Session I: Imaging

Additional Diagnostic Value of CMR to the European Society of Cardiology (ESC) Position Statement Criteria in a Large Clinical Population of Patients with Suspected Acute Myocarditis

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Purpose:
To determine the diagnostic yield of tissue characterization by cardiovascular magnetic resonance (CMR) in a large clinical population of patients with suspected acute myocarditis (AM), and to establish its diagnostic value within the 2013 ESC position statement criteria (PSC) for clinically suspected myocarditis.

Methods:
CMR exams of 303 hospitalized patients referred for work-up of suspected AM in two tertiary referral centers were analyzed. The CMR protocol included cine imaging, T2-weighted imaging and late gadolinium enhancement. CMR images were evaluated to assign each patient to a diagnosis. By using non-CMR criteria only, the 2013 ESC-PSC were positive for suspected myocarditis in 151 patients and negative in 30. In the remaining 122 patients, there was insufficient information available for ESC-PSC assessment, mostly due to lack of coronary angiography before the CMR examination (n=116, 95%).

Results:
CMR provided a diagnosis in 158 patients (52%), including myocarditis in 104 (34%), ischemic injury in 44 (15%), and other pathology in 10 patients (3%). CMR demonstrated myocarditis in 50 of the 151 ESC-PSC positive patients (33%), but in none of the 30 negative patients. In the ESC-PSC positive group, CMR additionally identified new cardiac disease that could explain the clinical syndrome in 27 patients (18%), thereby reclassifying them to the negative group (figure).

Conclusion:
Tissue characterization by CMR provided a good diagnostic yield in this large clinical population of patients with suspected AM. CMR proved to provide incremental diagnostic information in patients who fulfilled the ESC-PSC and reclassified a substantial number of patients to an alternative cardiac disease.
Figure 1:
CMR results stratified according to the pre-CMR diagnostic work-up. Cath, catheterization; ESC-PSC, 2013 ESC position statement criteria; DCM, non-ischemic dilated cardiomyopathy; ARVC, arrhythmogenic cardiomyopathy; Takotsubo, takotsubo cardiomyopathy.
Regional function after acute myocardial infarction: strain analysis is superior to wall thickening in detecting microvascular injury

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Purpose:
The aim of this study was to compare the diagnostic performance of tissue tagging derived strain and wall thickening in discriminating between infarcted and non-infarcted myocardium and in detecting microvascular injury (MVI) within infarcted segments.

Methods:
Seventy-one patients with a successfully treated STEMI underwent CMR imaging at 2-9 days after reperfusion. Imaging protocol included cine imaging, late gadolinium enhancement and myocardial tissue tagging. Regional circumferential and radial strain and strain rates were analyzed in a 16-segment model as well as absolute and relative wall thickening. Strain and wall thickening were stratified according to presence of hyperenhancement and MVI.

Results:
Hyperenhancement was detected in 418 (38%) of 1096 segments and was accompanied by MVI in 145 (35%) of hyperenhanced segments. Wall thickening, circumferential and radial strain were all significantly diminished in segments with hyperenhancement and decreased even further if MVI was also present (all p<0.001). Peak circumferential strain (CS) surpassed all other strain and wall thickening parameters in its ability to detect hyperenhancement (all p<0.05). Furthermore, CS was superior to both absolute and relative wall thickening in identifying MVI within infarcted segments (p=0.02 and p=0.001, respectively).

Conclusion:
Strain analysis is superior to wall thickening in differentiating between normal and infarcted myocardium and in identifying MVI within infarcted segments. Peak circumferential strain is the most accurate marker of regional contractile function.
Figure 1:
Receiver-operator characteristic (ROC) curves with corresponding area under the curves (AUCs) and 95% confidence intervals of wall thickening (top row), circumferential strain (middle row) and radial strain (bottom row) for detecting hyperenhancement (left column) and microvascular injury (right column).
Diagnostic value of transluminal attenuation gradient for the presence of ischemia as defined by fractional flow reserve and quantitative positron emission tomography

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Purpose:
Several functional coronary computed tomography angiography (CCTA) parameters have been developed in order to more accurately identify hemodynamically significant lesions, e.g. transluminal attenuation gradient (TAG), its correction model corrected contrast opacification (CCO), and transluminal diameter gradient (TDG). However, studies on the diagnostic value of these parameters have yielded conflicting results. This study aimed to investigate the incremental diagnostic value of TAG, CCO, and TDG over CCTA alone for the identification of ischemia as defined by the invasive gold standard fractional flow reserve (FFR) and the non-invasive gold standard quantitative positron emission tomography (PET).

Methods:
Patients underwent CCTA and [15O]H2O PET followed by invasive coronary angiography with FFR of all major coronaries. TAG, CCO, and TDG were calculated and the incremental diagnostic value of these parameters over CCTA alone for ischemia as defined by PET (hyperemic MBF ≤ 2.30 ml/min/g) and FFR (≤ 0.80) was determined.

Results:
A total of 557 (91.9%) coronary arteries of 201 patients were included. TAG, CCO, and TDG did not discriminate between vessels with or without ischemia as defined by either PET or FFR. These parameters did not have incremental diagnostic accuracy over CCTA alone for the presence of ischemia, defined by PET and FFR. There was a significant correlation between TDG and TAG (r=0.47, p<0.001) and TDG and CCO (r=0.37, p<0.001).

Conclusion:
TAG, CCO, and TDG do not provide incremental diagnostic value for the presence of ischemia. The lack of diagnostic value of contrast-based flow estimations may be a result of interrelations with variability in coronary luminal diameter.
Figure 1:
Receiver-operating characteristic curve analysis with area under the curve (AUC) for the diagnostic value of CCTA alone versus CCTA with TAG, CCO and TDG for the presence of ischemia as defined by PET (left column) and FFR (right column).

<table>
<thead>
<tr>
<th>Test</th>
<th>AUC (95% CI)</th>
<th>p-value *</th>
</tr>
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<tbody>
<tr>
<td>CCTA</td>
<td>0.68 (0.64 - 0.72)</td>
<td>-</td>
</tr>
<tr>
<td>CCTA + TAG</td>
<td>0.70 (0.67 - 0.74)</td>
<td>0.053</td>
</tr>
<tr>
<td>CCTA + CCO</td>
<td>0.70 (0.66 - 0.74)</td>
<td>0.08</td>
</tr>
<tr>
<td>CCTA + TDG</td>
<td>0.69 (0.65 - 0.73)</td>
<td>0.27</td>
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<table>
<thead>
<tr>
<th>Test</th>
<th>AUC (95% CI)</th>
<th>p-value *</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCTA</td>
<td>0.74 (0.68 - 0.79)</td>
<td>-</td>
</tr>
<tr>
<td>CCTA + TAG</td>
<td>0.75 (0.70 - 0.80)</td>
<td>0.52</td>
</tr>
<tr>
<td>CCTA + CCO</td>
<td>0.75 (0.70 - 0.80)</td>
<td>0.38</td>
</tr>
<tr>
<td>CCTA + TDG</td>
<td>0.74 (0.69 - 0.79)</td>
<td>0.87</td>
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Impact of Revascularization on Fractional Flow Reserve and Absolute Myocardial Blood Flow as Assessed by Serial [15O]H2O PET imaging

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Purpose:
The main goal of coronary revascularization is to restore myocardial perfusion in case of ischemia causing coronary artery disease (CAD). Yet, little is known on the effect of revascularization on absolute myocardial blood flow (MBF). Therefore, the present prospective study assesses the impact of coronary revascularization on absolute MBF as measured by [15O]H2O positron emission tomography (PET) and fractional flow reserve (FFR) in patients with stable CAD.

Methods:
53 Patients (87% men, mean age 58.7±9.0 years) with suspected CAD were included prospectively. All patients underwent serial [15O]H2O PET perfusion imaging at baseline and after revascularization by either percutaneous coronary intervention (PCI) or coronary artery bypass graft surgery (CABG). FFR was measured at baseline and directly post-PCI. Sequential absolute myocardial perfusion was compared and the relationship with FFR was explored.

Results:
After revascularization, regional rest and stress MBF improved from 0.77±0.16 to 0.86±0.25 mL·min⁻¹·g⁻¹ and 1.57±0.59 to 2.48±0.91 mL·min⁻¹·g⁻¹, respectively, yielding an increased coronary flow reserve (CFR) from 2.02±0.69 to 2.94±0.94 (p<0.01 for all). Baseline FFR improved post-PCI from 0.61±0.17 to 0.89±0.08 (p<0.01). After PCI, an increase in FFR paralleled improvement in absolute myocardial perfusion as reflected by stress MBF and CFR (r=0.74 and r=0.71, respectively, p<0.01 for both). PCI demonstrated a greater improvement of regional stress MBF as compared with CABG (1.14±1.11 vs. 0.66±0.69 mL·min⁻¹·g⁻¹, respectively, p=0.02).

Conclusion:
Successful coronary revascularization has a significant and positive impact on absolute myocardial perfusion as assessed by serial quantitative [15O]H2O PET. Notably, improvement of FFR after PCI was directly related to the increase in hyperemic MBF.
Ex-Vivo Validation of Cardiac Magnetic Resonance Velocity Mapping For Quantification of Aortic Regurgitation In a Porcine Model In The Presence Of a Transcatheter Heart Valve

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Purpose:
Paravalvular aortic regurgitation (PAR) following transcatheter aortic valve implantation (TAVI) is associated with impaired outcome. However, no data exist regarding maintenance of the accuracy of PAR measured by cardiac magnetic resonance (MR) in the presence of a transcatheter heart valve (THV). Therefore, we aimed to validate and determine the most appropriate location and the accuracy of MR velocity mapping for the quantification of PAR in presence of a THV.

Methods:
In an ex-vivo pig heart model, we studied the accuracy and repeatability of MR velocity mapping in the presence of a THV using a 1.5T MR system. All experiments were performed twice, at 5 different flow velocities (between 16.67 and 50 ml/sec) for a native valve, and two commonly used THVs: SAPIEN XT and CoreValve. For each THV, antegrade flow (AF) as well as retrograde flow (RF), were measured in the ascending aorta (Level A), in the valve (Level B), and in the left ventricular outflow tract (Level C) and compared to the True flow. Statistical analysis was performed by using Bland-Altman analysis and linear regression model.

Results:
There was a high level of accuracy and precision for the MR-derived flow volumes in both THVs and native valve. As expected, for both THVs, measurements through the THV frame were unreliable with errors of 36.7% to 76.6%. For Sapien XT, AF and RF results were comparable at level A and C. For AF, a systematic underestimation of 12.9% and 17.7%, and a clinically acceptable random bias of 6.9% and 7.1%, were observed at level A and C, for RF a systematic underestimation of 13.4% and 7.5%. For CoreValve, the AF was best estimated at level C with a systematic underestimation of 20.8% and a random bias of 10.5%. RF was best estimated at level A, with a systematic underestimation of 15.8% and a random bias of only 2.5%. For all valves and flow directions, the ICCs for intratest measurements were high with small intratest differences, indicating excellent repeatability.

Conclusion:
In this ex-vivo study, velocity encoded MR enabled accurate, precise and repeatable quantification of PAR after implantation of two commonly used THVs, when corrected for the systematic underestimation.
First single-center experience with on-line FFRct in clinical assessment of stable chest pain

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Purpose:
CT derived FFR (FFRct) could potentially have an additional value to coronary CT angiography (CCTA) in the diagnostic and therapeutic decision making of patients who are evaluated for coronary artery disease (CAD). We retrospectively evaluated our first single-center experience with FFRct in the clinical assessment of stable chest pain.

Methods:
Since February 2016, on-line FFRct computation were performed by a third party (HeartFlow Inc., Redwood City, California, USA) when the CCTA showed a stenosis >40% in any coronary artery and if no severe artefacts were present. We retrospectively defined that FFRct analysis could contribute to the final diagnostic decision making when the clinical presentation and CCTA outcome are contradictory or inconclusive. Secondly, we reviewed the CCTA outcome with the result of the FFRct analysis and assessed the potential impact of the FFRct analysis on medical management.

Results:
Between February 2016 and July 2017, 65 FFRct analysis were performed. We concluded that the FFRct analysis had a potential value in the final diagnostic decision making of 32 patients (49%) due to a presentation of non-anginal complaints with a stenosis >50% (n=18), typical angina with a 40-50% stenosis (n=4) or inconclusive CCTA results (n=10). Additionally, we concluded that the medical management of 23 patients (35%) could have been different if the FFRct was considered in the diagnostic work-up.

Conclusion:
We conclude that FFRct has an additional value to CCTA in the clinical assessment of our patients with suspected CAD, especially in patients in which clinical presentation and CCTA outcome are not completely corresponding.
Figure 1:
Case example: 64-year old female known with hypertension and familiar hypercholesterolemia presented herself with typical angina. The Agatston calcium score was 840, based on the coronary calcium scan. The coronary CT angiography showed several 50% stenoses in RCA (A) and LAD (B), but the evaluation was limited due the amount of calcium in the coronary arteries. The patient underwent an invasive coronary angiogram, after insufficient response to the medical therapy, which showed no significant stenosis in the RCA (C) and multiple intermediate lesions in the LAD (D) with a negative FFR measurement. The FFRct analysis showed no hemodynamic stenosis in all epicardial coronary arteries (E).
Adding Speckle Tracking Echocardiography to Visual Assessment of Systolic Wall Motion Abnormalities Improves the Detection of Myocardial Infarction

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Purpose:
To investigate the incremental value of strain imaging by speckle tracking echocardiography (STE) over visual assessment of systolic wall motion abnormalities (SWMA) to detect myocardial infarction (MI), using delayed enhancement cardiac magnetic resonance imaging (DE-CMR) as a reference standard.

Methods:
TTE was performed in 95 first MI patients 110 days (IQR 97-171) post-MI and in 48 healthy controls. Two observers, blinded for clinical and CMR data, independently assessed SWMA and categorized subjects as having MI or not. On a separate occasion longitudinal peak negative, peak systolic, end-systolic, global strain and strain rate were measured and averaged for the anterior, inferior, septal and lateral quadrant of the LV. ROC analysis was used to determine a single optimal cut-off value to detect MI. Finally, the diagnostic accuracy of an algorithm of visual assessment first followed by STE was tested (figure 1).

Results:
Median infarct transmurality and size were 64% (IQR 46-78) and 15% (IQR 7-24). Sensitivity, specificity and accuracy of the visual assessment to detect MI were 74% (95%CI: 63-82%), 85% (95%CI: 72-93), and 78% (95%CI: 70-84%), respectively. Of all strain parameters, strain rate had the highest diagnostic accuracy to detect MI (AUC 0.87 (95%CI: 0.80-0.93; cut-off value -0.9652s-1). The combined algorithm improved sensitivity over visual assessment alone (95% (95%CI: 88-98%), p<0.001), whereas specificity was not significantly changed. Overall accuracy improved to 90% (95%CI: 83-94%), p=0.009).

Conclusion:
The sensitivity and diagnostic accuracy of visually detecting chronic MI by assessing SWMA is moderate, but substantially improves by adding strain rate imaging.
Figure 1:
Algorithm combining visual assessment and strain rate average to identify myocardial infarction. SR = strain rate; SWMA = systolic wall motion abnormalities; 1 MI as detected by delayed enhancement cardiac magnetic resonance imaging.

Visual Assessment of SWMA
(n=143)

Definite SWMA
(n=55)

Possible SWMA
(n=22)

No SWMA
(n=66)

Additional SR (n=88)

SR abnormal
(n=45)

SR normal
(n=43)

MI (n=55)

Control (n=0)

MI (n=35)

Control (n=10)

MI (n=5)

Control (n=38)
Session II: Electrophysiology

How to Determine the QT-interval: Comprehensive Analysis of a Large Cohort of Long-QT syndrome Patients and Controls

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Purpose:
We assessed differences between different methods of QT-interval measurements and correction for HR in distinguishing Long-QT syndrome (LQTS) patients from controls.

Methods:
LQTS type 1 (LQTS1), 2 (LQTS2) and 3 (LQTS3) patients were included together with their genotype-negative family members (controls). Three complexes on the baseline-ECG were analyzed applying both the tangent (QT-tangent) and threshold method (QT-threshold) in separate sessions. Measured complexes were averaged and corrected for HR with the Bazett (QTcB) and Fridericia formula (QTcF). Sensitivity and specificity were determined for arbitrary cut-offs of 450 milliseconds (ms) in males and 460 ms in females, and optimal cut-off values based on receiver-operating characteristic analyses.

Results:
We included 1421 individuals (305 LQTS1, 372 LQTS2, 139 LQTS3 and 605 controls); aged 33 years (standard deviation 21 years); 55% female, median HR 70 (interquartiles 61-83) beats per minute. Compared to controls, LQTS patients were younger (29 years versus 39 years, p<0.001), and more likely to be female (57% versus 52%, p=0.06). There was no difference in HR (P=0.45). In LQTS1, LQTS3 and controls, the QT-tangent was significantly shorter compared to QT-threshold (absolute difference 7-13ms, p<0.0001). QTcF was significantly shorter using either QT-tangent or QT-threshold (both delta QTc-interval 13ms, p<0.0001) in the total cohort. Table 1 summarizes the performance of cut-off values using different methods.

Conclusion:
The QT-interval and its correction for HR are different depending on the method used for determination. Particularly, the number of false-positives is influenced by the method chosen to distinguish LQTS patients from controls, possibly resulting in inappropriate therapy in these patients.
Table 1:
Performance of both arbitrary and optimal cut-off values for QTc-interval using different methods to measure the QT-interval (Tangent and Threshold) and to correct it for the underlying heart rate (Bazett- and Fridericia formula).

<table>
<thead>
<tr>
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<th>Males</th>
<th>Females</th>
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<tbody>
<tr>
<td></td>
<td>Area under the curve</td>
<td>Arbitrary cut-off value (ms)</td>
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<tr>
<td><strong>Tangent</strong></td>
<td><strong>QTcB</strong></td>
<td>86%</td>
</tr>
<tr>
<td></td>
<td><strong>QTcF</strong></td>
<td>84%</td>
</tr>
<tr>
<td><strong>Threshold</strong></td>
<td><strong>QTcB</strong></td>
<td>84%</td>
</tr>
<tr>
<td></td>
<td><strong>QTcF</strong></td>
<td>84%</td>
</tr>
<tr>
<td><strong>Tangent</strong></td>
<td><strong>QTcB</strong></td>
<td>86%</td>
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<tr>
<td></td>
<td><strong>QTcF</strong></td>
<td>86%</td>
</tr>
<tr>
<td><strong>Threshold</strong></td>
<td><strong>QTcB</strong></td>
<td>86%</td>
</tr>
<tr>
<td></td>
<td><strong>QTcF</strong></td>
<td>85%</td>
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</tbody>
</table>
Regional Collaboration for Improving Care for Atrial Fibrillation Patients: Data from the Netherlands Heart Network

H.P. Cremers (Netherlands Heart Network, Veldhoven); C. Hoorn (Catharina Hospital, Eindhoven); H.P.A. van Veghel (Netherlands Heart Network, Veldhoven); L.J.H.J. Theunissen (Maxima Medical Center, Veldhoven); S. de Jong (Elkerliek Hospital, Helmond); P. Polak (St. Anna Hospital, Geldrop); P. van der Voort (Catharina Hospital, Eindhoven); L.R.C. Dekker (Catharina Hospital, Eindhoven)

Purpose:
Guideline non-adherence and variations in therapeutic and diagnostic trajectories result in suboptimal atrial fibrillation (AF) treatments. Large academic and referral hospitals demonstrated positive effects of protocolled, nurse-led outpatient AF clinics. Although, similar results have not been indicated in small peripheral hospitals yet, ample opportunities are present when collaboration is initiated on a regional level. Therefore, this study assesses the effectiveness of outpatient AF clinics in a collaborative region in the Netherlands.

Methods:
For this study baseline and 6 months follow-up data of a prospective cohort including newly diagnosed AF-patients of 4 hospitals involved in the Netherlands Heart Network are used. From January’15 to March’16 data regarding patient relevant outcome measures (i.e. EHRA-score, stroke, major bleedings, readmissions, and adverse effects of medication) are gathered. To assess effectiveness of outpatient AF clinics descriptive, logistic, and linear regression analyses are performed using SPSS 21.0.

Results:
In the analyses 448 AF-patients were included. After 6 months significant improvements regarding EHRA-score (p<0,01), hypertension (p<0,01), and type of AF (p<0,01) were indicated. Results of the patient relevant outcomes showed that AF-patients were hospitalized 75 times, 2 strokes and 2 major bleedings occurred. Furthermore, AF-patients reported adverse effects of medication 149 times.

Conclusion:
Collaboration between cardiologists in regional settings permits further improvement of AF care. Therefore, such quality targets are not exclusively reserved to large academic hospitals. Although promising, future research should, next to the patient relevant outcomes, put effort in measuring the quality of life and healthcare costs to provide proper conclusions on the patient value for AF-patients.
A Head-to-head Comparison of CMR Tagging, CMR Feature Tracking and Speckle Tracking Echocardiography in the Prediction of Cardiac Resynchronization Therapy Outcome

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Purpose:
Myocardial strain imaging is a potential tool to improve patient selection for cardiac resynchronization therapy (CRT). Multiple imaging modalities are presently available including CMR myocardial tagging (CMR-TAG), CMR feature tracking (CMR-FT) and speckle tracking echocardiography (STE). Despite promising results per imaging modality, a direct comparison between these methods is lacking. This study aims (i) to compare the predictive value of different strain parameters, and (ii) to evaluate the predictive performance per imaging modality.

Methods:
As part of the MARC study, patients were prospectively enrolled and underwent both CMR and echocardiographic examination before CRT implantation. Strain analysis was performed with dedicated software in the circumferential (CMR-TAG, CMR-FT and STE-circ) and longitudinal (STE-long) orientation. Basic strains, mechanical timing differences (dyssynchrony) and inefficient contraction patterns (discoordination) were quantified. After twelve months, CRT response was quantified by the echocardiographic change in left ventricular end-systolic volume (LVESV).

Results:
Twenty-six patients (age 65±9 y, 15 men) completed follow-up. Using CMR-TAG, various strain markers were strongly associated with LVESV change including segmental dysynchrony (SD-TTPLV) and segmental discoordination (ISF-LV), see figure. Both CMR-FT and STE showed weaker correlations for most parameters, but still showed a good correlation by measuring regional discoordination (ISFsep-lat). Overall, systolic septum strain (AVC strainsep) showed the strongest correlation with LVESV change.

Conclusion:
CMR-TAG demonstrates the highest predictive performance compared to other imaging techniques. CMR-FT and STE yield reasonable performance as well and might be more accessible in clinical practice. Overall, the basic AVC strainsep marker demonstrates the strongest correlation with CRT response.
Figure 1:
Correlations between strain parameters per imaging modality and reverse remodeling (percent LVESV change) after one year. Peak strain: maximal negative strain during the entire cardiac cycle; AVC strain: systolic strain at aortic valve closure; onset-delay: septal to lateral delay in onset contraction; peak delay: difference in time to peak contraction between the septal and lateral wall; SD-TTPLL: standard deviation of time to peak strain of all LV segments; SRSsep: systolic rebound stretch of the septum; SSIssep-lat: systolic stretch index; ISFsep-lat: internal stretch index; CURELV: circumferential uniformity ratio estimate; ISFLV: internal stretch index of all LV segments.
Abstracts of the Scientific Autumn Congress of the Netherlands Society of Cardiology
2-3 November 2017

Long-term success rate and predictors of outcome of VT ablation in patients with ischemic heart disease

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Purpose:
Catheter ablation has become an established treatment in patients with drug-refractory postinfarction ventricular tachycardia. Hemodynamic instability and VT nonmappability in patients with advanced structural heart disease make these procedures challenging. Landmark trials present a wide range of 2–year VT free survival rates (47-88%) in patients with hemodynamically stable VT. We assessed predictors of long-term outcome after VT ablation in a heterogeneous real-world population.

Methods:
Records of consecutive patients with prior myocardial infarction and recurrent VT who were treated with catheter ablation between 2006 and 2017 in the Isala hospital were retrospectively analyzed. Scar areas were identified using 3D electro-anatomic voltage mapping. Detailed mapping during VT was performed in case of hemodynamically stable VTs. Substrate ablation was performed when VT was nonmappable. Primary endpoint was recurrence of sustained VT in the monitoring zone or appropriate ICD therapy at 2-year follow-up. Secondary endpoints included all-cause mortality, complications and hospitalizations.

Results:
A total of 144 patients were included, 48.3% had severe LV dysfunction (LVEF<30%). In 32 patients (22.2%) VT was mappable. Median follow-up duration was 46 [17–78] months. Mean procedural time was 211 ± 82.8 minutes. Two years VT free survival was 56.6%. Recurrence rate was not significantly different (p=0.448) between mappable (37.5%) and unmappable VT (45%). In multivariate analysis, low ejection fraction (LVEF<30% vs 41-51%) was an independent predictor of arrhythmia recurrence.

Conclusion:
This study demonstrates a 2-year arrhythmia free survival (56.6%) after a single catheter ablation in a real world non-selected population including patients with hemodynamically unstable VT and severe LVEF dysfunction. LVEF is an important predictor of outcome, regardless of VT mappability.
Figure 1:
VT free survival and LVEF

VT free survival and LVEF

Log rank p = 0.022

| Nr at risk | EF <30% | 66 | 32 | 23 | 18 | 12 |
| EF 30-40   | 42     |    | 23 | 20 | 15 | 13 |
| EF 41-51   | 32     |    | 24 | 19 | 17 | 14 |
Acute Safety and Efficacy Outcomes of Shorter Cryoballoon Application Times for Cryoballoon Pulmonary Vein Isolation: Results of the 123-Study

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Purpose:
The second generation cryoballoon (CB2) significantly improves procedural outcome of pulmonary vein isolation (PVI) However, the optimal cryo-applicaton time is not known and is of importance as longer application times can result in more complications. The objective of the 123-study is to assess the optimal application duration using the CB2 for isolation of pulmonary veins (PVs).

Methods:
This study randomizes patients with paroxysmal AF, 2 PVs per side and a left atrial size <40cc/m² or <50mm to two times 1, 2 or 3 minute(s) of cryoballoon applications per vein. The assigned ablation time starts after reaching the maximum N2O cooling flow. If no PVI can be achieved with the assigned cryotherapy duration, more and eventually longer applications are applied until PVI is successful.

Results:
214 of 222 patients have been enrolled. Mean application time per cryoapplication was 104±13, 160±21 and 211±36 seconds for the 1, 2 and 3 minutes group. Complete PVI could be achieved after the assigned application times in 77% of the PVs in the 1 minute group and 86% in both the 2 and 3 minutes group. In 43 PVs, 5 in the 1 minute group, the application had to be stopped prematurely due to loss of phrenic nerve conduction.

Conclusion:
Shorter cryoballoon applications enhance the safety of cryoballoon PVI without compromising the acute success rate. These results indicate that shorter cryoapplications can be considered to enhance the safety profile of cryoballoon PVI.
Effect of Blood Pressure Control on Recurrence Rate after Radiofrequency Catheter Ablation for Atrial Fibrillation

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Purpose:
Treating underlying heart disease is key for atrial fibrillation (AF) management. However, many patients with hypertension are referred for pulmonary vein isolation (PVI) without optimal blood pressure control. Therefore, we studied the effect of blood pressure regulation on AF recurrences after a first PVI.

Methods:
The average of four blood pressure measurements from four different visits were analyzed before PVI: two from the last consecutive outpatient visits, and the first measurements on admission and in the electrophysiology laboratory. Outcome was documented AF recurrence, redo-PVI or anti-arrhythmic drug (AAD) use after 1 year. All patients were entered in our prospective database of PVI with active follow-up.

Results:
171 patients (34% females) with a mean age of 61 ±10 years were analyzed for a total of 606 blood pressure measurements, mean 3.5 ±0.7 per patient. The average blood pressure of all measurements of all patients was 136 ±13/81 ±7mmHg. Blood pressure was not predictive for recurrent AF, redo-PVI or AAD use 1 year after PVI (Table). PVI was performed in 69 patients (40%) with suboptimal control for hypertension, defined as average RR ≥140/90mmHg. In patients with and without suboptimal control for hypertension redo-PVI occurred in, resp. 28 vs 16% (p=0.060), recurrent AF in 29 vs 17% (p=0.089) and AAD use in 40 vs 31% (p=0.199).

Conclusion:
Although there is a trend to more recurrences in patients with suboptimal hypertension control, blood pressure is not associated with higher recurrence rates after PV isolation.

Table 1

<table>
<thead>
<tr>
<th></th>
<th>N=</th>
<th>Systolic blood pressure (mmHg)</th>
<th>P=</th>
<th>Diastolic blood pressure (mmHg)</th>
<th>P=</th>
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<tr>
<td>No redo PVI</td>
<td>136</td>
<td>136 ±13</td>
<td>0.254</td>
<td>81 ±8</td>
<td>0.871</td>
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<tr>
<td>Redo PVI</td>
<td>35</td>
<td>139 ±15</td>
<td></td>
<td>81 ±9</td>
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<tr>
<td>Free of AF</td>
<td>123</td>
<td>136 ±12</td>
<td>0.330</td>
<td>81 ±8</td>
<td>0.097</td>
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<tr>
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<td>35</td>
<td>138 ±17</td>
<td></td>
<td>83 ±10</td>
<td></td>
</tr>
<tr>
<td>No AAD use</td>
<td>108</td>
<td>136 ±13</td>
<td>0.431</td>
<td>81 ±9</td>
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<tr>
<td>AAD use</td>
<td>57</td>
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<td>81 ±8</td>
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</table>

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Abstracts of the Scientific Autumn Congress of the Netherlands Society of Cardiology
2-3 November 2017
Usefulness of the R wave Sign as a Predictor for Ventricular Tachyarrhythmia in Patients with Brugada Syndrome

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Purpose:
Brugada syndrome (BrS) is a cardiac channelopathy which is responsible for sudden death in young individuals. The goal of this study is to test the significance of R wave elevation in lead aVR as a predictor for ventricular arrhythmia (VTA) in patients with BrS.

Methods:
In this retrospective study, we included 132 patients with BrS (47±15 years, 65% male) who visited the outpatient clinic for cardiogenetic screening. Patients' medical records were examined for the presence of a positive R wave sign in lead aVR and VTA.

Results:
A positive R wave sign in lead aVR was observed in 41 patients (31%). This sign was more frequently observed in patients who experienced VTA (n=24) either before the initial diagnosis, during electrophysiological studies or during follow up (p< 0.001). The positive R wave sign occurred more frequently in symptomatic patients with a history of an out of hospital cardiac arrest, VTA or syncope, than asymptomatic patients (60% versus 26%; p=0.002). During the follow up period, this sign was more frequently detected in patients who developed either de novo (50%) or recurrent (80%) VTA (p=0.017). Multivariable analysis showed that R wave sign is an independent predictor for VTA development (OR 4.8, 95% CI 1.79-13.27).

Conclusion:
In patients with BrS, the presence of a positive R wave sign in lead aVR is associated with development of VTA. Our findings indicate that the positive R wave sign in lead aVR can be used to identify BrS patients at risk for malignant VTA.
Figure 1:
Kaplan-Meier curve demonstrating the cumulative freedom of ventricular tachyarrhythmic events and receiver operator characteristic (ROC) curve demonstrating the sensitivity of the positive R wave sign.
Session III: Congenital

Aortic stiffness as early detectable manifestation of aortic wall changes in patients with Turner syndrome or bicuspid aortic valve


**Purpose:**
Patients with Turner syndrome as well as patients with a bicuspid aortic valve (BAV) are at risk for aortic dilatation and dissection, but the exact pathophysiology is incompletely understood. A change in carotid-femoral pulse wave velocity (PWV), a direct measure of aortic stiffness, may possibly be an early detectable imaging biomarker of adverse structural and functional changes of the aortic wall.

**Methods:**
Aortic diameters and PWV were measured in three different patient groups who were prospectively included: Turner syndrome without bicuspid aortic valve (T+B-), Turner syndrome with bicuspid aortic valve (T+B+) and patients with a bicuspid aortic valve without Turner syndrome (T-B+). Systolic aortic diameters were measured at the aorta ascendens with computer tomography and corrected for BSA using the aortic size index. Pulse wave Doppler signals were registered with echocardiography at the common carotid artery and femoral artery. PWV was defined as: distance carotid artery to femoral artery/Δ time. Intra- and inter-observer variability of the PWV was assessed.

**Results:**
Overall 102 patients were enrolled: 39 T+B- patients (age 36±14 years, 100% female), 12 T+B+ patients (age 35±13 years, 100% female) and 51 T-B+ patients (age 35±12 years, 25% female). Age did not differ between groups. The aortic size index differed significantly between T+B- patients (17.5±3.2 mm/m²) and T+B+ patients (19.7±3.2 mm/m²) but not between T+B+ (19.7±3.2 mm/m²) and T-B+ (19.0±2.9 mm/m²) patients. No significant difference in PWV was found between the three groups (7.3±2.0, 6.9±1.3 and 6.6±1.4 m/s respectively). Multivariable analysis showed a significant association between age and PWV (β=0.08, p<0.001). Gender and aortic size index showed no association with PWV. Inter- and intra-observer variability were respectively 0.893 (95% CI 0.772-0.951) and 0.964 (95% CI 0.921-0.984).

**Conclusion:**
No difference could be found in aortic stiffness between the three groups. This suggests that the aortic structure is comparable between patients with Turner syndrome and patients with a bicuspid aortic valve. As would be expected, age had a significant association with aortic stiffness. Aortic distensibility at a specific level of the aorta was not investigated in this study, but might be important to detect local aortic vulnerability.
Figure 1:

**Aortic size index**

- **ASI (mm²/m²)**
  - Turner (TAV)
  - Turner (BAV)
  - BAV

- $p=0.04$, $p=0.47$

**Pulse wave velocity**

- **PWV (m/s)**
  - Turner (TAV)
  - Turner (BAV)
  - BAV

- $p=0.54$, $p=0.53$

**Age related changes in pulse wave velocity**

- **PWV (m/s)**
  - Age (years)

Abstracts of the Scientific Autumn Congress of the Netherlands Society of Cardiology
2-3 November 2017
Pulmonary hypertension before and after atrial septal defect in an adult population

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Purpose:
Atrial septal defect (ASD) closure is performed to prevent right ventricular (RV) failure and pulmonary hypertension (PH). Persistent PH after ASD closure is associated with poor clinical outcome. This study establishes the prevalence of PH in adults before and after ASD closure and investigate associations between patient characteristics and PH after ASD closure.

Methods:
Adults with surgical or percutaneous ASD closure between 2000-2014 in the Erasmus MC were included. Echocardiograms before and after ASD closure were retrospectively assessed. Patients were categorized into three groups; explained in Figure 1. Cox regression was performed to identify associations between patient characteristics and PH after ASD closure.

Results:
Of the 244 patients who underwent ASD closure, 198 adults underwent echocardiography before and median 15[IQR:12-35] months after ASD closure (median age at closure 45[IQR:30-57] years, 75% female). Figure 1 shows the PH prevalence before and after ASD closure. New York Heart Association (NYHA) class III-IV (HR:11.07, 95%CI 3.12-39.29, p<0.001), pulmonary disease (HR:10.43, 95%CI 2.12-51.21, p=0.004), use of cardiac medication (HR:3.96, 95%CI 1.02-15.34, p=0.047), tricuspid regurgitation velocity (HR:7.36, 95%CI 2.92-18.53, p<0.001), RV fractional area change (HR:0.87, 95%CI 0.81-0.93, p<0.001), tricuspid annular plane systolic excursion (HR:0.792, 95%CI 0.66-0.96, P=0.016) and PH before ASD closure (HR:23.03, 95%CI 3.39-156.54, P=0.001) were significantly associated with PH at follow-up.

Conclusion:
Adults with low pulmonary pressures before ASD closure are not at risk of developing PH after closure. Patients with PH before closure, high NYHA class, pulmonary disease, cardiac medication, and an impaired RV function at baseline are at risk and require close follow-up.
Resuscitation for Out-of-Hospital Cardiac Arrest in Adults with Congenital Heart Disease

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Purpose:
Adult congenital heart disease (ACHD) patients are at increased risk of sudden cardiac death and out-of-hospital cardiac arrest (OHCA). Currently, there are no data on the causes and circumstances of OHCA, and outcome of ACHD patients who are resuscitated for OHCA. We aim to describe these parameters in ACHD patients and compare these results to OHCA in the general population.

Methods:
We identified ACHD patients in whom resuscitation for OHCA was attempted by linking data from two large ongoing registries in The Netherlands: CONCOR, a nationwide registry of ACHD patients (n=15,727), and ARREST, a large regional cohort of OHCA cases (n=17,868). We included cases with a resuscitation attempt for OHCA from the general population as controls.

Results:
Sixty-two ACHD patients who were resuscitated for OHCA were identified. Ventricular septal defect (n=11), bicuspid aortic valve (n=10) and atrial septal defect (n=8) were the most common diagnoses. ACHD patients were significantly younger compared to controls (n=11,624) at the time of OHCA (mean age 47 (SD±17) years vs. 66 (SD±15) years, respectively, p<0.001), and more often had a shockable initial rhythm (67% vs 40%, respectively, p<0.001). OHCA was caused by a cardiac cause in 76% of ACHD patients, with 6% due to infarction or ischemia. Survival to hospital discharge after resuscitation for OHCA was significantly better in ACHD patients than in controls (44% vs. 19%, p<0.001). After correction for age, gender, witnessed arrest, bystander resuscitation, public location and shockable rhythm, ACHD was no longer significantly associated with an improved survival to discharge (odds ratio 1.33, 95% CI 0.71-2.46, p=0.373).

Conclusion:
ACHD patients resuscitated for OHCA are younger than other OHCA cases, and mostly have relatively simple congenital defects. Risk stratification efforts should therefore be expanded to patients with these defects. Although survival of ACHD patients after resuscitation for OHCA is better than in the general population, this is mainly driven by young age and a shockable initial rhythm.
Figure 1:
Kaplan-Meier estimate of survival after discharge from admission for OHCA in ACHD patients vs. OHCA cases without ACHD (only including patients who were discharged alive from the hospital).
Panel A: All out-of-hospital cardiac arrests, B: OHCA cases with VT or VF.

Panel A: All out-of-hospital cardiac arrests

Panel B: OHCA cases with VT or VF
The Prognostic Value of Various Biomarkers in Patients With Pulmonary Hypertension; a Multi Biomarker Approach

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Purpose:
An increasing emphasis has been laid on the discovery of new biomarkers to optimize the risk stratification in patients with pulmonary hypertension (PH). This study aimed to explore the prognostic value of a range of different (potential) biomarkers in patients with PH and to investigate whether a multi biomarker approach can contribute to a better risk stratification.

Methods:
This is a prospective cohort study in which adult patients with PH confirmed by right heart catheterization were included between May 2012 and October 2016. Patients with PH due to left heart failure were excluded. Baseline levels of N-terminal pro b-type natriuretic peptide (NT-proBNP), high-sensitive troponin T (hs-TnT), galectin-3, high sensitive c-reactive protein (hs-CRP), glomerular filtration rate (eGFR), urea, red blood cell distribution width (RDW), hemoglobin and sodium were measured. Associations between standardized biomarker levels and all-cause mortality or lung transplantation were investigated using Cox regression.

Results:
In total 104 patients were included (median age 59 years, 64.4% female, 55.8% NYHA 3/4), the median follow-up was 23.8[IQR14.8-39.0] months. The best predictive biomarkers based on the highest standardized hazard ratios were NT-proBNP, hs-TnT, galectin-3 and hs-CRP. Elevated levels of NT-proBNP (>15 pmol/L), hs-TnT (>14 ng/L), galectin-3 (♂ >16.9 ng/mL, ♀ >21.3 ng/mL) and hs-CRP (>10 mg/L) were found in 81 (77.9%), 43 (41.3%), 40 (38.5%) and 24 (23.1%) of the patients, respectively. The number of elevated biomarkers, when analyzed as a continuous variable, was significantly associated with mortality or transplantation (hazard ratio 1.49; 95%CI 1.12-1.99; p=0.007).

Conclusion:
Various biomarkers covering different pathophysiological pathways are associated with the transplant-free survival in patients with PH. A combination of elevated biomarkers may improve the risk stratification of these patients.
Figure 1:
Increased risk of mortality or transplantation per one standard deviation increase in each biomarker.

Univariable standardized hazard ratios

- Sodium: 0.69 (0.47-1.01) P = 0.05
- Hemoglobin: 0.67 (0.46-0.98) P = 0.02
- eGFR: 0.66 (0.48-0.91) P = 0.02
- RDW: 1.38 (1.02-1.88) P = 0.03
- Urea: 1.43 (1.02-2.01) P = 0.04
- High sensitive CRP: 1.45 (1.00-2.10) P = 0.05
- Galectin-3: 1.47 (1.11-1.93) P = 0.003
- High sensitive troponin-T: 1.55 (1.13-2.13) P = 0.003
- NT-proBNP: 1.86 (1.24-2.81) P = 0.003
Preliminary results of myocardial deformation in Tetralogy of Fallot patients, does rotation and twist predict cardiovascular events?

R.W.J. van Grootel (Erasmus MC, Rotterdam) V.J. Baggen (Erasmus MC, Rotterdam); J.S. McGhie (Erasmus MC, Rotterdam); J.W. Roos-Hesselink (Erasmus MC, Rotterdam); A.E. van den Bosch (Erasmus MC, Rotterdam)

Purpose:
Risk stratification for late complications in patients with repaired Tetralogy of Fallot (rToF) remains challenging. Myocardial deformation imaging is feasible and may have prognostic value, but is yet to be investigated. The aim of this study was to assess whether left ventricular rotation predicts cardiovascular events in rToF patients.

Methods:
Adults with rToF whom underwent a routine echocardiogram between 2011 and 2013 were prospectively enrolled and followed for cardiac events: death, heart failure, hospitalizations, arrhythmia and re-interventions. Basal and apical rotation was measured in the short-axis views and twist was calculated (apical rotation – basal rotation = twist). Abnormal apical rotation was defined as <4 degrees. Endpoint was a composite of death, heart failure and arrhythmia.

Results:
179 rToF patients (median age: 33 IQR 26-43, 60% male, 90% NYHA I) were included and followed for median 55 IQR 48-59 months. 6 patients died, 13 patients required treatment for heart failure and 35 patients suffered a new arrhythmic episode. BR was feasible in 118(66%), AR in 106(59%) and twist in 84(47%) patients. The apical rotation was 7.1±7.3 degrees and values for basal rotation and twist were -4.7 IQR-7.0—2.9 and 11.3 IQR 7.0—13.7 degrees, respectively. Twist, apical and basal rotation were not significantly associated with cardiovascular events when assessed with Cox regression. However a reduced apical rotation was (HR 2.420 [1.081-5.413]).

Conclusion:
Reduced left ventricular apical rotation assessed with speckle tracking echocardiography is predictive for death, heart failure and arrhythmia in adults with rToF.
Figure 1:
Survival curve for apical rotation

Survival curve for apical rotation

Legend

< 4 degrees

Cumulative survival

0  20  40  60  
0.5  0.6  0.7  0.8  0.9  1.0  1.1

time in months

Group 1  74  68  64  11
Group 2  30  26  20  2

Abstracts of the Scientific Autumn Congress of the Netherlands Society of Cardiology
2-3 November 2017
Pregnancy Outcomes in Women with Tetralogy of Fallot
Data from the European Society of Cardiology Registry on Pregnancy and Cardiac Disease (ROPAC)

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Purpose:
To describe the outcomes of pregnancy in women with Tetralogy of Fallot (ToF).

Methods:
Within the international prospective Registry On Pregnancy And Cardiac disease (ROPAC), we describe cardiac, obstetric and fetal outcomes of pregnancy within patients with ToF and identify predictors of adverse cardiac outcome.

Results:
In the 240 included ToF patients (mean age 28.7±5.1 years) no maternal mortality occurred. In 18 pregnancies (8%) at least one cardiac event occurred, of which heart failure was the most common complication (n=11,5%). Ventricular tachyarrhythmias complicated 7 pregnancies (3%) and supraventricular tachyarrhythmias occurred in 2% (n=5). One patient (0.5%) suffered from valvular prosthesis thrombosis. Seven patients (3%) had not undergone complete correction of ToF, of which 4 patients (2%) had only undergone either a surgical correction of VSD or valvular replacement. At least one obstetric event occurred in 10 patients (4%), with postpartum hemorrhage in 4 patients (2%) and pre-eclampsia in 3 (1%). There were 3 miscarriages (1%) and 4 patients suffered from pregnancy-induced hypertension (2%). Fetal events occurred in 40 patients (17%), with 3 cases of late fetal mortality (1%). Preterm birth (<37 weeks) and low apgar score occurred in 34 (14%) and 9 patients (4%) respectively. In univariable analysis, hypertension and heart failure prior to pregnancy were predictors of adverse cardiac outcome.

Conclusion:
Most women with ToF tolerate pregnancy well, and can safely embark upon pregnancy. However, cardiac and fetal complications were not uncommon. A history of hypertension and heart failure are predictors of adverse cardiac outcome.
Systemic Right Ventricular Function: Temporal Trends and Risk for Events

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Purpose:
In patients with congenitally corrected transposition of the great arteries (ccTGA) and transposition of the arteries after Mustard/Senning repair (TGA), systemic right ventricular (SRV) dysfunction is a major complication. Data regarding the natural course of SRV function throughout life as assessed with gold-standard cardiovascular magnetic resonance (CMR) imaging are lacking. We aimed to evaluate temporal trends in SRV ejection fraction (EF) and determine its impact on clinical outcome.

Methods:
We assessed serial CMR imaging using linear mixed modelling and performed regression analysis for risk of events (arrhythmia, heart failure, tricuspid valve surgery or death/transplant).

Results:
68 patients (65% male; 28% ccTGA, age 32±8 years) were included. Duration between first and last CMR imaging was 4.3 (IQR 3.0-7.3) years. There was no significant change in SRVEF; mean decline was 0.18% (95%CI -0.41% to +0.06%) per year (Figure). The individual course varied considerably, but males seemed to have a faster decline than females. No other relevant predictors of faster decline were found. Forty-one (60%) patients experienced events (arrhythmia n=38, heart failure n=15, tricuspid valve surgery n=6, death/transplant n=6). The probability of events increased with advancing age (Figure). Older patients with reduced EF experienced more episodes of heart failure. However, young patients with normal EF appeared also at high risk for particularly arrhythmias.

Conclusion:
In ccTGA and TGA patients, systemic right ventricular EF remains quite stable over time. Risk for events increased with advancing age. Yet, normal EF at younger age was also associated with significant morbidity. Thus, regular follow-up is required in all patients.
Figure 1:
Relation between age versus systemic right ventricular ejection fraction and age versus probability of events.
Session IV: Heartfailure

Limited diagnostic accuracy of the new ASE/EACVI algorithm for heart failure with preserved ejection fraction (VeeDIA-study I)

V. Enait (VUMC, Amsterdam); F.T.P. Oosterveer (VUMC, Amsterdam); A. Vonk Noordegraaf (VUMC, Amsterdam); A.C. van Rossum (VUMC, Amsterdam); W.J. Paulus (VUMC, Amsterdam); M.L. Handoko (VUMC, Amsterdam).

Purpose:
In 2016 the ASE/EACVI published a new and simplified algorithm to evaluate LV diastology. Grading of diastolic dysfunction is now based on the E/A-ratio and the presence of elevated E/e’, indexed left atrial volume (LAVi) and/or peak tricuspid regurgitation velocity (TRV) only. Diastolic dysfunction grade I suggests normal LV filling pressures at rest and grade II or III elevated LV filling pressures. Thus far, validation of this algorithm has been limited.

Methods:
We evaluated the new algorithm and used invasively measured pulmonary capillary wedge pressure (PCWP) as the gold standard.

Results:
72 patients with a preserved LVEF (>50%) were included in the analysis (2016-2017; age: 63±13 years, 39% female; 19% had diabetes, 49% hypertension, 26% dyslipidaemia, 38% obesity). Right heart catheterization (RHC) and echocardiography were performed concomitantly for unexplained dyspnea or pulmonary hypertension (PH). Patients with reduced LVEF, significant valvular disease or congenital heart disease were excluded.

There was a fair correlation between E/e’ or LAVi and PCWP (r=0.44 and 0.34 respectively, both p<0.01). However no correlation was found between peak TRV and PCWP (r=-0.16, p=0.23), even after exclusion of patients finally diagnosed with pre-capillary PH (r=-0.09, p=0.68). With PCWP=15mmHg as cut-off, ROC-analysis of the new algorithm revealed an AUC of 0.67, and sensitivity and specificity were 0.53 and 0.76 respectively. Overall diagnostic accuracy was 71% and it was particularly poor for diastolic dysfunction grade II (29%). PCWP did not statistically differ between diastolic dysfunction grade I (12+/−4 mmHg) or II (13+/−4 mmHg).

Conclusion:
The new algorithm to evaluate LV diastology had insufficient accuracy to predict LV filling pressures at rest and is thus of limited value to non-invasively evaluate patients suspected of heart failure with preserved ejection fraction (HFpEF). RHC deserves a more central role in the diagnostic evaluation of HFpEF.
Figure 1:
Persistent Increased Referral of Stable and Endstage Heart Failure to primary care in the Connect Heart Failure Program

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Purpose:
In 2015 the Connect Heart Failure Program started in the Netherlands. Major goal of this program is to optimize shared care for heart failure patients between primary and secondary/tertiary care. One of the goals is to refer stable and endstage heart failure (HF) patients back to primary care. The first region where the program is running is the region of Alphen a/d Rijn, which is connected to the Alrijne Hospital. In march 2016 the first data have been presented. This abstract shows subsequent data.

Methods:
Comparison was made between number of patients referred back to primary care from 2014-2015 and 2016-2017 in this region. Furthermore data for readmissions, referral back to secondary care, mortality and telefonic consultation of the specialized HF nurses were collected.

Results:
In 2014 and 2015 62 patiënts in total were discharged from the HF outpatient clinic to primary care. From 2016 till 2017 (31-7) 63 patiënts were discharged. From 2014-2017 (31-7) in total 125 patients were discharged. Five because of recovered myocardial function, 41 because of stable heart failure, 45 for end-stage heart failure or other end-stage illness, and 34 because of frailty. 69 of these 125 patients deceased, 6 of 125 were re-hospitalized. One of them has been send back to the HF outpatient clinic.
Data of telephonic consultation of the HF nurse will be presented at the congress.

Conclusion:
Application of the connect heart failure program results in an persistent and growing number of referred patients to primary care. Number of re-admmissions in these patients is very low.
Most patients with endstage heartfailure, frailty or other end-stage illness die shortly after discharge.
Potential Substitution of Chronic Heart Failure Care according to the 'Landelijke Transmurale Afspraak'

M.P.M. Vester (LUMC, Leiden); S.L.M.A. Beeres (LUMC, Leiden); L.F. Tops (LUMC, Leiden); C.M.H.B. Lucas (Alrijne, Leiderdorp); P.E.J. van Pol (Alrijne, Leiderdorp); M.J. Schalij (LUMC, Leiden)

Purpose:
The prevalence of chronic heart failure is increasing due to improved medical and invasive treatment. The Dutch 'national transmural agreement' (LTA) heart failure, agreed upon in 2015, aims to optimize the organization of heart failure care in the Netherlands. To evaluate the proportion of patients in which heart failure care can be transferred from the cardiologist to the general practitioner (GP), based upon the LTA.

Methods:
A total of 200 heart failure patients (100 from a secondary and 100 from a tertiary care hospital) were evaluated at the out-patient clinic. In line with the LTA, the following patients were considered eligible for referral to the GP: 1/ Stable heart failure patients with preserved ejection fraction (HF-pEF), 2/ Stable heart failure patients with mid-range ejection fraction (HF-mEF) and 3/ Stable heart failure patients with a recovered HF-rEF (LVEF>50%).

Results:
The population consisted of 57% male and mean age was 72±15 years. In total, 17% of patients were considered eligible for referral to the GP. It concerned 1.5% patients with HF-pEF, 5.0% patients with HF-mEF and 10.5% patients with recovered HF-rEF. The main indications for heart failure care by a cardiologist were: recent admission for decompensated heart failure (29.5%), recent adjustment in heart failure medication (7.5%) or active cardiac disease other than heart failure (39.5%).

Conclusion:
In a substantial amount of patients heart failure care can be transferred to the GP.
Figure 1:
Cardiac disease, included valve disease, a device, congenital heart disease and/or pulmonary hypertension. HFpEF, Heart Failure with Preserved Ejection Fraction; HFrEF, Heart Failure with mid-range Ejection Fraction; HFrEF, Heart Failure with Reduced Ejection Fraction
Incidence and Predictors of Early Cardiovascular Events After Kidney Transplantation

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Purpose:
To assess the incidence of cardiovascular events and determine risk factors associated with cardiovascular events during the first 3 months after kidney transplantation.

Methods:
We performed a retrospective analysis of all kidney transplants performed between 2010 and 2013 in our center. The results of pre-transplant cardiac evaluation as well as the incidence of post-operative cardiovascular events (a composite end point of cardiac death, isolated increase in troponin level, acute coronary syndrome, heart failure, or coronary intervention) were analyzed.

Results:
In total, 770 renal transplants were carried out and included in this analysis. There were 66 patients with a post-transplantation cardiovascular event (8.6%) Of those, 6 patients had no pre-operative ischemia detection analysis, 26 had negative ergometry, 3 had negative stress ultrasonography, 37 had MIBI scanning (11 had permanent and 11 reversible defects, 15 unremarkable), 11 had coronary angiogram (5 abnormalities, but no intervention). Only 6 patients (0.8%) underwent a revascularization procedure before transplantation: none of them had a cardiovascular event after transplantation. Binary regression analysis showed that the chance to have a post-transplant cardiovascular event was predicted by age (p=0.003), pre-transplant myocardial infarction (p<0.001) or heart failure (p<0.001), decrease in hemoglobin post-transplant (p=0.003) and abnormal MIBI scan (p=0.010). MIBI scanning was the only non-invasive ischemia detection modality that could predict cardiovascular events post-transplantation.

Conclusion:
Early cardiovascular complications after kidney transplantation are common despite pre-operative cardiac evaluation. We will conduct a randomized controlled trial to evaluate whether more stringent pre-transplant ischemia detection and treatment will reduce early post-transplant cardiovascular complications.
Real-world Heart Failure Treatment in 10.910 Patients with Chronic Heart Failure in the Netherlands: Preliminary findings of the CHECK-HF registry

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**Purpose:**
Optimal medical therapy and adherence to treatment guidelines is essential in order to improve the symptom burden and prognosis of heart failure patients. Data from registries may give insight into the use of recommended therapy. However, actual data from unselected real-world heart failure patients are scarce. Therefore, we performed a cross-sectional study of real-time heart failure care in the period of 2013-2016.

**Methods:**
In 34 participating centers in the Netherlands, 10,910 patients with chronic heart failure treated at cardiology centers were included in the CHECK-HF registry. Of these, 10,385 were managed at a heart failure out-patient clinic. Heart failure was diagnosed according to the ESC guidelines based on symptoms, ECG, biomarkers and echocardiography. Current medical treatment as well as rhythm and ICD therapy were recorded.

**Results:**
In the 10,910 patients with chronic heart failure, mean age was 73 years (Sd 12) and 60% were male. Frequent comorbidities were diabetes mellitus 30%, hypertension 43%, COPD 19%, and renal insufficiency 58%. The main cause of heart failure was ischemic in 45%. In our registry, the prevalence of HF-pEF was 21%. Current medical treatment in the 79% of patients with heart failure with reduced ejection fraction (HF-rEF) patients included beta blockers in 85%, ACE-inhibitors or angiotensin receptor blockers (ARB) in 81%, mineralocorticoid receptor antagonist (MRA) in 53% and If-inhibitor in 5%. Dose of important medication is depicted in Figure 1. An ICD either VVI/DDD or CRT-D was implanted in 31% of HF-rEF patients (22% in female, 36% in male patients).

**Conclusion:**
The current study presents an overview of current medical treatment in the Netherlands with further insights in real-world of guideline adherence in Western Europe.
Figure 1.
Median (IQR) dose of loop diuretics, ACE-inhibition/ARB, betablockade and MRA in patients with HFrEF.
Risk of Atrial Fibrillation in Heart Failure with Preserved Ejection Fraction. Results from the Treatment of Cardiac Function with an Aldosterone Antagonist (TOPCAT) Study

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Purpose:
Aldosterone antagonists, such as eplerenone, reduce the risk of AF in patients with HF and a reduced ejection fraction. However, the efficacy of spironolactone on AF suppression in HF with a preserved ejection fraction (HFpEF) remains unclear. To assess the efficacy of spironolactone to prevent new-onset AF or recurrence of paroxysmal AF (pAF) in patients with HFpEF.

Methods:
All patients (n:3,425) with HFpEF from the TOPCAT study were included. They were 1:1 randomised to spironolactone or placebo. New-onset AF and pAF were defined by using the study case forms obtained from the National Heart, Lung and Blood Institute. Subgroups analysis based on mean left atrial volume index (LAVI) was performed.

Results:
At baseline 2,218 patients (64.8%) had no history of AF. During a median follow-up of 3.1(IQR2.0-4.9) years, new-onset AF occurred in 5.2% (n=58) vs. 4.3% (n=48), spironolactone vs. placebo respectively (p=0.35). The risk of new-onset AF did not differ per treatment-arm, HR:0.82(CI0.56-1.21,p=0.32). LAVI did not influence risk of new-onset AF(LAVI<25.9 ml/m²,HR:0.75(CI0.20-2.80,p= 0.67); LAVI≥25.9 ml/m²,HR: 1.13(CI0.39-3.21,p=0.83).

At baseline 501 patients (14.6%) had pAF. During a median follow-up of 3.3(IQR 1.9-4.7) years, AF recurred in 11.6%(n= 30) vs. 11.9%(n= 29), spironolactone vs. placebo respectively (p=1.00). The risk of recurrence of AF did not differ per treatment-arm, HR:1.05(CI 0.63-1.76, p=0.84). LAVI did not influence risk of recurrence (LAVI<30.9 ml/m²,HR: 3.04(CI 0.78-11.8, p= 0.11); LAVI ≥30.9 ml/m²,HR:1.08(CI 0.35-3.37,p=0.89).

Conclusion:
Spironolactone treatment does not reduce the risk of new-onset or of recurrence of AF in patients with HFpEF, in contrast to patients with HF and a reduced ejection fraction.
Figure 1:
Cumulative hazard ratios of new-onset AF respectively recurrence of AF

Abstracts of the Scientific Autumn Congress of the Netherlands Society of Cardiology
2-3 November 2017
Is arrhythmogenic right ventricular cardiomyopathy (ARVC) always familial? A systematic evaluation of de novo mutations in a large transatlantic ARVC registry

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Purpose:
Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC) is associated with mutations in genes encoding the cardiac desmosome. ARVC is generally autosomally inherited, but may also result from a de novo mutation. Prevalence and characteristics of de novo desmosomal mutations have never been described.

Methods:
We identified 172 index patients (75 Dutch) who: met 2010 ARVC Task Force Criteria, carried pathogenic/likely pathogenic desmosomal variants, and whose family had undertaken genetic cascade screening. Variant inheritance was assessed by pedigree analysis. Haplotyping was conducted for five PKP2 variants (c.2386T>C, c.1848C>A, c.397C>T, c.235C>T, c.2146-1G>C).

Results:
Patients were predominantly male (66%). Half (52%) had no affected family members. Most had one pathogenic variant (157 PKP2, 7 DSP, 6 DSG2, 1 DSC2); one had variants in PKP2 and DSP. Three (1.7%) variants were de novo. Two involved entire gene deletions (PKP2 and DSP) and one a DSG2 missense variant. In contrast, inherited variants were often splice-site (46%), premature terminating (37%), or missense (11%) changes. Eleven (6%) were deletions larger than one exon. Five Dutch PKP2 variants shared six haplotypes. Two of these (c.235C>T and c.2146-1G>C) were also shared with US patients, suggesting common founders.

Conclusion:
Desmosomal gene mutations underlying ARVC are rarely de novo, and when de novo disproportionately involve whole gene deletions. Variants identified more than once are likely founder mutations. Most desmosomal mutation carriers have inherited their mutation, even in the absence of family history. This highlights the importance of testing seemingly healthy family members and using genetic tests that can identify large deletions.
One-Year Outcome of the ELECT Trial: Sapien 3 Versus CoreValve Device for Transcatheter Aortic Valve Implantation

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Purpose:
The ELECT study aims to compare the effects of the SAPIEN-3® (S3) and CoreValve® (MCV) systems on periprosthetic aortic valve regurgitation (PPR) and clinical outcomes at one year following transcatheter aortic valve implantation (TAVI).

Methods:
The ELECT study is a single-centre, randomised, controlled, clinical trial to compare the effects on PPR between the balloon-expandable S3 and the self-expanding MCV. Fifty six adult patients suitable for trans-femoral TAVI were randomly assigned to receive either the S3 (n=29) or the MCV (n=27). The primary endpoint was severity of post-TAVI PPR, quantitatively assessed with three different novel imaging modalities: quantitative contrast angiography (performed at the end of the index procedure); 3 dimensional transesophageal echocardiography (3DTEE, performed 4-5 days after the index procedure); and magnetic resonance imaging (CMR, also performed 4-5 days after the index procedure). Secondary endpoints included clinical outcomes according to Valve Academic Research Consortium-2 criteria.

Results:
Post-TAVI PPR appeared higher for the MCV compared to S3 by quantitative contrast angiography (12% vs. 0% moderate, 44% vs. 31% mild, 44% vs. 69% none/trace; p=0.062), by 3DTEE (11% vs. 0% moderate, 22% vs. 15% mild, 67% vs. 85% none/trace; p=0.414), and by CMR (regurgitation fraction 4.2%[IQR:2.7-10.4] vs. 2.6%[IQR:1.74-7.2]; p=0.088), but differences were not statistically significant.

At one year, patients treated with MCV had significantly more frequent mild PPR on TTE (63% vs 16%, p=0.003); a higher incidence of stroke (19% vs. 0%; HR 10.15 [1.72-59.8], p=0.01); mortality (19% vs. 0%; HR 8.8 [1.50-51.2], p=0.02); and a lower device success rate (85% vs. 100%; p=0.048).

Conclusion:
As compared with MCV, S3 was associated with lower risks of mild PPR, stroke, or death at one year, and a greater device success rate. (ClinicalTrials.gov number NCT01982032).
Short versus long DAPT following PCI, a systematic review and meta-analysis of randomised clinical trials

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Purpose:
Dual antiplatelet therapy (DAPT) remains the cornerstone therapy in the prevention of ischemic events following PCI. However, the mandatory duration of DAPT in new-generation drug-eluting stents (DES) remains a matter of debate. We aimed to evaluate efficacy and safety of short-term (≤6 months) versus long-term (≥12 months) duration of DAPT.

Methods:
PubMed, EMBASE, Cochrane databases, and international meetings were searched for randomized clinical trials (RCT) comparing short versus long DAPT. A systematic review and meta-analyses of major trials was performed with primary outcome: all-cause death, myocardial infarction, stent thrombosis, stroke, and major bleeding.

Results:
Nine RCTs (table 1) with a total number of 19.099 patients were pooled in this meta-analysis. As compared to long DAPT, a short regimen of DAPT was associated with a significant reduction in major bleeding (0.62% vs. 1.10%, Risk Ratio 0.58, 95%-CI 0.39 to 0.86, p<.007, I²=21%), whereas all-cause death (1.65% vs. 1.84%, Risk Ratio 0.90, 95%-CI 0.73 to 1.11, p=.34, I²=0%), myocardial infarction (1.68%, Risk Ratio 1.14, 95%-CI 0.92 to 1.40, p=.23, I²=0%), stent thrombosis (0.62% vs. 0.47%, Risk Ratio 1.25, 95%-CI 0.84 to 1.86, p=.27, I²=0%), and stroke (0.67% vs. 0.67%, Risk Ratio 0.91, 95%-CI 0.63 to 1.31, p=.61, I²=0%) were similar (figure 1).

Conclusion:
Short DAPT following new-generation DES results in a significant reduction of major bleeding with no apparent increase in all-cause death, ischemic events, stent thrombosis, or stroke. Clinicians should realize the potential drawbacks of DAPT and tailor the duration depending on the ischemic and bleeding risk of the individual patient.
Clopidogrel or Ticagrelor in Acute Coronary Syndrome Patients Treated with Newer-generation Drug-eluting Stents: CHANGE DAPT

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Purpose:
Acute coronary syndrome (ACS) guidelines have been changed, favouring more potent antiplatelet drugs. We evaluated the safety and efficacy of a ticagrelor- instead of clopidogrel-based primary dual antiplatelet (DAPT) regimen in ACS patients, treated with newer-generation drug-eluting stents (DES).

Methods:
CHANGE DAPT is a prospective observational study (clinicaltrials.gov NCT03197298) that assessed 2062 consecutive real-world ACS patients, treated by percutaneous coronary intervention (PCI), the primary composite endpoint being one-year net adverse clinical and cerebral events (NACCE: all-cause-death, any myocardial infarction, stroke or major bleeding). The primary analyses compared two treatment periods: the clopidogrel period (CP; December 2012-April 2014) versus the ticagrelor period (TP; May 2014-August 2015). Non-inferiority for the ticagrelor period will be assessed with a pre-specified margin of 2.7%. Propensity score-adjusted multivariate analyses will be performed to adjust for potential confounders.

Results:
The main results of CHANGE DAPT will be presented as Late Breaking Registry during a Hot Line session on August 29, at the European Society of Cardiology (ESC) Congress 2017 in Barcelona. The results will be simultaneously published online in EuroIntervention.

Conclusion:
Conclusions of this observational study will be presented first at the ESC Congress 2017 in Barcelona.
Predicting factors of definite stent thrombosis following percutaneous coronary intervention, a 7-year survey

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Purpose: Coronary stent thrombosis (ST) remains a harmful complication following percutaneous coronary intervention (PCI). We sought to determine incidence-, impact-, and predictors of ST.

Methods: All consecutive patients with angiographic confirmed ST (n=55) between 2010 and 2016 were 4:1 matched to a randomly assigned cohort of controls (n=1844), based on indication and index date ±6 weeks, with no restriction criteria. Coronary angiography (CAG) was reassessed by two individual experienced interventional cardiologists for suspected stent under expansion, stent edge dissection, and residual coronary artery disease <5mm of the stent. A third blinded independent interventional cardiologist was consulted to reach consensus if necessary. Observer agreement was calculated by the Kappa statistic(κ), and considered fair (κ=0.21 to 0.4), moderate (κ=0.41 to 0.60), substantial (κ=0.61 to 0.8).

Variables were selected and entered in a step-wise backward conditional logistical regression model analysis if p<0.10 and considered significant if p<0.05.

Results: A total of 55 cases of ST (25 acute, 20 sub-acute, 10 late ST) were matched to 220 randomly assigned control patients. Cases had a history of more PCI (52.7 vs. 43.6%, p<0.001), acute coronary syndrome (41.8 vs. 20.5, p=0.004), and stroke (16.4 vs. 5.5, p=0.022). The interobserver agreement was substantial overall (κ=0.628), for under expansion (κ=0.617), and dissection (κ=0.734), and moderate for residual coronary artery disease (κ=0.515).

A summary of the angiographic outcomes and uni-, multivariate analysis is shown in figure 1. Multivariate conditional logistic regression analysis identified angiographic no-reflow phenomenon (OR 5.35, 95%-CI 1.48 to 19.29, p=0.01) as the strongest predictor of ST, followed by: LVEF<30% (OR 3.70, 95%-CI 1.16 to 11.8, p=0.027), stent under expansion (OR 3.03, 95%-CI 1.47 to 6.25, p=0.003), stent edge dissection (OR 2.97, 95%-CI 1.17 to 7.50, p=0.027), and total stent length per patient (OR 1.04, 95%-CI 1.01 to 1.06, p=0.003).

Conclusion: Angiographic no-reflow, underexpansion, dissection, and increased lesion complexity are associated with ST and should be taken into account when defining a patient-tailored minimal duration of dual antiplatelet therapy.
Figure 1.

1A

<table>
<thead>
<tr>
<th>Angiographic Confirmed ST</th>
<th>Matched Controls</th>
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<tbody>
<tr>
<td>Stent Under Expansion</td>
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<tr>
<td>Stent Edge Dissection</td>
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<tr>
<td>Residual Coronary Artery Disease</td>
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<td>Angiographic Optimal Result</td>
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<tr>
<td>Angiographic Satisfactory Result</td>
<td>41.3</td>
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<td>Angiographic Suboptimal Result</td>
<td>8.6</td>
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</table>

1B

<table>
<thead>
<tr>
<th>Univariate Logistic Regression</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>p value</th>
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<td>ACC/AHA lesion complexity E or C</td>
<td>5.44</td>
<td>2.47 to 11.2</td>
<td>&lt; 0.001</td>
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<td>LVEF &lt;30%</td>
<td>4.77</td>
<td>1.87 to 12.2</td>
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<td>Angiographic Stent Under Expansion</td>
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<td>1.81 to 7.58</td>
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<td>Poor Stent</td>
<td>3.88</td>
<td>1.34 to 11.6</td>
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<td>Angiographic Suboptimal Result</td>
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<td>1.59 to 7.14</td>
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<td>Insulin-dependent diabetes mellitus</td>
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<td>1.38 to 7.79</td>
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<td>Coronary stent in the left main artery</td>
<td>3.04</td>
<td>0.83 to 9.99</td>
<td>0.048</td>
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<tr>
<td>Insulin-dependent Diabetes Mellitus</td>
<td>2.91</td>
<td>1.31 to 6.33</td>
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<td>Poor ACS</td>
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<td>Poor PCI</td>
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<td>Angiographic Residual Coronary Artery Disease</td>
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<td>Optimal Coronary Stent</td>
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<td>Minimal loss of coronary stent</td>
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<td>SYNTAX score</td>
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<td>1.01 to 1.07</td>
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<td>Total Stent Length Per Patient</td>
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<td>1.01 to 1.04</td>
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<td>Mean diameter of coronary stent</td>
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<td>1.02 to 1.04</td>
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<td>TIBDS flow 3 months after PCI</td>
<td>0.24</td>
<td>0.12 to 0.45</td>
<td>&lt; 0.001</td>
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</table>

<table>
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<tr>
<th>Multivariate conditional logistic regression</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>p value</th>
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<tbody>
<tr>
<td>Angiographic No-reflow Phenomenon</td>
<td>5.91</td>
<td>1.42 to 20.32</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>LVEF &lt;30%</td>
<td>3.70</td>
<td>1.38 to 11.71</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Angiographic Stent Under Expansion</td>
<td>3.03</td>
<td>1.47 to 6.35</td>
<td>&lt; 0.001</td>
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<tr>
<td>Angiographic Stent Edge Dissection</td>
<td>2.97</td>
<td>1.57 to 5.60</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>ACC/AHA lesion complexity E or C</td>
<td>2.86</td>
<td>1.38 to 5.09</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Coronary Stent Length</td>
<td>1.04</td>
<td>1.01 to 1.06</td>
<td>0.001</td>
</tr>
<tr>
<td>Angiographic Residual Coronary Artery Disease</td>
<td>2.48</td>
<td>0.93 to 6.34</td>
<td>0.079</td>
</tr>
</tbody>
</table>
Significant Incidental Findings in Computed Tomographic Angiography for TAVI Planning: a Systematic Review and Meta-Analysis

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Purpose:
To determine occurrence of significant incidental findings (SIF) on CT-imaging preceding Trans-Aortic Valve implantation(TAVI) and their influence on mortality and procedural planning.

Methods:
A systematic search was performed on MEDline, EMBASE and Cochrane for studies reporting SIF in the work-up of TAVI. Relevant data regarding SIF were extracted. A random effects meta-analysis was performed for SIF, with weighing based on study size.

Results:
A total of 3231 individuals from 13 studies were analyzed with mean age of 80 years and sex equally divided. Pooled rate of persons with SIF was 28.3% (95%CI 20.5-35.7; p<0.001), of which 7.1% needed direct clinical management. Most SIF reside in pulmonary regions, (43.8%) followed by (ad)renal (15.2%) and urogenital (7.9%) regions. A malignant finding was present in 3.2%. In patients screened for TAVI with SIF, two studies reported more mortality at 21- and 24-months follow-up compared to patients without SIF (HR 1.5; 95% CI 1.0-2.2 and HR 1.45; 95% CI 1.19-1.76 respectively). In patients accepted for TAVI, one study reported higher mortality in patients with SIF at five years follow up (HR 1.46; 95% CI 1.06-1.99). In patients declined for TAVI, there was no difference in mortality for patients with or without SIF. There was a trend towards more TAVI postponement and cancellation in patients with SIF.

Conclusion:
SIF are common in patients screened for TAVI. Patients with SIF have an increased mortality risk, which should be taken in consideration in decision making. These findings may help inform patients and aid patient selection.
Figure 1: Distribution of Significant Incidental Findings

- Pulmonary: 43.8%
- Renal: 15.2%
- Liver: 6.3%
- Pancreatic: 2.9%
- Urogenital: 7.9%
- Lymphatic: 6.8%
- Musculoskeletal: 3.5%
- Thyroid: 5.0%
- Other: 7.6%
1-year Clinical Outcomes of Real-World Patients Treated with Amphileimus Sirolimus-Eluting Stents or Zotarolimus-Eluting Stents: A Single-center Registry

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Purpose:
Amphileimus-eluting stents (A-SES) represent a novel elution-technology in the current era of drug-eluting stents (figure 1A). To investigate the clinical performance of A-SES we conducted a registry in real-world patients.

Methods:
All patients treated with either A-SES or ZES between January 2014 and February 2016 were retrospectively analyzed. Stent choice was at the operator’s discretion. Data were collected by routine visits to the outpatient clinic, by a medical questionnaire, and/or telephone assessment at 12-months follow-up. The primary endpoint was a device-oriented endpoint of target-lesion failure according to the Academic Research Consortium (ARC) definitions, and the secondary endpoint was Major Adverse Cardiac Events (MACE, defined as: cardiac death, myocardial infarction, ischemic stroke, or Major Bleeding BARC≥3) at 12-months follow-up.

Results:
A total of 734 consecutive patients (with 1269 DES implantations) were treated with either A-SES (n=373) or ZES (n=361). Baseline characteristics did not show any differences except for male gender (72.92% A-SES vs. 64.54% ZES, p=0.014). Analyzed by Kaplan-Meier method the cumulative incidence of TLF was 5.4% for A-SES versus 6.1% ZES, p=0.60) at 12-months follow-up. MACE-free survival was similar in both A-SES and ZES at 12-months follow-up (94.9% vs. 93.1%, Mantel-Cox p=0.15, see figure 1B).

Conclusion:
This registry suggests that PCI with A-SES implantation is safe and effective in real-world patients, with low rates of TLF at 12-months of follow-up. A large prospective multicenter trial should further investigate the clinical safety and efficacy of A-SES.
Figure 1A, 1B:
Figure 1A: Macroscopic picture of the abluminal reservoirs on the surface of the Cre8 stent, filled with an amphilimus formulation. B: Cumulative incidence of TLF and MACE-free survival at 12-months follow-up.
Timing of permanent pacemaker indication after transcatheter aortic valve implantation

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Purpose:
Transcatheter aortic valve implantation (TAVI) is frequently complicated by high-grade atrioventricular block (AVB), requiring post procedural permanent pacemaker implantation (PPI). There is no consensus on the required observation period after TAVI to evaluate new conduction disturbances (CD) and the need for PPI. This study aimed to investigate the minimum required admission time to discharge patients post TAVI safely regarding need for PPI.

Methods:
A retrospective analysis of all patients who underwent a TAVI in our hospital from 2008 till August 2016 (n=532) with either a balloon-expandable valve (Sapien, Sapien XT or Sapien 3 (SAPIEN)) or a self-expandable valve (CoreValve or Evolut R, (MCV)). Thirty four patients with pre-procedural PPI were excluded. Of all patients that received a PPI before discharge, we evaluated electrocardiograms (ECGs) at baseline, and ECGs and clinical records of telemetry post-TAVI to identify CD.

Results:
Out of 498 patients, 54 patients (9.2%, 80±7 years, EuroSCORE I: 18±10) received a PPI before discharge. In the Sapien group 9.3% (34/364), in the MCV group 14.9% (20/134). The timing of the occurrence of CD post-TAVI leading to PPI was <48 hours in 70% (38/54), between 48 and 72 hours in 20% (11/54), between 72 and 96 hours in 5.6% (3/54), and between 96 hours and discharge on day 5 in 3.7% (2/54) of the patients. There were no statistically significant differences between the two valve types. Predisposing factors for early development of CD, in patients requiring PPI post-TAVI, were pre-procedural right bundle branch block (BBB) (100% CD <48 hours, 15/15, p=0.002) or first degree AVB (Sapien group 100% CD <48 hours, 5/5, p=0.28; MCV group 100% CD <72 hours, 4/4, p=1.0). The baseline group with left BBB was too small for analysis (n=6).

Conclusion:
Most PPI indications (91%) are seen within 72 hours after TAVI. Patients that received a Sapien valve with pre-procedural right BBB and/or first-degree AVB, did not develop CD leading to pacemaker implantation after 48 hours of TAVI. Therefore, these patients might be safely discharged after 48 hours. This algorithm needs to be validated in a larger patient population.
Session VI: General Cardiology

Prognostic Factors in Cardiac Surgery for Infective Endocarditis (IE)

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Purpose:
Evaluating prognostic factors in cardiac surgery for infective endocarditis IE.

Methods:
An in hospital registry was made of all patients undergoing surgery for IE. Patients were scored for age, sex, medical history, affected valves, organism, mortality and morbidity.

Results:
A total of 243 patients received cardiac surgery of IE between 2005 and 2015. The majority of patients was male (76.9% (187/243)) with a mean age of 63 (27-87) years. Previous cardiac surgery was performed in 45.3% (110/243). Prosthetic valve IE was present in 41.1% (106/243). All patients had positive cultures and in 61.7% (150/243) a concomitant surgical procedure was performed.

There was no per-operative mortality. Mortality within 30 days after surgery was 14.4% (35/243). All-cause mortality was 32.5% (79/243). Univariate prognostic factors for mortality include age (HR 1.05 (1.02-1.07) p<0.0001 per life year), prosthetic valve endocarditis (HR 1.79 (1.14-2.81) p=0.0119), previous cardiac surgery (HR 1.84 (1.16-2.90) p=0.0090) and re-operation for IE (HR 1.77 (1.13-2.78) p=0.0134). In a multi-variate analysis age (HR 1.05 (1.02-1.07) p<0.0001 per life year) and previous cardiac surgery (HR 1.86 (1.18-2.94) p<0.0001 per life year) were independent prognostic factors for mortality.

Conclusion:
Surgery for IE has a 30 day mortality of 14.4% and an all-cause mortality of 32.5%. Prognostic factors include age, prosthetic valve IE, previous cardiac surgery and re-operation for IE.
The association of interleukin 6, soluble interleukin 6 receptor and soluble glycoprotein 130 on infarct size and left ventricular ejection fraction

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Purpose:
In STEMI patients interleukin 6 (IL-6) levels are increased, which may correlate with cardiac remodeling on the longer term. We aimed to investigate the course of members of the IL-6 cascade and their association with infarct size (IS) and left ventricular function (LVEF).

Methods:
In 379 consecutive STEMI patients of the GIPS-III trial levels of the IL-6 cascade were measured at baseline, 24 hours, 2 weeks, 7 weeks, 4 months, and 1 year post-PCI. In multivariate models sex, age, BMI, hypercholesterolemia, TIMI (pre- and postintervention), MBG, and ischemic time were included. IS and LVEF were assessed by magnetic resonance imaging at 4 months.

Results:
Baseline levels of IL-6, soluble IL-6 receptor (sIL-6R), and soluble glycoprotein (sgp) 130 were 3.72 pg/ml (IQR 2.05 – 6.69 pg/ml), 51.64 ng/ml (IQR 37.26 – 69.01 ng/ml), and 332 ng/ml (IQR 280 – 399 ng/ml) respectively. In multivariate analysis the highest quartile of IL-6, and sIL-6R/IL-6 ratio measured at 24 hours after myocardial infarction, remained independently associated with IS and LVEF (IS: β 5.41 (95% CI 3.33 – 7.48); p = 0.000, β -4.00 (95% CI -6.11 - -1.89); p = 0.000, respectively) (LVEF: β-4.24 (95% CI -6.67 - - 1.80); p = 0.001, β2.63 (95% CI 0.18 – 5.08); p = 0.035, respectively).

Conclusion:
IL-6 and sIL-6R/IL-6 ratio levels at 24 hours are independently associated with IS and LVEF measured at 4 months.
Figure 1:
Associations between members of the interleukin-6 signaling cascade measured in STEMI patients at 24 hours and IS and LVEF measured at 4 months, depicted as β and 95% CIs obtained from linear regression models. 95% CI = 95% Confidence Interval; IL-6 = interleukin 6; sIL-6R = soluble interleukin 6 receptor; sgp130 = soluble glycoprotein 130; Q1 = lowest quartile; Q4 = highest quartile; STEMI = ST-elevation myocardial infarction; IS = infarct size; LVEF = left ventricular ejection fraction. Multivariate analysis on IS: adjusted for age, sex, BMI, hypercholesterolemia, TIMI (pre- and post-intervention), MBG. Multivariate analysis on LVEF: adjusted for age, sex, hypercholesterolemia, TIMI (pre- and post-intervention), ischemic time.
Silent myocardial infarction in patients with first acute myocardial infarction is associated with worse long-term outcome

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Purpose:
While previous work suggested that silent myocardial infarction (MI) may be useful for identifying high-risk patients following acute myocardial infarction (AMI), long-term clinical implications of silent MI in the setting of first AMI are unknown. We investigated the prevalence of silent MI in patients presenting with first AMI, and its relation with mortality and major adverse cardiovascular events (MACE) after long-term follow-up.

Methods:
A two-center observational longitudinal study was performed in 392 patients presenting with first AMI between 2003-2013, who underwent LGE-CMR exam within 14 days post-AMI. Silent MI was assessed on LGE-CMR images by identifying regions of hyperenhancement with an ischemic distribution pattern in other territories than the current AMI. Mortality and MACE (composite endpoint of all-cause death, AMI, coronary artery bypass surgery and ischemic stroke) were assessed at 6.8 ± 2.9 years follow-up.

Results:
Thirty-two patients (8.2%) showed silent MI on LGE-CMR. Compared to patients without silent MI, mortality risk was higher in patients with silent MI (hazard ratio [HR] 3.33, 95% CI 1.34 – 8.27, p=0.009), as was risk of MACE (HR 3.55, 95% CI 1.66 – 7.55, p=0.001). These analyses were adjusted for clinical characteristics, CMR-derived left ventricular ejection fraction and (acute) infarct size.

Conclusion:
Silent MI occurred in 8.2% of patients presenting with first AMI. The presence of silent MI was associated with a more than three-fold risk of mortality and MACE at long-term follow-up, independent from clinical characteristics, left ventricular ejection fraction and (acute) infarct size, indicating that these patients represent a high-risk subgroup.
Figure:
Kapleing-meier curves showing (A) increased mortality and (B) MACE (composite endpoint of all-cause death, AMI, CABG and ischemic stroke) in patients with silent MI compared to those without silent MI.
Connect-AF: First Results of a ‘Trans-mural’ Program to Increase Detection and Improve Guideline-Adherent Treatment of Atrial Fibrillation

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Purpose:
In order to improve detection and treatment of AF, a ‘trans-mural’ protocol was developed by local general practitioners (GPs) and cardiologists from the 4 hospitals in the province Groningen, The Netherlands. Part of this program consists of AF screening by GPs using a hand-held single lead ECG device with automated AF detection (MyDiagnostick) in all patients ≥ 65 years, an online cardiology consulting service for AF confirmation (on the MyDiagnostick ECG) and treatment advice. GPs were trained on AF screening and treatment guidelines. The purpose of this study was to evaluate the effects of this program on AF detection and anticoagulation treatment.

Methods:
The program started April 1st, 2015 and was first evaluated January 1st, 2017. The number of AF patients in all GP offices were counted based on diagnosis (ICPC) code K078 in the GP’s database. The quality of AF treatment was evaluated by a data pull from the electronic patient charts using ATC medication codes for administration of oral anticoagulation.

Results:
In the course of 20 months 106 GP offices started participation out of 259 GPs in the region. The participating centres deliver care to 48.213 patients versus 60.339 patients >65 years in the centres that did not participate. Average age (77.8 years) and sex distribution (53% males) were similar in both groups. On average, AF prevalence increased from 7% to 9% in all GP offices during the 4 years preceding start of the program, with no difference in the participating versus the non-participating centres. During the 1.5 years of our trans-mural AF program, the number of AF patients in the participating centres further increased to 11.0% versus 10.3% in the non-participating centres. This 0.7% difference corresponds with 337 extra AF patients detected by the screening program.

In the participating centres 93% of AF patients received oral anticoagulation versus 87% of AF patients in the non-participating centres. This corresponds to approximately 318 extra AF patients in the participating centres receiving anticoagulation.

In total, GPs participation in this trans-mural AF program resulted in appr 630 extra AF patients on oral anticoagulation. In theory, with an untreated CVA risk of 5%, and 70% risk reduction with anticoagulation, this will lead to a reduction of 22 ischemic strokes per year.

Conclusion:
Our trans-mural AF program implemented by general practitioners and supported by cardiologists resulted in more patients diagnosed by screening, and more AF patients treated with oral anticoagulation.
Significant regional variation in optimal medical treatment, one year after acute myocardial infarction

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Purpose:
Optimal medical treatment after an acute myocardial infarction is associated with increased survival and lower rate of new cardiovascular events. The aim of the current study is to assess regional variation in medical compliance in the Netherlands.

Methods:
In the Netherlands, all inhabitants are by law obliged to have health care insurance and all claim data is centrally registered. All national diagnose-codings concerning acute myocardial infarction in 2012 and 2013 were assessed. Furthermore, one year after myocardial infarction, data regarding use of medication was acquired from the Dutch national Pharmacy Information System. The regions were based on the first two digits of the postal code. Optimal medical treatment was assessed in one-year survivors and defined as the use of aspirin (or replaced by vitamin K antagonists or novel oral anticoagulant), P2Y12-inhibitors, statins, beta-blockers and ACE inhibitors during the first year following myocardial infarction. Additionally, regional variation was assessed by the coefficient of variance (standard deviation divided by the mean).

Results:
In total, 59,534 patients (aged 67±13 years old, 66% male gender), from ninety postal code regions, were included. After one year follow-up, 52,672 patients survived. Of these patients, 49% had received optimal medical treatment (minimum 27%, maximum 64%). The coefficient of variance for the administration of optimal treatment is 0.14.

Conclusion:
In the Netherlands, 49% of the patents received optimal medical treatment one year after myocardial infarction. Significant regional variation was observed.
Figure 1:
Optimal medical treatment following acute myocardial infarction.
Risk of chronic Q-fever in patients with cardiac valvulopathy, after a large outbreak of Q-fever in the Netherlands

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Purpose:
From 2007 through 2010, a large epidemic of acute Q-fever occurred in the Netherlands. Acute Q-fever patients with cardiac valvulopathy have a high risk to develop chronic Q-fever. This patient group was not routinely screened during and after the epidemic, so it is unknown if chronic Q-fever among patients with valvulopathy were diagnosed in time. The objective of this study is to investigate how many chronic Q-fever patients can be identified, by routinely screening patients with valvulopathy, to establish whether the policy of not routinely screening should be adapted.

Methods:
This is a one-year cross sectional study (2016-2017) in a hospital in the epicentre of the outbreak. One blood sample was taken from patients above 17 years with a valvulopathy, who attended the hospital (admitted or routine check-up). The blood sample was tested for IgG antibodies against phase I and II of the Coxiella burnetii bacterium, with an immunofluorescence assay. An IgG phase II titre of ≥1:64 was serological evidence of a previous Q-fever infection, and an IgG phase I titre of ≥1:512 was suspicious for a chronic Q-fever infection.

Results:
Of the 904 included patients, 133 (15%) had serological evidence of a previous Q-fever infection. Six (5%) of these 133 patients had a serological indication for a chronic infection that warranted further medical evaluation.

Conclusion:
Chronic Q-fever is still diagnosed in patients with a valvulopathy, 10 years after the start of the epidemic. This should be taken in to account in estimating cost effectiveness of a screening programme.
Mitral regurgitation in the Netherlands: Results from a national survey

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Purpose:
Mitral regurgitation (MR) carries an impaired prognosis but recently treatment possibilities are extended with the MitraClip procedure. We wanted to determine the contemporary prevalence and treatment of MR.

Methods:
All patients who underwent echocardiography according to the digital echo system between October 1th 2016 and January 1th 2017 in five nonacademic hospitals in the Netherlands were included in the Netherlands Heart valve Survey (NHS). All patients with moderate-severe and severe MR were studied in detail, including clinical symptoms and echocardiographic parameters. The final treatment decision within three months after the echocardiography was determined.

Results:
A total of 5679 patients (median age: 68 (interquartile range (IQR) 57-77) years; male: 51%) were included in the NHS. 5% of the patients who underwent an echocardiography had moderate-severe or severe MR. The prevalence of moderate-severe or severe MR increased with age, ranging from 1.0% of the patients <45 years old to 8.6% in the elderly patients of ≥75 years old. Overall, 55% of these patients were symptomatic. After 3 months, surgery was considered in 8%, cardiac resynchronization therapy was considered in 2% and a MitraClip implantation was considered in 27%. The remaining 63% patients were treated conservatively.

Conclusion:
Moderate-severe or severe MR is common in this population and increases with age. Despite current guidelines, in the majority of patients conservative treatment is advised, while there seems an important undertreatment of surgery and MitraClip implantation.
Figure 1: