0.99], p=0.016), sRV end systolic volume (80±31 ml/m2, HR=1.19[95%CI 1.01-1.40], p=0.034), global LS (HR=1.25, 95%CI 1.01-1.54, p=0.041) and postsystolic shortening (HR=4.10[95%CI 1.48-11.37], p=0.007) were all associated with heart failure-free survival in univariable analysis. Postsystolic shortening was the only parameter associated with heart failure-free survival in bivariable analysis, corrected for each of the other parameters.

Conclusion:
Longitudinal strain parameters, especially postsystolic shortening, have additional value in the prognostic assessment for heart failure and death in systemic right ventricle patients. These easily available parameters should be integrated in risk prediction scores and used in the clinic to guide follow-up intensity.
Session II: Coronary artery and vascular disease

DOBUTAMINE STRESS CARDIAC CT FOR EXCLUDING DIRECT COMPRESSION OF INTERARTERIAL COURSE OF ANOMALOUS LEFT CORONARY ARTERY: FIRST EXPERIENCE AS NEW MODALITY FOR DECISION MAKING

P.V.M. Linsen; M.J.M. Kofflard (Albert Schweitzer Ziekenhuis, Dordrecht); M.C.J.M. Kock (Albert Schweitzer Ziekenhuis, Dordrecht).

Purpose:
A 62-year old man was admitted to our hospital with typical symptoms of angina for two hours. Laboratory results showed an initial Troponin I of 0.02 which raised up to 21.3 ug/L. The electrocardiogram revealed a ST depression in the inferolateral leads. Invasive coronary angiography (ICA) was performed and demonstrated a significant stenosis in the circumflex artery and an aberrant origin of the left coronary artery (LCA) from the right coronary cusp with an indefenite course. Percutaneous coronary intervention was performed to revascularize the circumflex artery. Coronary computed tomography angiography (CTA) showed a codominant coronary system and confirmed the anomalous origin of the LCA from the right coronary cusp. Coronary CTA depicted a potentially malignant interarterial route of the LCA. To evaluate the impact of cardiac stress on both the interarterial route of the LCA and cardiac wall motion a cardiac stress CT was performed. Stress was administred through a continuous intravenous infusion of dobutamine with administration of 0.5 mg atropine. Retrospective ECG-gated 4D cardiac low dose CT was performed using 80 kV and 332 mAs with an estimated effective dose of 6.1 mSv. Cine CT imaging during stress demonstrated neither stenosis of the LCA nor wall motion abnormalities in the territory of the LCA (image and supplementary videos). These findings suggest that conservative management with active surveillance and drug treatment could be advised. This report demonstrates that dobutamine stress CT imaging is feasable and helps in the decision for treating a potentially malignant interarterial route of the coronaries.

Methods:
See Purpose (case report)

Results:
See Purpose (case report)

Conclusion:
See Purpose (case report)
Figure Legend: Panel A: Short-axis reconstruction during dobutamine stress in the diastolic phase. LV: Left ventricle. RV: Right ventricle. Panel B: Short-axis reconstruction during dobutamine stress in the systolic phase showed no wall motion abnormalities. Panel C: Oblique reconstruction in rest in the systolic phase of the LCA. Ao: Aorta. PA: pulmonary artery. Arrow: LCA. Panel D: Oblique reconstruction of of the LCA during dobutamine stress and during systolic phase which showed no compression of the LCA.
THORACIC AORTIC DISEASE AND INHERITED AORTOPATHIES: TO EXERCISE OR NOT?

C.G.E. Thijsen; C.G.E. Thijsen (Erasmus MC, Rotterdam), L.R. Bons (Erasmus MC, Rotterdam), A.L. Gökalp (Erasmus MC, Rotterdam); R.R.J. van Kimmenade (Radboud UMC, Nijmegen); M.M. Mokhles (Erasmus MC, Rotterdam); J.J.M. Takkenberg (Erasmus MC, Rotterdam); J.W. Roos-Hesselink (Erasmus MC, Rotterdam)

Purpose:
Current guidelines recommend patients with thoracic aortic diseases (TAD) including inherited aortopathies to avoid strenuous and isometric exercise, because exercise causes a rise in blood pressure and heart rate, potentially increasing the risk of acute aortic dissection. However, regular exercise also has many positive effects. In order to facilitate counselling, we aimed to provide an up-to-date systematic review of the available literature on exercise and sports participation in TAD patients.

Methods:
A broad systematic search was performed in Medline, Embase and Web of Science on: thoracic aortic aneurysm, thoracic aortic dissection, various inherited aortopathies like Marfan Syndrome (MFS), bicuspid aortic valve (BAV) and sports, exercise, athletes. The resulting 1652 records were reviewed by two independent observers.

Results:
Finally 26 articles and 12 case-reports were included. However, no studies longitudinally evaluated the effect of exercise on survival or the risk of aortic dissection in TAD patients. About five percent of acute type A dissections seem related to sports-activities. Athletes have small but significantly larger aortic diameters than controls, but prevalence of aortic dilatation is similar. In patients with BAV, regular exercise does not seem to increase aortic growth rate. In mice with MFS moderate dynamic exercise was found to decelerate aortic dilatation rate and improve aortic wall structure and function, indicating a potential positive effect of dynamic exercise.

Conclusion:
There is a gap in knowledge about the effects of exercise and sports participation in TAD patients. Current circumstantial evidence suggests mild-moderate dynamic exercise is probably safe and even beneficial. More research is clearly needed.
Figure:
Flowchart of literature search and selection of studies

Hazard Ratio 0.91 (95% CI, 0.58 - 1.42)
P=0.668

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LOW CORONARY ARTERY CALCIFICATION PREVENTS ‘UNNECESSARY’ REST MYOCARDIAL SINGLE PHOTON EMISSION COMPUTED TOMOGRAPHY (SPECT)

N.M. Borren; N.M. Borren, J.P. Ottervanger, M. Mouden, S. Knollema, J.R. Timmer, P.L. Jager. (Isala, Zwolle)

Purpose:
Stress-only myocardial single photon emission computed tomography (SPECT) protocols are increasingly used. Only if the stress SPECT is abnormal or equivocal, additional rest SPECT is performed. However, in a substantial part, the rest SPECT is in retrospect not necessary. Possibly, knowledge of coronary artery calcification (CAC) scoring may prevent these unnecessary rest SPECT scans. Our aim was to assess whether low CAC prevents unnecessary rest SPECT in a stress-only SPECT protocol.

Methods:
We performed an analysis of patients with a final normal SPECT diagnosis who were referred for both stress-only SPECT and CAC scoring. We analyzed whether a CAC score of 0 was an independent preventer from performing unnecessary additional rest-SPECT.

Results:
We included 6237 patients in the study, mean age was 62 ± 11 years, 39% was male. Median CAC score was 28 (range 0 to 8863). CAC was 0 in 2094 patients (34%). A subsequent rest SPECT was performed in 2119 patients (34%). In patients with CAC of 0, rest SPECT was performed in 18%, compared to 42% in patients with CAC > 0 (odds ratio 0.31, 95% confidence interval 0.27 – 0.36). Also adjusted multivariable analyses demonstrated that CAC 0 prevents from performing additional ‘unnecessary’ rest SPECT (adjusted odds ratio 0.39, 95% confidence interval 0.34 – 0.45).

Conclusion:
Low CAC scoring prevents ‘unnecessary’ rest SPECT imaging in a stress-only SPECT protocol.
CARDIOPULMONARY EXERCISE TESTING SUGGESTIVE FOR CORONARY ARTERY DISEASE IN ASYMPTOMATIC ATHLETES: PRELIMINARY RESULTS.

Tom Wiggers; T. Wiggers (OLVG, Amsterdam); A.R. Willems (OLVG, Amsterdam); G. Reurink (OLVG, Amsterdam)

Purpose:
The number of middle-aged and elderly participating in sports is increasing. Especially in this population ST segment anomalies during exercise testing are frequently observed, but its clinical relevance remains a subject of debate. Adding breath-by-breath gas exchange analysis (cardiopulmonary exercise testing (CPET)) to conventional exercise testing have shown to improve the diagnostic accuracy for coronary artery disease (CAD) in patients with documented CAD and chest pain. The purpose of this study is to assess whether adding breath-by-breath gas exchange analysis to the conventional stress ECG may also improve diagnostic accuracy in the asymptomatic athlete, thereby reducing the false positive rate of exercise testing for CAD.

Methods:
We included 15 consecutive athletes presenting with a positive exercise stress ECG or a positive gas exchange analysis. The latter is defined as the coexistence of an inflection of VO2/workrate slope with O2-pulse flattening (Belardinelli et al. 2003 and 2014). All subjects were referred to the cardiology department for the further diagnostic work-up according to the ESC guidelines for non-invasive testing in patients with suspected CAD. The primary outcome was the presence of CAD on CT angiography, defined as a calcium score >100 or a stenosis >50%. We calculated the sensitivity and specificity for the detection of CAD with the exercise stress ECG criteria and the VO2-kinetic findings.

Results:
Four patients had presence of CAD on CT (27%). The sensitivity and specificity for the exercise stress ECG criteria were 75% (95%CI 33-100) and 45% (95%CI 16-75) respectively. For the gas exchange analysis this was 50% (95%CI 1-99) and 45% (95%CI 16-75) respectively.

Conclusion:
Adding breath-by-breath gas exchange analysis to the conventional stress ECG does not seem to improve diagnostic accuracy of exercise testing for CAD in asymptomatic athletes.
HEMODYNAMIC EFFECTS OF PAH-SPECIFIC THERAPY IN PATIENTS WITH HFPEF AND COMBINED PRE- AND POSTCAPILLARY PULMONARY HYPERTENSION


Purpose:
Pulmonary hypertension and right ventricular (RV) dysfunction is highly prevalent in patients with heart failure with preserved ejection fraction (HFpEF). Selective pulmonary vasodilators, approved for the treatment of pulmonary arterial hypertension (PAH), have been considered for patients with HFpEF and combined pre- and postcapillary PH (Cpc-PH). Here, we studied the effect of PAH-specific treatment on cardiac volumes, cardiac load and left ventricular (LV) filling pressures in patients with HFpEF and Cpc-PH.

Methods:
In this prospective open-label study, 23 patients with HFpEF and Cpc-PH patients underwent right heart catheterization (RHC), including fluid loading and inhaled nitric oxide (iNO) and cardiac MRI at baseline. RHC and cardiac MRI were repeated after 4 months of treatment with PAH-specific treatment.

Results:
After treatment, we observed a significant reduction in RV and LV afterload (Ea) and increased RV and LV stroke volume. However, pulmonary capillary wedge pressure (PCWP) significantly increased after treatment, shifting the LV to its steeper part of the end-diastolic pressure-volume relationship (Figure). At baseline, increasing preload by fluid loading resulted in a comparable increase in PAWP, whereas reducing RV afterload and increasing LV distensability by iNO had no effect on LV filling pressures.

Conclusion:
In patients with HFpEF and Cpc-PH, PAH-specific treatment increased RV and LV stroke volume at the expense of increased PAWP.
Figure: Pressure-volume relationships of RV (A) and LV (B), summarizing the effects of PAH-specific drugs in patients with HFpEF and Cpc-PH. After treatment, RV afterload (Ea) decreased and RV stroke volume (SV) increased, as a consequence LV SV and PCWP increased.
THE COMBINATION OF SEQUENTIAL 1-HR HIGH-SENSITIVE TROPOGIN AND THE HEART SCORE TO RULE-OUT MACE IN ACUTE CHEST PAIN AT THE EMERGENCY DEPARTMENT

M.T. Epping; M.T. Epping (Diakonessenhuis, Utrecht); C.E.E. van Ofwegen-Hanekamp (Diakonessenhuis, Utrecht); A. Limburg (Diakonessenhuis, Utrecht)

Purpose:
We aim to identify low-risk patients with acute chest pain and safely and quickly rule-out major adverse cardiac events (MACE), including NSTEMI myocardial infarction and unstable angina pectoris. To identify low-risk patients we have used the 1-hr high-sensitive troponin T protocol (hs-troponin). This protocol is safe for use at the emergency department (Röttger et al., 2017), but not sufficient to detect unstable angina. We have investigated whether the combination of hs-troponin with the HEART score improves the diagnosis and ruling-out of MACE.

Methods:
We have retrospectively analyzed clinical data of 850 patients presenting with acute chest pain at the emergency department with low hs-troponin T (≤0.012) and repeated low hs-troponin after 1 hour (1-hr protocol). STEMI’s were excluded. The HEART scores of all patients were determined at presentation. Primary outcome was the MACE rate (%), at <6 weeks (follow-up 1 year).

Results:
Preliminary results of 850 patients show that in subgroups of patients with HEART scores 0-3: MACE 0.63%, HEART scores 4-6: MACE 4.5% (incl. 0.28% NSTEMI). MACE rates were lower than reported in the prospective validation study of the HEART score (resp. 1.7% and 16.6%, Backus et al., 2013). Due to small numbers of patients with HEART 7-10, no MACE rate could be determined in this subgroup.

Conclusion:
The 1-hr hs-troponin T combined with the HEART score identifies low-risk patients and is safe to rule-out NSTEMI myocardial infarction. In patients with low serial 1-hr hs-troponin, the HEART score further improves the diagnosis of unstable angina. HEART scores 0-3 identify extremely low-risk patients in this setting.
Patients with low serum levels of serial 1-hr high-sensitive troponin T (≤0.012) were analyzed and stratified by HEART score. In each HEART score subgroup, the major adverse cardiac event (MACE) rate <6 weeks from presentation was determined. In our study, we analyzed the data of 850 patients who presented with acute chest pain at the Diakonessenhuis (Diak) between 2013-2017 (follow-up 1 year). Columns represent total MACE (%) and % NSTEMI myocardial infarction and unstable angina pectoris (uAP) followed by PCI. There were no other types of MACE events. The data were compared to the total MACE rate (%) reported in the prospective validation study of the HEART score (Backus et al., 2013).
IMPACT OF INDIVIDUALIZED SEGMENTATION ON DIAGNOSTIC PERFORMANCE OF QUANTITATIVE POSITRON EMISSION TOMOGRAPHY FOR HEMODYNAMICALLY SIGNIFICANT CORONARY ARTERY DISEASE

M.J. Bom; M.J. Bom (Amsterdam UMC, Vrije Universiteit, Amsterdam); S.P. Schumacher (Amsterdam UMC, Vrije Universiteit, Amsterdam); R.S. Driessen (Amsterdam UMC, Vrije Universiteit, Amsterdam); P.G. Ralijmakers (Amsterdam UMC, Vrije Universiteit, Amsterdam); H. Everaars (Amsterdam UMC, Vrije Universiteit, Amsterdam); P. van Diemen (Amsterdam UMC, Vrije Universiteit, Amsterdam); A.A. Lammertsma (Amsterdam UMC, Vrije Universiteit, Amsterdam); A.C. van Rossum (Amsterdam UMC, Vrije Universiteit, Amsterdam); J. Knuuti (Turku University Hospital, Turku, Finland); M. Mäki (Turku University Hospital, Turku, Finland); I. Danad (Amsterdam UMC, Vrije Universiteit, Amsterdam); P. Knaapen (Amsterdam UMC, Vrije Universiteit, Amsterdam)

Purpose:
Despite high variability in coronary anatomy, quantitative positron emission tomography (PET) perfusion in coronary territories is traditionally calculated according to the standard American Heart Association (AHA) 17-segments model. This study investigated the impact of individualized segmentation of myocardial segments on the diagnostic accuracy of hyperemic MBF values for hemodynamically significant coronary artery disease (CAD).

Methods:
Patients with suspected CAD (n=204) underwent coronary computed tomography angiography (CCTA) and [15O]H2O PET followed by invasive angiography with fractional flow reserve (FFR) of all major coronary arteries. Hyperemic MBF per vascular territory was calculated using both standard segmentation according to the AHA model and individualized segmentation, in which CCTA was used to assign coronaries to perfusion territories. Diagnostic values of hyperemic MBF for hemodynamically significant CAD (FFR≤0.80) were compared between standard and individualized segmentation.

Results:
In 122 (59.8%) patients one or more segments were redistributed after individualized segmentation. Per vascular territory, mean hyperemic MBF-values were slightly different between standard and individualized segmentation, 2.77±1.15 and 2.80±1.17 mL/min/g respectively (p=0.004). These changes, however, resulted in discordant PET-defined ischemia between segmentation methods in only 5 (0.8%) vessels. The diagnostic value for detecting hemodynamically significant CAD did not differ between individualized and standard segmentation (AUCs of 0.79 and 0.78 respectively, p=0.34).

Conclusion:
Individualized segmentation using CCTA-derived coronary anatomy led to redistribution of standard myocardial segments in 60% of patients. However, this had little impact on [15O]H2O PET MBF-values and diagnostic value for detecting hemodynamically significant CAD did not change. Therefore, clinical impact of individualized segmentation seems limited.
Figure:
Case example of myocardial segmentation analysis
QUANTITATIVE CTA ANALYSIS OF CORONARY PLAQUE PROGRESSION IN SMARTOOL CLINICAL STUDY: THE ASSOCIATION BETWEEN BASELINE CLINICAL PARAMETERS AND PLAQUE PROGRESSION

J.M. Smit; J.M. Smit (LUMC, Leiden); A.R. van Rosendaal (LUMC, Leiden); F. Barbon (Exprivia, Trento); D. Neglia (Fondazione Toscana Gabriele Monasterio, Pisa); J. Knuuti (Turun Yliopisto, Turku); R. Buechel (Universitaet Zuerich, Zürich); A. Teresinska (Instytut Kardiologii w Warszawie, Warsaw); M.N. Pizzi (Hospital Universitari Vall d’Hebron, Barcelona); R. Poddighe (ASL12 U.O.C. Cardiologia, Viareggio); C. Caselli (Institute of Clinical Physiology CNR, Pisa); S. Rocchiccioli (Institute of Clinical Physiology CNR, Pisa); O. Parodi (Institute of Clinical Physiology CNR, Pisa); G. Pelosi (Institute of Clinical Physiology CNR, Pisa); A.J. Scholte (LUMC, Leiden)

Purpose:
The SMARTTool clinical study (Horizon 2020) aims to develop an integrated artery- and patient-specific comprehensive predictive model of plaque progression using serial coronary CT angiography (CTA). Although semi-automated techniques for quantitative assessment of coronary plaques are highly reproducible, only few studies have investigated the use of these techniques to assess plaque progression. The purpose of our study was to assess the association between baseline clinical parameters and plaque progression using serial coronary CTA.

Methods:
Patients were prospectively included to undergo serial coronary CTA. Quantitative assessment of all coronary plaques was performed using a dedicated software package (QAngio CT RE, Medis, Leiden, The Netherlands). Plaque progression was defined by an increase in plaque volume above the median. A binomial logistic regression was performed, including the baseline clinical parameters, low-density lipoprotein (LDL) and statin use at follow-up as independent variables and the annual change in plaque volume (also classified according to the tissue components) as dependent variable.

Results:
In total, 590 coronary segments from 212 patients were quantitatively assessed with a mean interscan period of 6.2 ± 1.4 years. The median annual change in overall plaque volume was 2.33 (interquartile range (IQR) 0.36-6.46) mm³. Moreover, the median annual change in plaque volume for the fibrous, fibrous-fatty, necrotic core and dense calcium tissue components were -0.16 (IQR -2.44-1.57) mm³, -0.04 (IQR -0.88-0.77) mm³, 0.81 (IQR -0.20-2.91) mm³ and 1.41 (IQR 0.24-3.70) mm³, respectively. In multivariable analysis, only hypertension was independently associated with an annual change in overall plaque volume (odds ratio (OR) 1.64, 95% confidence interval (CI) 1.17-2.31; P = 0.004). Although statin use at follow-up was not associated with an annual change in overall plaque volume (OR 1.02, 95% CI 0.71-1.46; P = 0.93), an independent association with dense calcium volume change was found (OR 1.88, 95% CI 1.22-2.89; P = 0.004).

Conclusion:
Hypertension was the only clinical parameter associated with overall plaque progression, assessed by quantitative CTA analysis. Although statin use did not show any effect on overall plaque progression, its use was associated with a significant increase in dense calcium volume, thereby potentially reducing coronary plaque vulnerability.
Figures:

Example of a patient with plaque progression and calcification of the plaque
(A = baseline scan; B = follow-up scan)
Session III: Shock and other vascular issues

IABP AND VA-ECMO IS ASSOCIATED WITH HIGHER SURVIVAL THAN VA-ECMO ALONE IN THE TREATMENT OF CARDIOGENIC SHOCK IN STEMI

F.S. van den Brink; F.S. van den Brink (Medisch Centrum Leeuwarden, Leeuwarden), C. Zivelonghi (University of Verona, Verona), G. Bleeker (Haga Ziekenhuis, Den Haag), T. Vossenberg (Medisch Centrum Leeuwarden, Leeuwarden), K. Sjauw (Medisch Centrum Leeuwarden, Leeuwarden), F. Ribichini (University of Verona, Verona), J.M. ten Berg (St. Antonius Ziekenhuis, Nieuwegein)

Purpose:
VA-ECMO is an upcoming technique in the treatment of cardiogenic shock in STEMI however it increases afterload. Combination of VA-ECMO and IABP has been suggested to reduce afterload and increase survival.

Methods:
A multi-centre in hospital registry was kept on all patients undergoing VA-ECMO or VA-ECMO and IABP treatment for cardiogenic shock in STEMI.

Results:
Between 2011 and 2018 18 patients with STEMI underwent VA-ECMO +/- IABP treatment for cardiogenic shock. The majority was male (78% (14/18)) with a median age of 59 (47-75) years. The culprit was a left main in 33% (6/18), a left anterior descending artery in 44% (8/18), a right coronary artery in 22% (4/18) and 56% (10/18) had concomitant coronary artery disease. A cardiac arrest was witnessed in 83% (15/18). The median SYNTAX score was 26.1 (4-48.5) and the mean SAVE score was -6 (-2—11) representing an estimated survival of 25%-35%.
Survival to discharge was 72% (13/18) of which 67% (12/18) was neurologically intact. Only one patients died after survival due to aspiration pneumonia due to neurological impairment after prolonged resuscitation. Target revascularization was achieved in 78% (14/18).
VA-ECMO and IABP was performed in 39% (7/18) and 61% (11/18) received VA-ECMO alone. Survival in the VA-ECMO and IABP group was 100% (7/7) while survival in the VA-ECMO group was 55% (6/11) p=0.035.

Conclusion:
VA-ECMO can improve survival in patients with cardiogenic shock due to STEMI even when in cardiac arrest. VA-ECMO in combination with IABP is associated with higher survival than VA-ECMO alone.
EFFICACY AND SAFETY OF GLYCOPROTEIN IIB/IIIa INHIBITORS ON TOP OF A POTENT P2Y12 INHIBITOR IN STEMI: A PRE-SPECIFIED SUB-ANALYSIS OF THE ATLANTIC TRIAL

A.H. Tavenier; A.H. Tavenier; R.S. Hermanides; E. Fabris; F. Lapostolle; J. Silvain; J. Flensted Lassen; L. Bolognese; W.J. Cantor; A. Cequier; M. Chettibi; S.G. Goodman; C.J. Hammett; K. Huber; M. Janzon; B. Merkely; R.F. Storey; U. Zeymer; O. Stibbe; P. Ecollan; W.M.J.M. Heutz; E. Swahn; J-P. Collet; F.F. Willems; C. Baradat; M. Licour; A. Tsatsaris; E. Vicaut; C.W. Hamm; G. Montalescot; A.W.J. van ‘t Hof.

Purpose:
Fast and optimal platelet inhibition is an important therapeutic goal in STEMI. Previous research showed that glycoprotein IIb/IIIa inhibitors (GPI) in combination with clopidogrel improve clinical outcomes without an increase in non CABG-related TIMI major bleeding in STEMI. Ticagrelor is a more potent P2Y12-inhibitor and the efficacy and safety of GPI in addition to ticagrelor has not been fully investigated yet. This pre-specified sub-analysis of the ATLANTIC trial (Administration of Ticagrelor in the catheterization Laboratory or in the Ambulance for New ST elevation myocardial Infarction to open the Coronary artery) aims to study the efficacy and safety of GPI administration in addition to ticagrelor in STEMI patients.

Methods:
1630 patients undergoing primary PCI were analyzed in this sub-analysis of the ATLANTIC trial. Patients were divided in three groups: no GPI, GPI administration routinely before PCI and GPI administration in bail-out situations. Primary efficacy outcome was a composite of death, myocardial infarction, urgent target revascularization and definite stent thrombosis at 30-days. Safety outcome was non-CABG-related major PLATO bleeding at 30-days.

Results:
When compared to no GPI (n=930), administration of GPI before PCI (n=525) or in bail-out situations (n=175) did not improve the 30-day composite of death, myocardial infarction, urgent target revascularization and definite stent thrombosis (4.2% in no GPI use vs. 4.0% in routine use of GPI vs. 6.9% in bail-out use of GPI; p=0.58). GPI in bail-out situations increased the rate of non CABG-related major PLATO bleeding compared to no GPI (odds ratio 3.40, 95% confidence interval 1.58-7.33; p<0.01). Though, in a univariate (odds ratio 1.60, 95% confidence interval 0.81-3.16; p=0.65) and multivariate analysis (odds ratio 1.78, 95% confidence interval 0.88-3.61; p=0.92), GPI routinely given before PCI compared to no GPI did not increase rate of bleeding.

Conclusion:
GPI administration in addition to the potent P2Y12 inhibitor ticagrelor in STEMI patients did not improve 30-days ischemic outcomes and mortality. In particular, an increase in 30-days non-CABG-related major PLATO bleeding was seen in patients who received GPI in a bail-out situation.
Table: Clinical efficacy outcomes and safety endpoint regarding GPI use
FEMORAL VENOUS CLOSURE DEVICE AFTER ELECTROPHYSIOLOGY STUDY: SAFETY AND FEASIBILITY STUDY.

G. Tokmaji; G. Tokmaji (Hagaziekenhuis, Den Haag); S.M. Chaldoupi (Hagaziekenhuis, Den Haag); C.J.W. Borleffs (Hagaziekenhuis, Den Haag); F. Houtzager (Hagaziekenhuis, Den Haag); J.W. Vriend (Hagaziekenhuis, Den Haag); V.J.H.M van Driel (Hagaziekenhuis, Den Haag); H. Ramanna (Hagaziekenhuis, Den Haag).

Purpose:
Vascular complications at the femoral vein access site are the most common complications after electrophysiological studies (EPS), occurring up to 13% of procedures and potentially causing prolonged hospital stay and increasing costs. Vascular closure devices are predominantly used to achieve adequate hemostasis of arterial access sites following cardiac catheterization procedures. Until now, few studies were performed to investigate vascular closure devices for femoral access site after EPS. Our aim was to assess the safety and feasibility of a vascular closure device (Perclose ProGlide®, Abbott) that was recently approved for venous use in patients who underwent an EPS.

Methods:
All consecutive patients who underwent an EPS with vascular closure device were evaluated retrospectively. Patients continued their anticoagulants and were heparinized. Up to 6 hours bedrest including 4 hours pressure dressing was maintained postprocedure. We determined the rate of vascular access site complications.

Results:
A total of 100 patients (age, 62 ± 15 years; 60 males) were analyzed. 14 patients had additional suture (figure-of-eight) during the procedure due to access site oozing. During 30 days follow-up, no false aneurysm, arteriovenous fistula, major bleeding, thrombosis, or surgical intervention was observed. 64 patients experienced no events, 4 patients had a hematoma, 22 patients had minor dermal oozing in the first 24 hours of whom 19 received additional pressure dressing for more than 6 hours. No ProGlide® or bleeding related prolonged hospital stay was observed.

Conclusion:
In patients who underwent an EPS, femoral venous closure with the ProGlide® seems to be a safe and feasible novel technique.
POTENTIAL BENEFIT OF EARLY IMPELLA PLACEMENT IN STEMI COMPLICATED BY CARDIOGENIC SHOCK

V.V. Hemradj; M. Karami (Amsterdam UMC, Amsterdam); D.M. Ouweneel (Amsterdam UMC, Amsterdam); J. de Brabander (Amsterdam UMC, Amsterdam); K.D. Sjauw (MCL, Leeuwarden); A.E. Engström (Amsterdam UMC, Amsterdam); M.M. Vis (Amsterdam UMC, Amsterdam); J.J. Wykrzykowska (Amsterdam UMC, Amsterdam); M.A. Beijk (Amsterdam UMC, Amsterdam); K.T. Koch (Amsterdam UMC, Amsterdam); J. Baan (Amsterdam UMC, Amsterdam); R.J. de Winter (Amsterdam UMC, Amsterdam); J.J. Piek (Amsterdam UMC, Amsterdam); A.H.G. Driessen (Amsterdam UMC, Amsterdam); B.A.J.M. de Mol (Amsterdam UMC, Amsterdam); J.P. Ottervanger (Isala, Zwolle); J.P.S. Henriques (Amsterdam UMC, Amsterdam)

Purpose:
Mortality in patients with STEMI complicated by CS remains high, even with primary PCI. Impella support may be beneficial in selected patients. Timing of initiation of Impella support remains however unclear. We studied the effect of Impella placement before versus directly after primary PCI on 30 day mortality.

Methods:
All patients hospitalized between January 2006 and December 2016 with STEMI complicated by CS and treated with primary PCI and Impella support in the acute setting, were included. Patients were analyzed according to the Impella support i.e. before or after the primary PCI. Primary outcome was 30 day mortality.

Results:
A total of 88 patients received Impella therapy during the same session as the primary PCI. Impella was placed pre-PCI in 21 (23.9%) and post-PCI in 67 (76.1%) patients. There were no relevant significant differences between these two patient groups. The 30-day mortality was 42.9% in the pre-PCI versus 59.7% in the post-PCI group (p =0.175). However, after multivariate analysis, Impella placement post-PCI was associated with a significantly higher 30-day mortality (HR 3.5, 95% CI 1.1-11.1). This effect was particularly seen in patients with higher lactate levels, lower MAP or cardiac arrest with ROSC-time of more than 20 minutes.

Conclusion:
In patients with STEMI complicated by CS, Impella placement before primary PCI is associated with better 30-day survival than Impella placement after primary PCI, particularly in patients with higher lactate levels, lower MAP or cardiac arrest with ROSC-time of more than 20 minutes.
Fig. 1. Risk of 30 day mortality in CS patients with Impella placement after PPCI, as compared to those with CS and Impella placement before PPCI in several subgroups.
VA-ECMO IN PATIENTS UNDERGOING HIGH RISK PCI

T.A. Meijers; T.A. Meijers (Vrije Universiteit Medisch Centrum, Amsterdam); F.S. van den Brink (Medisch Centrum Leeuwarden, Leeuwarden); S.H. Hofma (Medisch Centrum Leeuwarden, Leeuwarden); A.J. van Boven (Medisch Centrum Leeuwarden, Leeuwarden); A. Nap (Vrije Universiteit Medisch Centrum, Amsterdam); A.B.A. Vonk (Vrije Universiteit Medisch Centrum, Amsterdam); P. Symersky (Vrije Universiteit Medisch Centrum, Amsterdam); L.L.R. van der Pijl (Medisch Centrum Leeuwarden, Leeuwarden); P. Knaapen (Vrije Universiteit Medisch Centrum, Amsterdam)

Purpose:
High risk PCI (e.g. unprotected left main, last remaining vessel, complex bifurcation lesion, CTO, impaired left ventricular function) can cause haemodynamic instability. VA-ECMO is an emerging technique for cardiopulmonary support in high risk PCI however outcome is unclear.

Methods:
A multi-centre registry of all patients undergoing high risk PCI and receiving VA-ECMO for cardiopulmonary support.

Results:
A total of 14 patients (92% (13/14) male, median age 69.5 (53-83)) of which 50% (7/14) had previous coronary artery disease in the form of CABG (36% (5/14)) and PCI (14% (2/14)) underwent high risk PCI and received prophylactic VA-ECMO support. The main target lesion was a left main in 78% (11/14) a LAD in 14% (2/14), a RCA in 7% (1/14) and 71% (10/14) underwent multi vessel PCI in addition to main target vessel PCI. The median Syntax score was 27.2 (8-42.5) and in 64% (9/14) there was a CTO lesion. LV function was mildly impaired in 7% (1/14), moderately impaired in 14% (2/14) and severely impaired in 64% (9/14). Cannulation was femoral-femoral in all patients. Median ECMO run was 2.57 hours (1-4). Survival was 86% (12/14). Two patients died during hospitalisation due to refractory cardiac failure. All other patients survived to discharge. Complications occurred in 14% (2/14) with one patient developing a TIA post ECMO and one patient developing a thrombus in the femoral vein used for ECMO cannulation.

Conclusion:
VA-ECMO in high risk PCI is feasible with good outcome. It can be successfully used for cardiopulmonary support in selected patients.
THE POTENTIAL OF DONATION AFTER CIRCULATORY DEATH HEART TRANSPLANTATIONS IN THE NETHERLANDS

S. Roest; S. Roest (Erasmus Medical Center, Rotterdam); N.P. Van der Kaaij (University Medical Center Utrecht, Utrecht); K. Damman (University Medical Center Groningen, Groningen); L.W. van Laake (University Medical Center Utrecht, Utrecht); J.A. Bekkers (Erasmus Medical Center, Rotterdam); M.E. Erasmus (University Medical Center Groningen, Groningen); O.C. Manintveld (Erasmus Medical Center, Rotterdam)

Purpose:
The number of patients on the waiting list for a heart transplant is still rising while the number of transplantations is decreasing. Currently, only donation after brain death (DBD) is performed in heart transplantation. However, in England and Australia the first centers have started accepting hearts from donation after circulatory death (DCD) with excellent results. This represents a new pool of donors. Cardiac screening in DCD procedures is not performed in the Netherlands. In this study, the potential of DCD heart donors in the Netherlands was investigated with the data supplied by the “Nederlandse Transplantatie Stichting”.

Methods:
We retrospectively reviewed all DCD procedures in the Netherlands from January 2013 until December 2017 and applied the in- and exclusion criteria from England and Australia; age, DCD class III, medical history (excluding cardiac disease, hepatitis B/C, etc.) and level of inotropic/vasopressor drugs.

Results:
In these 5 years, 1006 DCD donors used for transplantation were identified. Of these, 319 donors were ≤50 years. After applying DCD exclusion criteria, 112 potential DCD heart donors remained. When the age limit was extended to ≤57 years, the number of potential DCD heart donors increased to 201. In comparison, in the same period 215 patients underwent a DBD heart transplant in the Netherlands.

Conclusion:
DCD heart transplantation has a great potential in the Netherlands to decrease the time on the waiting list and reduce waiting list mortality. Cardiac screening in DCD procedures should become standard care to facilitate the potential of DCD heart transplantation.
HOW TO OVERCOME THE LEARNING CURVE FOR LEFT DISTAL TRANSRADIAL APPROACH (LDTRA) FOR CORONARY ANGIOGRAPHY?

Ahmed A. Hassan; P.M. van der Zee, W. Yassi, G.A. Somsen, F. Kiemeneij

Purpose:
We aim to share our learning experience in performing coronary angiography (CAG) by left distal transradial approach (ldTRA) via the anatomical snuffbox. Backgrounds, techniques, and results will be discussed in more detail.

Methods:
Since January 21 2018, ldTRA was introduced in our center under proctorship of an expert in ldTRA. In the course of time, patient- and table preparation, access equipment, hemostasis techniques were optimized and ultrasound guided puncture was introduced. In addition, the trainee underwent a two days dedicated course on ldTRA.

Results:
From January 21 to August 7, 2018, 168 CAG’s were performed. Out of these, 63 (37%) were done by (n=15) or under supervision (n=48) of an expert in this approach. Of these 48 patients, the trainee was initially successful in 32 cases (67%). After the failed first attempt, the instructor was able to successfully perform the procedure in 14 of 16 failed first attempts (88%), so the total success rate was 46 out of 48 proctored patients (96%). When divided in 4 batches of 12 patients, success rates were 75%, 50%, 58% and 83% respectively. Success rate in the last month by trainee alone without supervision was 95% (18 out of 19).

Conclusion:
Mastering ldTRA for coronary access is associated with a learning curve. It is advisable to have a proper training before starting, to perform the first cases under supervision, to have optimal equipment available and to use ultrasound guidance.
IMPACT OF SCAN QUALITY ON THE DIAGNOSTIC PERFORMANCE OF CCTA, SPECT AND PET FOR DIAGNOSING MYOCARDIAL ISCHEMIA AS DEFINED BY FRACTIONAL FLOW RESERVE - A PACIFIC-TRIAL SUBSTUDY -

P.A. van Diemen; P.A. van Diemen (Amsterdam UMC, VU University Medical Center, Amsterdam); R.S. Driessen (Amsterdam UMC, VU University Medical Center, Amsterdam); W.J. Stuijfzand (Amsterdam UMC, VU University Medical Center, Amsterdam); P.G. Rajmakers (Amsterdam UMC, VU University Medical Center, Amsterdam); S.P. Schumacher (Amsterdam UMC, VU University Medical Center, Amsterdam); J.K. Min (New York-Presbyterian, New York); J.A. Leipsic (University of British Colombia, Vancouver); J.Knuuti (Turku University Hospital, Turku); S.R. Underwood (Royal Brompton Hospital, London); P.M. van de Ven (Amsterdam UMC, VU University Medical Center, Amsterdam); A.C. van Rossum (Amsterdam UMC, VU University Medical Center, Amsterdam); I. Danad (Amsterdam UMC, VU University Medical Center, Amsterdam); P. Knaapen (Amsterdam UMC, VU University Medical Center, Amsterdam)

Purpose:
To study the impact of scan quality on the diagnostic performance of CCTA, SPECT and PET for the assessment of hemodynamic significant coronary artery disease (CAD) as indicated by fractional flow reserve (FFR).

Methods:
This post-hoc analysis comprised 208 patients with suspected CAD, who underwent 256-slice CCTA, 99mTc-tetrofosmin SPECT and [15O]H2O PET prior to invasive coronary angiography in conjunction with three-vessel FFR measurements. Scans were analyzed in core laboratories and graded as scans of good, moderate or poor quality. A FFR ≤0.80 defined significant CAD. Results are presented on a per patient level.

Results:
Distribution of good, moderate and poor quality scans was as follows for CCTA; 137 (66%), 45 (22%), 27 (12%). SPECT and PET scans were graded as good, moderate and poor quality in 108 (52%), 79 (38%), 19 (10%) and 175 (86%), 27 (13%), 2 (1%) patients, respectively. Specificity (75%), positive predictive value (PPV, [71%]) and accuracy (80%) of good quality CCTA scans were significantly higher compared to moderate image quality scans, 31%, (p<0.001), 51% (p=0.050), and 67% (p=0.009), respectively (Figure 1A). There was no significant difference in sensitivity or negative predictive value (NPV) of CCTA across the different scan quality groups (Figure 1A). Sensitivity of good quality SPECT scans was superior to moderate (76% vs 41%, p=0.001) and poor image quality scans (30%, p=0.003). A similar trend was observed with regard to the NPV and accuracy of SPECT (Figure 1B). Scan quality did not influence diagnostic value of PET (Figure 1C). A comparison of diagnostic performance of good quality CCTA, SPECT and PET scans revealed a similar accuracy of 80%, 85%, and 85%, respectively (p=0.247). Similarly, area under the curves were 0.86, 0.81, and 0.88, respectively, with overlapping 95% confidence intervals.

Conclusion:
Diagnostic value of CCTA and SPECT was significantly hampered by scan quality, while PET seemed not to be affected by scan quality. Exclusion of moderate and poor quality scans resulted in a high and comparable diagnostic performance of CCTA, SPECT and PET for the diagnosis of hemodynamic significant CAD.
Figure: Figure displays diagnostic performance of CCTA, SPECT and PET.
Session IV: Arrhythmias

CLINICAL DETERMINANTS OF EARLY SPONTANEOUS CONVERSION TO SINUS RHYTHM IN PATIENTS PRESENTING AT THE EMERGENCY DEPARTMENT WITH ATRIAL FIBRILLATION.


Purpose:
Background. Spontaneous conversion (SCV) rates of atrial fibrillation (AF) range from 18-90% in different reports of acute AF cases, mostly depending on the duration of the observation period after onset.
Objectives. Identify clinical determinants of early SCV to sinus rhythm (SR) in patients presenting at the Emergency Department (ED) because of AF.

Methods:
Methods. Observational study of patients who visited the ED because of documented AF between July 2014 and December 2016. Clinical characteristics and demographics were compared between patients with and without SCV before or at the ED.

Results:
Results. We enrolled 943 consecutive patients (age 68.7±12.4 years, 47.3% female). SCV occurred in 187 patients (19.8%). Compared to patients without SCV, patients with SCV more often had first detected AF (41.2% vs. 31.7%, p=0.015), a duration of AF<24 hours (88.2% vs. 67.7%, p<0.001) and left atrial (LA) -diameter ≤40mm (54.0% vs. 34.0%, p<0.001). A history of CABG (2.1% vs. 7.7%, p=0.006), hypercholesterolemia (27.3% vs. 36.4%, p=0.019) and COPD (2.1% vs. 4.0%, p=0.018) were less frequently observed in patients with SCV. Logistic regression analysis showed that duration of AF<24 hours (OR 3.5, 95%CI 2.4–5.3, p<0.001), first detected AF (OR 1.9, 95%CI 1.4–2.7, p<0.001), LA-diameter ≤40mm (OR 1.9, 95%CI 1.4–2.6, p<0.001) and chest pain at presentation (OR 1.5, 95%CI 1.1–2.1, p=0.026) were independent determinants of early SCV.

Conclusion:
Conclusion. Early SCV of acute AF during ED observation is most likely in patients with a first episode of AF or relatively short duration of AF. Pre-admission identification of patients prone to SCV may help change management algorithms and adopt a wait-and-see approach, thus avoiding needless admissions and potentially hazardous and costly rhythm control interventions.
**Figure:**
Figure 1. Spontaneous conversion rate divided by different determinants for early spontaneous conversion. *LA-diameter≤40mm or unknown.
Purpose:
Recurrent atrial fibrillation (AF) after pulmonary vein isolation (PVI) occurs in approximately 30% of patients during first year of follow-up. Several imaging characteristics, including atrial volumes, left/right atrial volume index (LAVI/RAVI), left atrial sphericity (LASP) and left atrial appendage volume have been identified as predictors of AF recurrence in separate studies. The aim of the present study was to compare the predictive value of these imaging parameters for AF recurrence after PVI in the same cohort.

Methods:
Consecutive patients with symptomatic, drug-refractory atrial fibrillation undergoing index PVI were studied. Cardiac computed tomography (CT) was used to assess atrial volumes, dimensions and sphericity. Duration of follow-up was 12 months.

Results:
The study population consisted of 222 patients (57% paroxysmal AF, age 62±9 years, 61% male). Three patients were excluded due to absence of cardiac CT imaging. Successful pulmonary vein isolation was achieved in all patients. Arrhythmia recurrence was documented in 75 patients (34%). Left atrial volume (113.3±32.1ml vs. 127.8±36.7ml, p=0.004), LAVI (54.6±14.3ml/m² vs. 62.6±19.4ml/m², p=0.001), LASP (83.5±3.2% vs. 84.2±2.8%, p=0.044) and left atrial appendage volume index (4.5±1.6ml/m² vs. 5.1±2.6ml/m², p=0.047) were significantly higher in the recurrence group. Right atrial volume and RAVI did not differ between patients with and without AF recurrence. Multivariable analysis using Cox regression identified only LAVI (HR 1.02, p=0.001) as independent predictor of AF recurrence after PVI, with an optimal cut-off value of 55.1 ml/m² as determined by ROC analysis.

Conclusion:
LAVI is an independent predictor of AF recurrence after PVI; other atrial CT parameters provide no additional predictive value.
Figure:
Kaplan-Meier survival curves showing freedom from AF recurrence after catheter ablation according to LAVI <55.1 ml/m² or >55.1 ml/m².
Purpose:
Heart failure (HF) and atrial fibrillation (AF) are closely related and interact with increased mortality and morbidity. The purpose of this study was to evaluate treatment differences between chronic heart failure patients with and without AF in the Netherlands.

Methods:
The current analysis is part of a large scale cross-sectional registry of 10,910 chronic HF patients at 34 Dutch outpatient clinics in the period of 2013 until 2016 (CHECK-HF). Demographic parameters, laboratory and echocardiographic values as well as medication use were recorded in detail.

Results:
2,999 (28.1%) of the 10,910 chronic HF patients had any form of AF. Patients with AF were on average older (77.5±9.1 vs. 71.0±12.3 years, p<0.01), were in a higher NYHA classification (33.9% vs. 25.5% were in NYHA class III or IV, p<0.01) and had more often hypertension (47.9% vs. 41.1%, p<0.01), thyroid disease (8.9% vs. 7.1%, p<0.01) and renal insufficiency (64.7% vs. 55.4%, p<0.01). Drug prescription of HF patients with and without AF is shown in Table 1. Patients with AF received significant less often sotalol and amiodarone and more often digoxin, independently of ejection fraction (EF). In both HF with reduced (HFrEF) and preserved EF (HFpEF), patients with AF received more often beta-blockers, MRA and diuretics and less often ICD and CRT.

Conclusion:
This current large HF registry, presents an overview of observed significant differences in antiarrhythmic, anticoagulation and device therapy between chronic HF patients with and without AF.
Figure:
Table 1. Therapy in HF patients with and without AF

<table>
<thead>
<tr>
<th></th>
<th>HF/EF</th>
<th>No AF</th>
<th>p-value</th>
<th>HFpEF</th>
<th>No AF</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antiarrhythmic therapy</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Sotalol</td>
<td>57 (2.7)</td>
<td>338 (5.6)</td>
<td>&lt;0.01</td>
<td>13 (1.6)</td>
<td>60 (4.6)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Amiodarone</td>
<td>167 (12.9)</td>
<td>575 (15.2)</td>
<td>0.04</td>
<td>31 (9.1)</td>
<td>64 (15.3)</td>
<td>0.01</td>
</tr>
<tr>
<td>Digoxin</td>
<td>838 (40.1)</td>
<td>561 (9.3)</td>
<td>&lt;0.01</td>
<td>293 (35.6)</td>
<td>90 (6.8)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td><strong>Anticoagulation</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>APT</td>
<td>205 (10.1)</td>
<td>2,506 (46.3)</td>
<td>&lt;0.01</td>
<td>56 (7.1)</td>
<td>549 (51.5)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>OAC</td>
<td>1,665 (82.4)</td>
<td>2,258 (41.7)</td>
<td>&lt;0.01</td>
<td>679 (86.2)</td>
<td>416 (39.0)</td>
<td>&lt;0.01</td>
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<tr>
<td>NOAC</td>
<td>148 (7.3)</td>
<td>196 (3.6)</td>
<td>&lt;0.01</td>
<td>51 (6.5)</td>
<td>28 (2.6)</td>
<td>&lt;0.01</td>
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<tr>
<td><strong>HF Pharmacotherapy</strong></td>
<td></td>
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<tr>
<td>Beta-blocker</td>
<td>1,708 (81.7)</td>
<td>4,805 (79.7)</td>
<td>0.04</td>
<td>649 (79.0)</td>
<td>950 (72.3)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>RAS-inhibitor</td>
<td>1,591 (76.1)</td>
<td>5,013 (83.1)</td>
<td>&lt;0.01</td>
<td>543 (66.1)</td>
<td>899 (68.4)</td>
<td>0.26</td>
</tr>
<tr>
<td>MRA</td>
<td>1,194 (57.1)</td>
<td>3,117 (51.7)</td>
<td>&lt;0.01</td>
<td>410 (49.9)</td>
<td>410 (31.2)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Diuretics</td>
<td>1,872 (89.7)</td>
<td>4,855 (80.6)</td>
<td>&lt;0.01</td>
<td>767 (93.3)</td>
<td>931 (70.9)</td>
<td>&lt;0.01</td>
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<tr>
<td><strong>Device therapy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICD</td>
<td>255 (15.4)</td>
<td>1,764 (35.7)</td>
<td>&lt;0.01</td>
<td>12 (2.4)</td>
<td>70 (10.3)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>CRT</td>
<td>120 (7.3)</td>
<td>997 (20.2)</td>
<td>&lt;0.01</td>
<td>2 (0.4)</td>
<td>55 (8.1)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Pacemaker</td>
<td>141 (8.5)</td>
<td>410 (8.3)</td>
<td>0.77</td>
<td>69 (13.6)</td>
<td>175 (25.8)</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

HF, Heart Failure; AF, Atrial Fibrillation; HF/EF, HF with reduced Ejection Fraction; HFpEF, HF with preserved Ejection Fraction; APT, Anti Platelet Therapy; OAC, Oral Anti Coagulation; NOAC, Non vitamin K antagonist Oral Anti Coagulation; RAS, Renin-Angiotensin System; MRA, Mineralocorticoid Receptor Antagonist
DEMOGRAPHICS, SAFETY AND ACUTE PROCEDURAL OUTCOMES USING PHASED RF ABLATION FOR ATRIAL FIBRILLATION ABLATION IN THE NETHERLANDS: DATA FROM THE MULTICENTER PROSPECTIVE GOLD AF REGISTRY

M.N. Klaver; M.N. Klaver (St. Antonius Ziekenhuis, Nieuwegein), L.I.S. Wintgens (St. Antonius Ziekenhuis, Nieuwegein), B.A. Schoonderwoerd (Medisch Centrum Leeuwarden, Leeuwarden), L.V.A. Boersma (St. Antonius Ziekenhuis, Nieuwegein)

Purpose:
Phased radiofrequency ablation (RFA) has been used to treat atrial fibrillation (AF) for over 10 years. However, there are limited publications on large, prospective, multi-center patient population treated with the second-generation PVAC GOLD catheter in “real world” clinical practice. The GOLD AF registry (NCT02433613) aimed to fulfill this demand.

Methods:
The GOLD AF registry (NCT02433613) is a prospective, observational, multi-center study. The present analysis reports baseline demographics, procedural parameters, and acute outcomes of patients treated with phased RFA and enrolled into the GOLD AF registry in the 2 sites in the Netherlands participating in the registry.

Results:
In total, 180 patients scheduled to the Phased RF ablation were enrolled and included in this analysis (mean age 62.0 ± 9.2, 130 males (72.2 %), BMI 26.9 ± 3.7). Of these, 102 (56.7 %) had paroxysmal AF, 75 (41.7 %) persistent AF (PerAF), and 3 (1.7 %) long standing PerAF. 172 (95.6 %) patients were symptomatic prior to the index procedure. Time from the first AF diagnose to the index procedure was 4.2 ± 4.9, years and 2 (1.1 %) patients had other catheter AF ablations prior to the study phased RF procedure. Mean atrial diameter was 42.6 ± 10.6 mm (n=48). Regarding comorbidities, 70 (38.9 %) patients had hypertension, 12 (6.7 %) patients diabetes mellitus, 36 (20.1 %) patients obesity and 12 (6.7 %) patient prior myocardial infarction, 5 (2.8 %) patient chronic heart failure. CHA2DS2-VASc Score >2 was in 53 (29.4 %) patients, HAS-BLED Score ≥3 was in 6 (3.3 %) patients. Cardioversion (CV) performed within 12 months prior to the enrollment date in 93 (51.7 %) patients, using electrical CV in 90 (96.8 %) and pharmacological in 5 (5.4 %) patients. Hospitalizations due to AF within last 12 months took place in 14 (7.8 %). 178 patients (98.9 %) were prescribed with oral anticoagulants OAC at baseline. Of these, 45 (25.0 %) patients received VKA and 132 (73.3%) received NOACs. Among NOACs, Rivaroxaban was taken by 78 (59.1 %) patients, Apixaban by 26 (19.7 %), Dabigatran by 23 (17.4 %) and Edoxaban by 5 (3.8 %). OACs were discontinued prior to procedure in 2 (1.1 %) patients. Number of RF applications per patient was 21.9 ± 6.2. The mean procedure time was 75.4 ± 19.6 min, CathLab time 118.9 ± 20.1 min, LA dwell time 59.4 ± 16.9 min. The mean fluoroscopy time was 15.3 ± 6.2 min and DAP was 2632 ± 1890 cGy*cm². In 29 (16.2 %) patients, dormant conduction check was done, which extended the overall procedure time by 16.7 ± 23.9 min. Procedure was evaluated by investigators as successful in 171 (95.0 %) patients. 9 (5.0 %) procedures were considered as unsuccessful due to: inability to isolate all PVs with PVAC GOLD catheters in 7 cases, phrenic nerve stimulation during ablation of RSPV in 1 case and PVAC GOLD technical failure in 2 cases. System or procedure related periprocedural complications prior to hospital discharge were observed in 6 (3.3 %) patients. Among these, 5 vascular access complications, 1 transient ST elevation in inferior leads following transseptal puncture with spontaneous normalization on ECG. All complications were resolved prior to the hospital discharge.

Conclusion:
These results support the safety and efficiency of phased RF technology with second generation of PVAC catheter in the Netherlands. High acute success rate and low preprocedural complication rate were observed.
SINUS NODE DYSFUNCTION AFTER THORACOSCOPIC ABLATION FOR ATRIAL FIBRILLATION – SUBANALYSIS OF THE ATRIAL FIBRILLATION ABLATION AND AUTONOMIC MODULATION VIA THORACOSCOPIC SURGERY (AFACT) STUDY

J. Neefs; S. Ons (Amsterdam UMC-AMC, Amsterdam); W.R. Berger (OLVG, Amsterdam); S.P.J.Krul (Amsterdam UMC-AMC, Amsterdam); N.W.E. van den Berg (Amsterdam UMC-AMC, Amsterdam); F.R. Piersma (Amsterdam UMC-AMC, Amsterdam); J.S.S.G. de Jong (OLVG, Amsterdam); W.J.P. van Boven (Amsterdam UMC-AMC, Amsterdam); A.H.G. Driessen (Amsterdam UMC-AMC, Amsterdam); J.R. de Groot (Amsterdam UMC-AMC, Amsterdam)

Purpose:
Sinus node dysfunction (SND) may complicate thoracoscopic atrial fibrillation (AF) ablation. Identifying and discriminating patient at risk is important, since SND may require pacing therapy, temporarily or permanently. Currently, the incidence and risk factors of SND remain unclear.

Methods:
This subanalysis of the Atrial Fibrillation Ablation and Autonomic Modulation via Thoracoscopic Surgery (AFACT) study determined the incidence and risk factors of SND in 30 days postoperatively. SND was defined as symptomatic or asymptomatic bradycardia (<60 beats per minute) or a junctional rhythm. The SND risk was assessed by a multivariable logistic regression model and expressed as odds ratios (OR) with 95% confidence intervals (CI). The rate of temporary and permanent pacemaker implantation and the pacing rate during follow-up was determined.

Results:
The AFACT study included 240 patients. Postoperatively, 17 (7.1%) patients developed SND, of whom 15 patients were symptomatic. Patients with SND compared to no SND patients suffered significantly more often from persistent AF (88.2% vs. 57.4%, respectively, p=0.01). After multivariable testing, AF duration ≥5 years decreased the SND risk (OR: 0.28, CI: 0.07-0.85, p=0.03), while additional left atrial lesion increased the risk (OR: 30.60, CI: 1.47-951.40, p=0.03). During admission six patients warranted temporary pacing, moreover permanent pacemakers were implanted in five patients.

Conclusion:
Symptomatic SND occurs relatively often after thoracoscopic AF ablation. Additional left atrial lesions increase the SND risk strongly. The majority of SND was temporary and resolved to sinus rhythm within days.

Figure:
Multivariable analyses of the odds ratios of sinus node dysfunction after thoracoscopic atrial fibrillation ablation.

<table>
<thead>
<tr>
<th></th>
<th>OR</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, ≥65 years</td>
<td>2.44</td>
<td>0.84</td>
<td>7.05</td>
</tr>
<tr>
<td>Persistent AF</td>
<td>0.37</td>
<td>0.04</td>
<td>6.20</td>
</tr>
<tr>
<td>AF duration ≥5 years</td>
<td>0.28</td>
<td>0.07</td>
<td>0.05</td>
</tr>
<tr>
<td>Additional lesion set</td>
<td>30.60</td>
<td>1.47</td>
<td>951.40</td>
</tr>
</tbody>
</table>
RANDOMIZED CONTROLLED TRIAL OF SURGICAL VERSUS CATHETER ABLATION FOR PAROXYSMAL AND EARLY PERSISTENT ATRIAL FIBRILLATION

T.J. Buist; A. Adiyaman (Isala Heart Centre, Zwolle), T.J. Buist (Isala Heart Centre, Zwolle), R.J. Beukema (Isala Heart Centre, Zwolle), J.J.J. Smit (Isala Heart Centre, Zwolle), P.P.H.M. Delnoy (Isala Heart Centre, Zwolle), M.E.W. Hemels (Isala Heart Centre, Zwolle), H.T. Sie (Isala Heart Centre, Zwolle), A.R. Ramdat Misier (Isala Heart Centre, Zwolle), A. Elvan (Isala Heart Centre, Zwolle).

Purpose:
Current guidelines recommend both percutaneous catheter ablation and surgical ablation in the treatment of atrial fibrillation (AF), with different levels of evidence. No direct comparison has been made between minimally invasive thoracoscopic pulmonary vein isolation (PVI) with left atrial appendage ligation (surgical MIPI) versus percutaneous catheter ablation (CA) comprising of PVI as primary treatment of AF. We therefore conducted a randomized controlled trial comparing the safety and efficacy of these 2 treatment modalities.

Methods:
Eighty patients were enrolled in the study and underwent implantable loop recorder implantation. 28 patients did not reach randomization criteria. A total of 52 patients with symptomatic paroxysmal or early persistent AF were randomized, 26 to CA and 26 to surgical MIPI. The primary endpoint was defined as freedom of atrial tachyarrhythmias, without the use of anti-arrhythmic drugs. The safety endpoint was freedom of complications.

Results:
Median age was 57 years (range 37-75) and 78% was male. Paroxysmal AF was present in 74%. Follow-up duration was ≥2 years in all patients. CA was noninferior to MIPI in terms of single procedure arrhythmia free survival after 2 years follow-up (56.0% versus 29.2%, hazard ratio [HR], 0.56; 95% confidence interval [CI], 0.26 to 1.20, log-rank P=0.059). Procedure related major adverse events occurred significantly more often in MIPI than CA (20.8% versus 0%, P=0.029).

Conclusion:
Percutaneous PVI was noninferior to MIPI in terms of efficacy and resulted in less complications.
Figure: Kaplan–Meier curves displaying time to first atrial tachyarrhythmia with 3-month blanking period (intention-to-treat analysis). Log-rank: $P = 0.059$. 

HR 0.56 (95%CI: 0.26 – 1.20), $P=0.13$
EPICARDIAL ABLATION IN SYMPTOMATIC BRUGADA PATIENTS, A DUTCH CASE SERIES

D.M. Haanschoten; D.M. Haanschoten (Isala,Zwolle); A. Elvan(Isala,Zwolle); N. Ahmed Asaad(Hamad Heart Hospital, Qatar); P.G. Postema(AMC, Amsterdam); R.M.A ter Bekke (MUMC, Maastricht); A. Adiyaman(Isala,Zwolle); W. Aanhaanen(Isala,Zwolle); J.J.J. Smit(Isala,Zwolle); A.R. Ramdat Misier (Isala,Zwolle); P.P.D Delnoy(Isala,Zwolle); H.J.G.M. Crijns(MUMC,Maastricht); A.A.M. Wilde(AMC, Amsterdam)

Purpose:
Brugada Syndrome (BrS) is a condition with a wide divergence of clinical expression and a challenge lies in the identification and management of high risk patients for ventricular arrhythmia (VA). In the past few years, promising results were described targeting arrhythmogenic substrate of the right ventricle outflow tract (RVOT) epicardium. In this report we describe our experience with endo- and epicardial substrate mapping and ablation in a series of BrS patients.

Methods:
Our study population consists of 6 patients with BrS and one patient with arrhythmogenic right ventricular cardiomyopathy (ARVC) in retrospect, from a consecutive series that underwent epicardial catheter ablation in two Dutch hospitals (Isala hospital Zwolle; and Academic Medical Centre Amsterdam) and Hamad Heart Hospital in Qatar between 2013 and 2017. All patients had an ICD and experienced ATP/shock therapy due to recurrent VA episodes including electrical storm. All patients underwent mapping of the RVOT region to search for abnormal fractionated signals. Elimination of fractionated signals and normalization of BrS ECG pattern was the aimed endpoint of the procedure.

Results:
The study group consist of 7 patients (6 males), age 45.6 ± 16.9 years at time of endo- and epicardial mapping and ablation. Five patients had a putative pathogenic variant in SCN5A. One patient was excluded from analysis since ablation could not be performed due to a very large substrate with high epicardial impedance and later ARVC was diagnosed associated with a SCN5A variant. One patient underwent both endo- and epicardial ablation to eliminate VA. After a mean follow-up of 3.6 ± 1.5 years, 5/6 BrS patients remained free of arrhythmia with 2 patients continuing quinidine. One BrS patient had recurrence of VA two months after the ablation procedure due to incomplete ablation of a large substrate with recurrence of typical BrS ECG pattern. Quinidine was restarted and the patient remained VA free afterwards.

Conclusion:
The majority of these highly symptomatic BrS patients had a SCN5A mutation and the substrate was mainly located epicardically. Catheter ablation was associated with an excellent long-term VA free survival.
Purpose:
Grown-up congenital heart disease (GUCH) patients often suffer from atrial fibrillation (AF). eHealth monitoring enables ambulatory measurements of blood pressure and heart failure parameters. We aimed to determine whether these eHealth monitoring parameters are associated with AF in these patients.

Methods:
Symptomatic GUCH patients included in the HartWacht eHealth program perform rhythm monitoring (Kardia), blood pressure monitoring (Omron) and heart failure monitoring with a weight scale. Cox multivariate proportional hazard analysis was used to determine the association of clinical characteristics and eHealth monitoring parameters with the first occurrence of AF. Because of censoring, no blood pressure measurements were included after the occurrence of an AF event.

Results:
In 110 GUCH patients 2507 rhythm strips were available. In total, 161 AF events (6%) were found, and the median time to an AF event was 28 days (range 1 – 99). Of the clinical characteristics male sex (HR 10.4) and symptoms (HR 0.17) remained significant predictors of AF. Of the serial eHealth monitoring data, 3580 serial blood pressure measurements and 3348 weight measurements were available. Of the 161 events, 19 blood pressure measurements performed simultaneously, for the other 142 AF events the blood pressure measurements were taken before the AF event. Of the eHealth monitoring parameters systolic blood pressure (HR 1.7) and diastolic blood pressure (HR 0.49) remained significant predictors of AF, see Figure.

Conclusion:
A multivariate model of clinical characteristics and eHealth blood pressure monitoring determines AF in GUCH patients, emphasizing a role of eHealth blood pressure home monitoring, with swift intervention possibilities.
**Figure:**
Systolic blood pressure measurements determine atrial fibrillation

![Graph showing survival probability over time with different systolic blood pressure measurements and time periods labeled as 0-100 and 100-200. The graph includes lines for 1 Standard Deviation Decrease, Mean Systolic Blood Pressure, and 1 Standard Deviation Increase.]
Session V: Surgery in cardiovascular heart disease

EPICARDIAL OPEN CHEST VT ABLATION. COMBINED HYBRID APPROACH BETWEEN THORACIC SURGEON AND ELECTROPHYSIOLOGIST

Fabiano Porta; F. Porta (Isala, Zwolle), A. Elvan (Isala, Zwolle), A. Adiyaman (Isala, Zwolle),
A.R. Ramdat Misier (Isala, Zwolle), P.P.H.M. Delnoy (Isala, Zwolle), J.J.J. Smit (Isala, Zwolle)

Purpose:
Epicardial catheter ablation for ventricular tachycardia (VT) is often hampered by the coronary artery anatomy and catheter lesion formation by myocardial fatty tissue. Therefore ablation of large anatomical epicardial scar is often incomplete.

Methods:
We describe the case of a 75 year old man, known with a non-ischemic cardiomyopathy possibly caused by rheumatic heart disease 20 years ago, who presented with a ventricular tachycardia (VT) storm and appropriate internal defibrillator (ICD) shocks. He underwent epicardial catheter VT ablation of a large epicardial scar in 2007 due to VT storm, during which normal endocardial voltage was found. He has normal coronary anatomy and presented in 2010 with heart failure and he underwent His bundle ablation for symptomatic atrial fibrillation and biventricular pacing in 2016 resulting in a current ejection fraction of 30-35% on echocardiography. After initial recompensation because of signs and symptoms of heart failure, he continued to present nonsustained VT with an epicardial morphology. A redo epicardial VT ablation with surgical access was performed due to expected pericardial adhesions. After median sternotomy, cardiopulmonary bypass was established and an epicardial voltage map was performed with a multispline mapping catheter (Pentaray®, Biosense Webster) using a 3-D mapping system (CARTO®, Biosense Webster) to find scar tissue and late potentials and middiastolic potentials. Thereafter, VT’s were induced with an endocardial pacing catheter in the right ventricular apex and the epicardium was remapped during VT to enhance entrainment mapping. After mapping and allocation of VT channels epicardial VT ablation with irrigated radiofrequency (RF) was performed (Cardioblate Surgical ablation Pen, Medtronic Inc) in the posterolateral scar along the border zone of the scar by the thoracic surgeon after manual tilting of the heart. After RF ablation of a large epicardial scar VTs were not inducible anymore.

Results:
Patient recovered quickly after ablation and did not experience VT storms anymore since discharge, under amiodarone therapy. He was eventually re-admitted to the hospital due to heart failure but discharged after re-compensation. Eight months after the procedure patient is still free from VT’s.

Conclusion:
Hybrid epicardial VT ablation was successfully performed by an electrophysiologist and a thoracic surgeon together via sternotomy and cardiopulmonary bypass using a 3-D mapping system and epicardial mapping with a multispline catheter.
ENDOSCOPIC VEIN HARVESTING IN CORONARY ARTERY BYPASS GRAFTING: RATE OF RE-INTERVENTION AND QUALITY OF LIFE

V.J. Kroeze; V.J. Kroeze (Catharina Hospital, Eindhoven); K.Y. Lam (Catharina Hospital, Eindhoven); A.H.M. van Straten (Catharina Hospital, Eindhoven); M.A. Soliman Hamad (Catharina Hospital, Eindhoven)

Purpose:
Earlier reports concerning endoscopic vein harvesting have shown some controversy regarding the patency of the vein graft after coronary artery bypass grafting (CABG). Also, data on the quality of life are lacking. In this study, we investigated our experience with endoscopic vein harvesting in regard to these endpoints.

Methods:
All patients who underwent isolated CABG from January 2012 till December 2016 were included in the analysis. Patients were divided in two groups stratified by the technique of saphenous vein harvesting: open versus endoscopic. Primary outcome was the rate of coronary re-intervention, while secondary outcomes were the physical and mental scores of the SF-36 questionnaire. Regression analysis was performed to adjust the endpoint re-intervention for relevant covariates.

Results:
In total 2123 patients were included in the open group, while 883 patients were included in the endoscopic group. The demographics of both groups showed no significant differences. Significantly more re-interventions were seen in the open group ($p = 0.001$). Overall mortality was significantly higher in the open group ($p=<0.001$). Regression analysis identified age, gender and number of anastomoses as significant covariates. Endoscopic vein harvesting showed a trend of decreased hazard of re-intervention, but was not statistically significant ($p=0.056$). Postoperative quality of life showed no significant differences between the two groups.

Conclusion:
Endoscopic vein harvesting was comparable to open vein harvesting in terms of re-intervention rate and quality of life. In addition to the benefits on wound complications, we recommend the routine use of endoscopic vein harvesting in coronary surgery.

Table I. Cox proportional hazard model for rate of re-intervention

<table>
<thead>
<tr>
<th></th>
<th>Univariable analysis</th>
<th>Multivariable analysis</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Hazard ratio (95% CI)</td>
<td>P-value</td>
</tr>
<tr>
<td>Age</td>
<td>0.99 (0.97 − 1.00)</td>
<td>0.129</td>
</tr>
<tr>
<td>Female</td>
<td>1.60 (1.12 − 2.30)</td>
<td>0.010</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>1.03 (0.71 − 1.51)</td>
<td>0.873</td>
</tr>
<tr>
<td>Peripheral vascular disease</td>
<td>1.36 (0.87 − 2.13)</td>
<td>0.172</td>
</tr>
<tr>
<td>Left ventricular ejection fraction &lt;35%</td>
<td>0.67 (0.21 − 2.11)</td>
<td>0.497</td>
</tr>
<tr>
<td>Serum creatinine</td>
<td>1.00 (1.00 − 1.00)</td>
<td>0.366</td>
</tr>
<tr>
<td>Total distal anastomoses</td>
<td>0.76 (0.64 − 0.91)</td>
<td>0.002</td>
</tr>
<tr>
<td>Perioperative myocardial infarction</td>
<td>2.60 (1.07 − 6.35)</td>
<td>0.036</td>
</tr>
<tr>
<td>Endoscopic vein harvesting</td>
<td>0.69 (0.45 − 1.07)</td>
<td>0.097</td>
</tr>
</tbody>
</table>
Purpose:
Optimal management remains unclear in patients with acute retrograde aortic dissection (AD) originating from a tear in the descending with extension into the arch or ascending aorta. To elucidate this, we provide data on the management and outcomes of such patients.

Methods:
All patients enrolled in the International Registry of Acute Aortic Dissection from 1996-2015 were reviewed. Retrograde AD was defined by primary tear in the descending aorta with proximal extension into the arch or ascending aorta. Primary end-points were in-hospital management strategy and mortality.

Results:
We identified 101 patients with retrograde AD (67 men; 63.2±14.0 years). During hospitalization, medical (MED), open surgical (SURG), and endovascular (ENDO) therapies were undertaken in 44, 33, and 22 patients, respectively. The SURG group presented with larger ascending aorta (P=0.04) and more frequent ascending aortic involvement (81.8% [27/33] vs 22.7% [15/66], P<0.001) compared with the MED and ENDO groups. Early mortality rate was 9.1% (4/44), 18.2% (6/33), and 13.6% (3/22), for the MED, SURG, and ENDO groups (P=0.51), respectively. A favorable early mortality rate was observed in patients with retrograde extension limited to the arch (8.6% [5/58]) vs into the ascending aorta (18.6% [8/43], P=0.14). Early mortality rate of patients with retrograde AD (12.9% [13/101]) was significantly lower than those with classic type A AD (20.0% [195/977], P=0.001).

Conclusion:
A subset of patients with acute retrograde AD originating from primary tear in the descending aorta might be managed less invasively with acceptable early results, particularly among those with proximal extension limited to the arch.
Figure:
(A) Axial view on computed tomography of the same acute retrograde aortic dissection as in Figure 1B, showing the entry tear (*), patent false lumen in the descending aorta (white arrow), and completely thrombosed false lumen in the ascending aorta (black arrow). (B) Axial view showing the dissection extension in the arch. (C) After 2 months of thoracic endovascular aortic repair, demonstrates complete thrombosis of the descending aortic false lumen (black arrow). (D) Coronal view demonstrating the implanted endograft.
MINIMALLY INVASIVE SURGERY FOR ADULT PATIENTS WITH CONGENITAL HEART DISEASE: THE DUTCH EXPERIENCE

M. Zegel; M. Zegel (University Medical Center of Groningen, Groningen); R.E.P. Theunissen (University Medical Center of Groningen, Groningen); P.C. van de Woestijne (Erasmus Medical Center, Rotterdam); S.C. Arrigoni (University Medical Center of Groningen, Groningen)

Purpose:
Since 2010 minimally invasive surgery for congenital heart defects have been used in the Netherlands. With a limited submammary incision, this technique offers an alternative to conventional sternotomy. However, results of the Netherlands have not yet been described. In this study we describe the results of this technique.

Methods:
All adult patients who underwent minimally invasive surgical correction of congenital heart defects in the University Medical Center of Groningen and in the Erasmus Medical Center of Rotterdam from August 2010 until August 2018 have been included. Patient characteristics, operation, hospital-stay and follow-up were retrospectively collected.

Results:
Seventy-nine patients were included, mean age was 37.4 years (range 18.0 – 73.0) with mean weight of 71.6 kg (range 53 – 117). Fifty-eight (73%) patients underwent ASD closure, other patients underwent correction of more complex congenital defects. Four patients required conversion to sternotomy. Conversion was two times needed due to lung adhesions, once due to complexity of operation and once because of small femoral artery. Thirty (38%) patients were extubated at the OR. Seventy-six (95%) patients were discharged from the ICU ≤24 hours. There was no in-hospital and follow-up mortality. Five patients needed re-operation; two times because of recurrent ASD, once because of bleeding, once due to cardiac tamponade and once due to lung herniation. Six patients developed a complication related to groin perfusion.

Conclusion:
Minimally invasive surgery represents a safe alternative for correction of congenital heart defects in adult patients. Compared to conventional sternotomy this technique provides earlier extubation and improved cosmetic outcomes.
MINIMAL INVASIVE EXTRACORPOREAL CIRCULATION FOR AORTIC VALVE REPLACEMENT SURGERY - A RANDOMISED CONTROLLED TRIAL ON BLOOD LOSS

F.R. Halfwerk; K. Knol (Thorax Centrum Twente, Enschede); S. Mariani (Thorax Centrum Twente, Enschede); G. Mecozzi (UMCG, Groningen); J.G. Grandjean (Thorax Centrum Twente, Enschede)

Purpose:
Developments in Extracorporeal Circulation (ECC) such as Minimal Invasive ECC (MiECC) imply many advantages. Thus far, only small studies with invasive components such as roller pumps were published. Therefore, this study aims to compare MiECC to an advanced ECC (AdECC) with respect to blood loss for Aortic Valve Replacement (AVR) surgery.

Methods:
128 adult patients were included in a Randomised Controlled Trial (RCT). Primary endpoint was blood loss after 12 hours, with secondary endpoints on clinical laboratory data and long-term survival.
Our MiECC system had a smaller circuit volume (800 mL vs 1600 mL) and a closed circuit with no blood-air contact. In both groups, centrifugal pumps, coated circuits and arterial filters were used.

Results:
Blood loss favoured MiECC (n=63) with 230 mL (95% CI: 203, 261 mL), compared to AdECC (n=62) with 288 mL after 12 hours (95% CI: 241, 344 mL), p = 0.04.
Haemoglobin levels were significantly better preserved in the MiECC group after 1 and 12 hours (p < 0.001, see Figure 1).
There was no difference in 120 days or long-term survival (median follow up of 1600 days).

Conclusion:
This first RCT comparing MiECC and AdECC on blood loss shows a significant lower blood loss in MiECC patients, yet this effect is not clinically significant.
AdECC might be a valid alternative to MiECC, benefitting from fully coated lines, a centrifugal pump and arterial filters.
Figure 1 Haemoglobin levels pre- and post Aortic Valve Replacement (AVR) surgery

![Haemoglobin levels pre- and post Aortic Valve Replacement (AVR) surgery graph](image)
SURGICAL TREATMENT AND LONG-TERM OUTCOMES OF ADVANCED AORTIC VALVE ENDOCARDITIS COMPLICATED BY ANNULAR ABSCESS

A. Angkasuwan; A. Angkasuwan (University College Roosevelt, Middelburg); S. Croon (University College Roosevelt, Middelburg); A. Khamooshian (Catharina Hospital, Eindhoven); A.H. van Straten (Catharina Hospital, Eindhoven); T.W. Elenbaas (Catharina Hospital, Eindhoven); M.A. Soliman-Hamad (Catharina Hospital, Eindhoven)

Purpose:
Aortic valve endocarditis is occasionally complicated with periannular spreading of the infection and abscess formation, leading to a more aggressive course of the disease and life-threatening complications. We investigated the long-term outcomes of patients having this complication, which was surgically managed with annular reconstruction and aortic valve replacement.

Methods:
Between 1998 and 2018, 69 patients were identified with aortic valve endocarditis complicated by a periannular abscess. Patients were all treated with debridement of the infected tissue, gentamicin filling of the abscess cavities, annulus reconstruction with bovine pericardium and valve replacement. Long-term follow-up was performed to detect the rate of recurrence of endocarditis, aortic valve reoperation and survival.

Results:
Mean age was 58 ± 15 years, 81% of patients were male, and the infected valve was native in 51% of all patients. Five and 10-year survival was 69.4 ± 12.0% and 55.7 ± 14.3%, respectively. Freedom from recurrent endocarditis at 10 years was 83.5 ± 13.3%. A significantly negative effect on survival time was found for prosthetic endocarditis (χ²(1)=5.472, p=0.019), having a tricuspid aortic valve (χ²(1)=5.083, p=0.024), receiving a biological valve (χ²(1)=7.049, p=0.008), and suffering from diabetes mellitus (χ²(1)=4.878, p=0.027), peripheral vascular disease (χ²(1)=5.276, p=0.022), or prior transient ischemic attack (χ²(1)=10.714, p=0.001).

Conclusion:
Endocarditis with annular abscess remains associated with high morbidity and mortality and aggressive treatment of the infected tissue and abscess cavities is crucial. Compared with the available literature, long-term outcome of annular reconstruction in this series is comparable with aortic root replacement.
Table 1: Comparison of studies concerning management and outcomes of aortic valve endocarditis complicated by periannular abscess

<table>
<thead>
<tr>
<th>Reference</th>
<th>n</th>
<th>NVE vs.</th>
<th>Prosthesis</th>
<th>Offending Microorganisms</th>
<th>Mortality</th>
<th>Freedom from Re-</th>
<th>Freedom from Re-</th>
<th>Survival</th>
<th>Comment</th>
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<tr>
<td></td>
<td></td>
<td>PVE</td>
<td>Bio vs.</td>
<td></td>
<td></td>
<td>endocarditis</td>
<td>operation</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Mech</td>
<td></td>
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<tr>
<td>Present study</td>
<td>69</td>
<td>51% - 49%</td>
<td>28% - 72%</td>
<td>Staphylococci: 28%</td>
<td>13% (30-day)</td>
<td>83.5 ± 13.3% (10 years)</td>
<td>85.9 ± 10.6% (10 years)</td>
<td>69 ± 12% (5 years)</td>
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<tr>
<td>Takahashi</td>
<td>25</td>
<td>68% - 32%</td>
<td>36% - 64%</td>
<td>Staphylococci: 48%</td>
<td>20% (30-day)</td>
<td>100% (3 years)</td>
<td>100% (3 years)</td>
<td>80 ± 8% (3 years)</td>
<td>Patients with LV-Ao discontinuity</td>
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<tr>
<td>(2013)</td>
<td></td>
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<tr>
<td>Leonтьev</td>
<td>172</td>
<td>56% - 44%</td>
<td>82% - 10.5%</td>
<td>Staphylococci: 49%</td>
<td>25% (30-day)</td>
<td>80 ± 4% (5 years)</td>
<td>50 ± 4% (5 years)</td>
<td>7.5%</td>
<td>Ao allograft</td>
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<tr>
<td>(2012)</td>
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<tr>
<td>David</td>
<td>135</td>
<td>51% - 49%</td>
<td>41% - 49%</td>
<td>Staphylococci: 40% (operative)</td>
<td>15.6%</td>
<td>88 ± 3% (5 years)</td>
<td>96 ± 2% (5 years)</td>
<td>71 ± 4% (5 years)</td>
<td>Ao allograft</td>
</tr>
<tr>
<td>(2007)</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>10%</td>
</tr>
<tr>
<td>Naqvi</td>
<td>45</td>
<td>47% - 53%</td>
<td></td>
<td>Staphylococci: 50%</td>
<td>31% (hospital)</td>
<td>62% (1 year)</td>
<td>37 (82%) patients had surgery.</td>
<td></td>
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<tr>
<td>(2005)</td>
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<tr>
<td>Aasgura</td>
<td>67</td>
<td>60% - 40%</td>
<td></td>
<td>Staphylococci: 30%</td>
<td>19% (hospital)</td>
<td></td>
<td></td>
<td>Multicenter study. Ill with vs without abscess</td>
<td></td>
</tr>
<tr>
<td>(2005)</td>
<td></td>
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<tr>
<td>Krasailla</td>
<td>65</td>
<td>72% - 28%</td>
<td>5% - 23%</td>
<td>Staphylococci: 40%</td>
<td>23.5% (30-day)</td>
<td>72.1% (11 years)</td>
<td>72.9% (11 years)</td>
<td>64.7 % (11 years)</td>
<td>Ao allograft</td>
</tr>
<tr>
<td>(2000)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>72%</td>
</tr>
<tr>
<td>d’Udenekm</td>
<td>70</td>
<td>49% - 51%</td>
<td>43% - 51%</td>
<td>Staphylococci: 53%</td>
<td>13% (operative)</td>
<td>76 ± 10% (8 years)</td>
<td>4.3%</td>
<td>64 ± 8% (8 years)</td>
<td>Ao allograft</td>
</tr>
<tr>
<td>(1996)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6%</td>
</tr>
</tbody>
</table>

Ao = Aorta; NVE = Native valve endocarditis; IE = Infertive endocarditis; LV = Left ventricle; PVE = Prosthetic valve endocarditis
CONSTRUCTIVE PERICARDITIS: OUTCOMES AFTER PERICARDIECTOMY

M.J. Tilly; M.J. Tilly (Erasmus MC, Rotterdam), K.M. Veen (Erasmus MC, Rotterdam), T.W. Galema (Erasmus MC, Rotterdam), J.J.M. Takkenberg (Erasmus MC, Rotterdam), J.A. Bekkers (Erasmus MC, Rotterdam).

Purpose:
Constrictive pericarditis (CP) is a rare form of chronic inflammation, causing fibrosis, loss of pericardial elasticity, and heart failure. Series describing long-term outcomes and quality-of-life after surgery for CP are scarce.
We aimed to evaluate the short and long-term outcomes and the quality-of-life of patients with CP after pericardiectomy.

Methods:
All consecutive patients operated between January 1990 and May 2017 were included in this retrospective study. Univariate Cox-regression models were used to find factors associated with late mortality. During follow-up, quality-of-life was assessed using SF-36 questionnaires and compared to the age-matched general Dutch population.

Results:
56 patients (mean age 58 years, 80% male) were included. Operative mortality (<30 days) was 8.9% (N=5). One patient died of sepsis, four of heart failure. All patients with preoperative right ventricular dilatation died. Median survival was 12 years. During follow-up, an additional 17 patients died. Survival at 1, 3, and 15 years was 87.4±4.5%, 83.3±5.2%, and 46.3±9.1%, respectively. Factors associated with mortality are presented in Table 1. In total, 25 patients completed a SF-36 survey (mean time after surgery: 8.8±6.5 years). The SF-36 surveys showed significantly decreased scores in physical functioning (63.6 vs 76.8, p=0.007) and general health (55.2 vs 65.0, p=0.02) compared to the general Dutch population.

Conclusion:
Patients may benefit from undergoing early pericardiectomy, before severe right heart failure develops. A complete pericardiectomy is associated with better long-term survival. CP after previous cardiac surgery has a higher mortality risk compared to other causes.

Table 1

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>HR</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partial pericardiectomy vs complete</td>
<td>6.258</td>
<td>2.034 – 19.257</td>
<td>0.001</td>
</tr>
<tr>
<td>Post-cardiac surgery vs other etiologies</td>
<td>4.202</td>
<td>1.504 – 11.740</td>
<td>0.006</td>
</tr>
<tr>
<td>Serum Creatinine per 1 μmol/L</td>
<td>1.007</td>
<td>1.002 – 1.012</td>
<td>0.003</td>
</tr>
</tbody>
</table>
A STRUCTURED APPROACH TO NATIVE MITRAL VALVE INFECTIVE ENDOCARDITIS: IS REPAIR BETTER THAN REPLACEMENT?

R.J. Defauw; R.J. Defauw (LUMC, Leiden); A Tomšič (LUMC, Leiden); TJ van Brakel (LUMC, Leiden); N Ajmone Marsan (LUMC, Leiden); RJM Klautz (LUMC, Leiden); M Palmen (LUMC, Leiden)

Purpose:
Mitral valve (MV) repair in active native infective endocarditis (IE) is technically challenging. The survival benefit over valve replacement is poorly established and could be absent due to the high risk of repair failure and reoperation. We explored the results of our structured treatment approach in these patients.

Methods:
Between 1/2000 and 1/2017, 149 patients underwent surgery for native mitral IE. 97 (66%) patients underwent valve repair whilst 52 (34%) underwent replacement. Our structured approach consists of early surgery, radical resection of infected tissue, and “patch” repair techniques. A critical assessment of expected repair durability was made intraoperatively and repair was not performed if concerns regarding long-term durability existed. To study the effects of valve repair on overall survival, a landmark analysis was performed.

Results:
In-hospital mortality was 16.1% (14 repair patients vs. 10 replacement patients; P=0.381). There were no cases of residual IE or early reoperations. On Cox proportional-hazards analysis, valve replacement was not inferior to repair within 1 year post-surgery, (HR 1.38; 95%CI 0.57-3.30; P=0.474). Beyond 1 year post-surgery, replacement was associated with decreased survival (HR 2.62; 95%CI 1.07-6.44; P=0.036). Recurrent infective endocarditis occurred in 5 repair and 1 replacement patient (P=0.667) and MV re-intervention occurred in 8 and 5 patients respectively (P=0.765).

Conclusion:
Native MV IE is associated with high mortality and morbidity rates. A structured approach allows two-thirds of patients to undergo valve repair. Clinical results could be improved by focussing on early surgery, prior to extensive valve destruction, enabling durable repairs and improved late outcomes.
Figures:
Landmark Analysis of Overall Survival

10 year overall survival
MV repair: 80.6% (95%CI 69.6-91.6%)
MV replacement: 47.9% (95%CI 15.4-80.4%)
log-rank: 0.036
ABANDONED LEADS DO NOT INCREASE COMPLICATIONS OF LEAD EXTRACTION FOR CARDIAC IMPLANTABLE ELECTRONIC DEVICE INFECTION

F. Bracke; F. Bracke (Catharina Hospital, Eindhoven); N. Verberkmoes (Catharina Hospital, Eindhoven); M. van ’t Veer (Catharina Hospital, Eindhoven); B. van Gelder (Catharina Hospital, Eindhoven)

Purpose:
It is often assumed that abandoned leads are increasing complications during lead extraction, thereby prompting preemptive extraction if leads become non-functional. We examined the influence of abandoned leads on complications during lead extraction for device related infection.

Methods:
All patients from our center with lead extraction for device related infection from 2006 to 2017 were included. The primary endpoints were major complications and procedural outcome.

Results:
Abandoned leads were present in 141 out of 500 patients. Median cumulative implant times were respectively 24.2 and 11.6 years with or without abandoned leads. A femoral approach was favored until mechanical rotational tools were introduced in 2013. The femoral approach alone was used in 50.4%, (additional) mechanical rotational tools in 22.2% and laser in 5% of patients. Major complications occurred in 0.7% with, compared to 1.7% without abandoned leads (p = 0.679). Procedural failure of endovascular extraction (not all leads completely removed) with or without abandoned leads was respectively 14.9% and 6.7% (p = 0.055), but a clinical successful outcome without complications was obtained in respectively 99.3% and 98.3%. Patients with abandoned leads needed more surgical bail-out procedures (5.7% vs. 0.8%; p = 0.003) but mechanical rotational tools significantly reduced procedural failure with abandoned leads to 9.3%.

Conclusion:
Despite longer implant times, patients with abandoned leads did not experience more complications during lead extraction. The extraction result was influenced by the choice of extraction tools. These results do not warrant preventive extraction of non-functional leads to avoid complications at a later stage.
THE IDEAL MITRAL VALVE PROSTHESIS SHOULD MIMIC THE ASYMMETRIC ANATOMY OF THE MITRAL VALVE

M.T. Bijland; H.J. Dieker (Radboudumc, Nijmegen); A.P.J. van Dijk (Radboudumc, Nijmegen); M. Verkroost (Radboudumc, Nijmegen); G.A.M. Pop (Radboudumc, Nijmegen)

Purpose:
The large anterior and small posterior leaflet of the mitral valve leads to a preferential diastolic blood flow into the left ventricle (LV). Mean diastolic gradient for Björk-Shiley prostheses in mitral position was significantly less at rest and during exercise (2.7mmHg , resp 4.2 mm Hg for size 27) if this flow profile was respected by positioning the major orifice of the Bjork-Shiley prosthesis towards posterior. Current mitral valve bioprostheses have no asymmetric construction: in our study the hemodynamic consequences were measured by Echo-Doppler at rest and during exercise.

Methods:
Color Doppler echocardiograms were performed in a stable condition >6 months after valve surgery in 17 consecutive patients with Perimount Magna Ease bioprostheses (size 27-29); mean age 69y, LV-ejection fraction >40%; Haemoglobine >7.0 mmol/l, mean heart rate 73.5/min). In 4 patients we also performed Echo-Doppler during exercise.

Results:
Color-Doppler showed abnormal mitral inflow pattern in all patients (11 patients with septal intracavitary flow pattern, 2 patients with mid intracavitary flow pattern). Mean gradient, calculated by CWDoppler was 5.24 mmHg (± 1.64 mmHg). No significant difference was observed between the 2 groups with different flow patterns (p=0.26). In 4 patients (prosthesis size 27)mean gradient increased from 6.47 mmHg ±2.72mmHg at rest to 11.65 mmHg ±5.1mmHg during exercise.

Conclusion:
Current bioprostheses in mitral position do not respect physiological blood flow patterns within the left ventricle. This contributes to significantly higher transprosthetic gradients as compared to asymmetric mechanical prostheses, which do respect intracavitary flow pattern (Björk-Shiley).
ARE NOACS SAFE IN ADULT CONGENITAL HEART DISEASE PATIENTS WITH MODERATE AND COMPLEX DEFECTS AND VALVULAR DISEASES? RESULTS FROM A WORLDWIDE STUDY

H. Yang; B.J Bouma (AMC, Amsterdam); K. Dimopoulos (Royal Brompton Hospital, London); P. Khairy (Montreal Heart Institute, Montreal); M. Ladouceur (Hôpital Européen Georges Pompidou, Paris); K. Niwa (St. Luke’s International Hospital, Tokyo); M. Greutmann (University Hospital Zurich, Zurich); M. Schwerzmann (Bern University Hospital); A. Egbe (Mayo Clinic, Rochester); G. Scognamiglio (Vincenzo Montaldi Hospital, Naples); W. Budts (University Hospitals Leuven, Leuven); G. Veldtman (Cincinnati Children’s Hospital Medical Centre, Cincinnati); A.R. Opotowsky (Boston Children’s hospital, Boston); C.S. Broberg (Oregon Health & Science University Hospital, Portland); L. Gumbiene (Vilnius University Hospital Santaros Klinikos, Vilnius); F.J. Meijboom (UMCU, Utrecht); T. Rutz (University Hospital Centre Vaudois, Lausanne); M.C. Post (St. Antonius hospital, Nieuwegein); T. Moe (Phoenix Children’s Heart Centre, Phoenix); M. Lipczyńska (Cardinal Wyszyński National Institute of Cardiology, Warsaw, S.F. Tsai (University of Nebraska Medical Centre, Nebraska); S. Chakrabarti (St Paul's Hospital, Vancouver); D. Tobler (University Hospital Basel, Basel); W. Davidson (Penn State Health Milton S. Hershey Medical Center, Hershey); M. Morissens (Brugmann University Hospital, Brussels); A. van Dijk (RadboudMC, Nijmegen); J. Buber (Sheba medical Center, Ramat Gan); J. Bouchardy (University Hospital Geneva, Genève); K. Skoglund (Sahlgrenska University Hospital, Gothenburg); C. Christersson; (Uppsala University Hospital, Uppsala, T. Kronvall (Örebro University Hospital, Örebro); T.C. Konings (VUMC, Amsterdam); R. Alonso-Gonzalez (Royal Brompton Hospital, London); A. Mizuno (St. Luke’s International Hospital, Tokyo); G. Webb (Cincinnati Children’s Hospital Medical Centre, Cincinnati); M. Laukyte (Vilnius University Hospital Santaros Klinikos, Vilnius); G.T.J. Sieswerda (UMCU, Utrecht); K. Shafer (Boston Children’s hospital, Boston); J. Aboulhosn (Ronald Reagan UCLA Medical Centre, Los Angeles); B.J.M. Mulder (AMC, Amsterdam)

Purpose:
Current guidelines do not recommend non-vitamin K antagonist oral anticoagulants (NOACs) in adults with congenital heart disease (ACHD) with moderate or severely complex defects, significant valvular lesions or prosthetic valves including bioprosthetic valves, due to lack of safety and efficacy data on NOACs in ACHD. The NOTE registry was initiated to evaluate safety, efficacy, adherence and quality of life (QoL) of NOACs in ACHD.

Methods:
This is an international multicenter prospective study of ACHD using NOACs. Follow-up took place at 6 months or yearly thereafter. Primary endpoints were thromboembolic events and major bleeding. Secondary endpoints were minor bleeding, QoL measured by SF-36 questionnaire, adherence by pharmacy interrogation and Morisky-8 questionnaire.

Results:
In total, 531 ACHD patients (mean age 47 years;54% male) with mainly moderate and complex defects(85%), significant valvular lesions(47%) and bioprosthetic valves(10%) using NOACs were included. Mean duration of follow-up was 1.2years. Annual incidence of thromboembolism was 1.0%[95%CI0.4-2.0](n=6). Annual incidence of major bleeding was 1.1%[95%CI0.5-2.2](n=7). Annual incidence of minor bleeding was 6.3%[95%CI4.5-8.5](n=37). Adherence was sufficient during 2 years of follow-up in 80-93% of patients. At 1-year follow-up, among the subset of previous vitamin K antagonist users who completed the survey (n=33), QoL improved in 6 out of 8 domains (p<0.05).

Conclusion:
This worldwide prospective study demonstrates that NOACs are safe and may be effective for thromboembolic prevention in short term in ACHD patients using NOACs. Current recommendations to avoid NOACs in ACHD patients with moderate and complex defects, significant valvular lesions and bioprosthesis valves should be reconsidered.
Figure: Kaplan-Meier curves for survival free from thromboembolic event, major bleeding and minor bleeding under the use of NOACs in ACHD patients.
TREATMENT OF MITRAL VALVE REGURGITATION USING THE CARILLON DEVICE: THE LEEUWARDEN EXPERIENCE

T.N.E. Vossenberg; T.N.E. Vossenberg (Medisch Centrum Leeuwarden, Leeuwarden); F.S. van den Brink (Medisch Centrum Leeuwarden, Leeuwarden); O. Bondarenko (Medisch Centrum Leeuwarden, Leeuwarden); A.J. van Boven (Medisch Centrum Leeuwarden, Leeuwarden)

Purpose:
Mitral regurgitation (MR) is one the leading causes of heart failure. We describe the first Dutch experience with the Carillon percutaneous mitral valve repair device.

Methods:
A single centre registry containing all patients undergoing mitral valve repair with the Carillon device.

Results:
A total of 8 patients (median age 74.5 (69-82) years, 50% male) with functional MR due to annular dilatation underwent implantation of the Carillon device for the treatment of severe MR. Coronary artery disease was present in 63% (5/8) of which 25% (2/8) was obstructive and led to ischaemic cardiomyopathy. Mean LVEF was 17.5% (10-40) prior to implantation, NYHA class was 3.25 (3-4) and MR was grade 3.87 (3-4).
Implantation was successful in 75% (6/8) with a decrease in MR to mean grade 2.33 (2-3). NYHA class improved to 2.25 (1-4). Mitral valve annulus decreased from 41.2mm (34-48) to 37.0mm (24-45). 6-minute walk test improved from 325 (243-398) meters pre-implantation to 341 (252-378) meters 1 month after implantation. BNP levels dropped from 11461 pre-implantation to 7629 post-implantation.
There was no peri-procedural mortality and all patient survived to discharge. In the follow up period one patient died due to end stage heart failure. There were two failed implants due to complete (reversible) RCx obstruction and coronary sinus dissection.

Conclusion:
The carillon device can be successfully used in selected patients with functional MR to reduce MR, and improve symptoms of heart failure (NYHA class and 6 minute walk test). Complication rate is low and there was no procedural mortality.
O.A.E. Salden; O.A.E. Salden (UMC Utrecht); D.J. van Ginkel (UMC Utrecht); W.M. van Everdingen (UMC Utrecht); F. Mohamed Hoesein (UMC Utrecht); M.J.M. Cramer (UMC Utrecht); P.A. Doevendans (UMC Utrecht); M. Meine (UMC Utrecht); S.A.J. Chamuleau (UMC Utrecht); F.J. van Slochteren (UMC Utrecht)

Purpose:
Suboptimal placed left ventricular (LV) leads may result in cardiac resynchronization therapy (CRT) non-response. Pre-procedural identification of optimal pacing sites could be especially useful in patients with ischemic cardiomyopathy (ICM) since pacing in or near scar is associated with poorer outcomes. In the present study we test the feasibility of a full-CMR workup for LV target selection based on 16-segments and 36-segments cardiac bullseye plots. Furthermore we determine the effect of pacing in the CMR-defined target on LV reverse remodeling.

Methods:
Retrospective analysis of thirty CRT patients with ICM. Optimal pacing sites were determined using late gadolinium enhancement (scar identification) and feature-tracking (contraction timing analysis). LV lead positions were scored on both 16-segment and 36-segment bullseyes. The association between the LV lead location, the CMR target area and CRT response was evaluated for both bullseyes.

Results:
CMR-based target selection was feasible in all patients. The 36-segment model outperformed the 16-segment model by displaying significant more LVESV change in patients paced from within the CMR-defined target segment(-28±11%), compared to patients stimulated adjacent to(-12±28%), or remote from(-1±19%) the target area. Moreover, pacing in a scar free segment led to significantly more LVESV change(-21±21%) compared to pacing in scar(1±25%). The relation of the LV lead position with respect to the CMR target and myocardial scar based on a 16-segment model was non-significant.

Conclusion:
CMR-based segmentation of the LV into 36 segments is feasible and may allow for a more accurate determination of the best site for LV pacing. This may lead to improved CRT response rates.
SUBCUTANEOUS IMPLANTABLE CARDIOVERTER-DEFIBRILLATOR (S-ICD) EXPERIENCE IN A COMMON ICD POPULATION WITH PREDOMINANTLY PATIENTS WITH ISCHEMIC CARDIOMYOPATHY

F.J. Oosterwerff; F.J. Oosterwerff (Isala, Zwolle); A. Balci (Isala, Zwolle); A. Adiyaman (Isala, Zwolle); L. Hoek (Isala, Zwolle); K. Breeman (Isala, Zwolle); F. Demirel (Isala, Zwolle); A. Ghani (Isala, Zwolle); J.J. Smit (Isala, Zwolle); A.R. Ramdat Misier (Isala, Zwolle); A. Elvan (Isala, Zwolle); P.P.H.M. Delnoy (Isala, Zwolle)

Purpose:
The subcutaneous implantable cardioverter-defibrillator (S-ICD) continues to be preferentially used in specific patients (younger and less frequently in low ejection fraction). The aim of this analysis was to describe the experience regarding S-ICD implantation in a high volume center in all types of patients who need an ICD without the need for pacing.

Methods:
From November 2010 to August 2017 216 patients who underwent S-ICD implantation for primary and secondary prevention at Isala Hospital in Zwolle were prospectively observed.

Results:
Mean follow up was 41 ±21 months. Mean age at implantation was 56 ±15 years, 71% were man. The mean ejection fraction was 38 % with the most common underlying etiology ischemic cardiomyopathy 54%, off these, 72.2 % (N=83) had an ejection fraction ≤ 35% and 27.8% (N = 32) an ejection fraction > 35%. Other etiologies were dilated cardiomyopathy 17%, hypertrophic cardiomyopathy 11% and idiopathic VT/VF 10%. Complication rate needing invasive intervention was 10%, consisting of hematoma (1.9%), infection (3.7%), pain (2.8%) and DFT fail (1.9%). The appropriate shock rate was 9.7% (2.8%/year) and inappropriate shock rate was 7.4% (2.2%/year). Main reason for inappropriate shock was T-wave oversensing.

Conclusion:
Previous S-ICD studies comprise a more selected patient population with younger patients with less ischemic etiology. Our ‘real world’ S-ICD data in a more common ICD population demonstrates acceptable complication rates.
**Figure:**
Differences in clinical etiology of patients with an ejection fraction ≤35 % and >35 %.
PRIMARY TRANSAXILLARY TAVI; FEASIBILITY AND OUTCOMES

K. van der Wulp; M.W.A. Verkroost (Radboudumc, Nijmegen); M.H. van Wely (Radboudumc, Nijmegen); H.R. Gehlmann (Radboudumc, Nijmegen); L.A.F.M. Van Garsse (Radboudumc, Nijmegen); L. Noyez (Radboudumc, Nijmegen); M.A. Brouwer (Radboudumc, Nijmegen); P.C. Kievit (Radboudumc, Nijmegen); M-J De Boer (Radboudumc, Nijmegen); H. Suryapranata (Radboudumc, Nijmegen); W.J. Morshuis (Radboudumc, Nijmegen); N. van Royen (Radboudumc, Nijmegen)

Purpose:
The femoral artery is generally used as default access for TAVI. However, peripheral artery disease often precludes femoral access. Aim of current study was to describe clinical outcome of TAVI using the left axillary artery (LAA) as primary access site.

Methods:
All consecutive patients treated with a TAVI via the LAA between December 2008 and June 2016 were included. Outcome was prospectively collected and registered according to the updated VARC-2 criteria. Mortality check was performed nationally.

Results:
In total 362 patients were included (median age 80±84 years, logistic Euroscore 17±12%). Successful axillary access was achieved in 99%. In-hospital, major vascular complications occurred in 5% of patients, 1% was LAA-related. Life-threatening or major bleeding was observed in 2% and 10%, respectively. Additional complications were: new LBBB(30%), new permanent pacemaker(11%) and stroke(1%). There were 6(2%) procedural deaths and 19(5%) deaths within 30 days. One-year mortality rate was 19%.

Conclusion:
This is the first study reporting on outcome after TAVI using the LAA as default access. We conclude that it is highly feasible and safe with low rates of major vascular complications, bleeding and stroke.
PACEMAKER DEPENDENCY AFTER NEW PERMANENT PACEMAKER IMPLANTATION AFTER TRANSCATHETER AORTIC VALVE IMPLANTATION

M.S. van Mourik; N.H.M. Kooistra (University Medical Center Utrecht, Utrecht); A.H. Maass (University Medical Center Groningen, Groningen); K.M. Kooiman (Amsterdam UMC - University of Amsterdam, Amsterdam); H.W. van der Werf (University Medical Center Groningen, Groningen); N. Jongejan (University Medical Center Utrecht, Utrecht); J.P.S. Henries (Amsterdam UMC - University of Amsterdam, Amsterdam); P.A.F. Doevendans (University Medical Center Utrecht, Utrecht); N.E.G. Beurskens (Amsterdam UMC - University of Amsterdam, Amsterdam); J. Vendrik (Amsterdam UMC - University of Amsterdam, Amsterdam); A.O. Kraaijeveld (University Medical Center Utrecht, Utrecht); P.R. Stella (University Medical Center Utrecht, Utrecht); J. Baan (Amsterdam UMC - University of Amsterdam, Amsterdam); M. Voskuil (University Medical Center Utrecht, Utrecht); M.M. Vis (Amsterdam UMC - University of Amsterdam, Amsterdam)

Purpose:
A frequent complication after TAVI is the development of conduction disorders (CD) often lead to permanent pacemaker implantation (PPI). However, CD can be temporary and may evolve over time. How to optimally treat CD post-TAVI is still debated and is of growing importance in a progressively younger TAVI population. This study aimed to investigate the progression of conduction disturbances (CDs) over time after transcatheter aortic valve implantation (TAVI) and to find predictors for pacemaker (PM) dependency at two-month follow-up.

Methods:
This multicenter study was conducted in patients who received a PPI after TAVI within 30 days post-TAVI. Retrospective data was collected in a prospectively set up registry. We evaluated pacemaker follow-up records and electrocardiograms to determine PM dependency. PM dependency was determined by an experienced pacemaker technician and (technical) physician. Logistic regression analysis was used to identify predictors for PM dependency.

Results:
Complete evaluation of PM dependency during the first 2-months after PPI was available in 152/190 (80%) patients of 2,056 treated consecutive patients without prior PPI. The principal indication for new PPI was a third-degree AV block (3AVB, 84%). After two months, 48% of the patients were PM non-dependent. The development of CD within 24 hours post-TAVI, pre-procedural PR-interval and the absence of both coronary artery disease (CAD) or stroke were independent predictors to remain PM dependent.

Conclusion:
After two months, half of the patient population was not PM dependent. Frequent PM follow-up and more patient specific programming optimization may prevent a mismatch between PM demand and actual PM dependency and could further minimize unnecessary right ventricular pacing. The development of CD within 24 hours post-TAVI was the strongest predictor for PM dependency.