Pretreatment with P2Y12 Receptor Antagonists in ST-Elevation Myocardial Infarction: A Report from the Swedish Coronary Angiography and Angioplasty Registry

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Background:
Prehospital administration of P2Y12 receptor antagonists to patients with ST-elevation myocardial infarction (STEMI) is supported by guidelines and is a common practice despite the lack of definite evidence for its benefit.

Methods:
Using data from the Swedish Coronary Angiography and Angioplasty Registry on procedures between 2005 and 2016 we stratified all patients who underwent primary PCI due to STEMI in Sweden by whether or not they were pretreated with P2Y12 receptor antagonists. We investigated associations between P2Y12 pretreatment and the risk of adverse outcomes with propensity-scores adjusted mixed-effects logistic regression, which accounted for clustering of patients within hospitals. The primary endpoint was all-cause death within 30 days. Secondary endpoints were IRA (infarct-related artery) occlusion, 30-day stent thrombosis, in-hospital bleeding, neurological complications and cardiogenic shock.

Results:
In total, 44,804 patients were included. They were treated with clopidogrel (N=26,136, 58.3%), ticagrelor (N=15,792, 35.3%), or prasugrel (N=2,352, 5.3%); 37,840 (84.5%) were pretreated, and 30,387 (67.8%) had IRA occlusion. At 30 days, there were 2,488 (5.6%) deaths and 267 (0.6%) stent thromboses. Pretreatment was not associated with better survival (OR 1.07; 95% CI 0.94 - 1.22; P=0.313) at 30 days, reduced IRA occlusion (OR 1.01; 95% CI 0.95 - 1.08; P=0.635), or decreased stent thrombosis (OR 0.99; 95% CI 0.69 - 1.41; P=0.941), or higher risk of in-hospital bleeding (OR 1.04; 95% CI 0.89 - 1.23; P=0.604), or neurological complications (OR 0.66; 95% CI 0.38 - 1.30; P=0.129)

Conclusion:
Pretreatment of STEMI patients with P2Y12 receptor antagonists was not associated with improved clinical outcomes.
Background:
Patients with NSTEMI are frequently pretreated with P2Y12 receptor antagonist (P2Y12) and other antithrombotic agents in order to increase patency of IRA and decrease ischemic events. However, there is no clear evidence from randomized clinical trials that pretreatment with P2Y12 in myocardial infarction reduces ischemic events and improves prognosis. The aim of this study was to investigate whether pretreatment with P2Y12 improves patency of IRA at the time of PCI.

Methods:
We used data from the SCAAR registry (Swedish Coronary Angiography and Angioplasty Registry). This database contains information about all consecutive PCI procedures that are performed in Sweden at 31 hospitals. We included all procedures performed between 2005 and 2015 in NSTEMI patients with complete data. The patients were divided into the two groups, P2Y12 pretreated and not-pretreated. We used multilevel modeling based on complete–case mixed-effects logistic regression to adjust for hierarchical database due to clustering of observations. Treated segment (IRA) was the primary observational unit while individual patients and hospitals were treated as additional levels of clustering. These variables were used to adjust for differences in patient's characteristics: age; gender; hypertension; hyperlipidemia; smoking status; diabetes; calendar year, prior myocardial infarction, coronary by-pass surgery and/or PCI; severity of coronary artery disease; pretreatment with ASA, type of P2Y12 agent, clopidogrel, ticagrelor, prasugrel.

Results:
The total of 42,104 patients were included in the study of which 40,731 (97%) were pretreated with P2Y12 and 1,373 (3%) were not. Three different P2Y12 were used, clopidogrel (n=33,431, 79%), ticagrelor (n=7,991, 19%) and prasugrel (n=682, 2%). The number of treated segments was 94,373 of which 10,658 (11%) were occluded and 83,715 (89%) were patent prior to PCI. Non-patent IRA was associated with higher risk of death at 30 days (adjusted OR 2.1; 95% CI 1.68 to 2.56; P<0.001). Pretreatment with P2Y12 was not associated with higher probability for patent IRA (adjusted OR 0.91; 95% CI 0.77 to 1.05; P=0.21). We found no difference between clopidogrel, ticagrelor and prasugrel in regard to patency of IRA (P=0.26 for interaction test).

Conclusion:
In this observational study, non-patent IRA was associated with higher risk of death at 30-days in patients with NSTEMI. Pretreatment with P2Y12 was not associated with improved patency of IRA.
30-day and 5-year mortality for patients with takotsubo compared to acute coronary syndrome

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Background:
The incidence of the Takotsubo syndrome (TS) has increased over the last decade, but high-quality outcomes data from large TS cohorts are scarce and the impact of TS on prognosis is poorly understood. Whereas prognosis in TS was first believed to be excellent recent reports imply as high risk of dying as for patients with acute myocardial infarction.

Methods:
Using data from the Swedish Coronary Angiography and Angioplasty Registry on procedures performed between 2009 and 2016 we compared patients with TS to patients with ST-elevation (STE) non ST-elevation (NSTE) ACS in regards to 30-day and 5-year mortality. We adjusted for patient characteristics (age, sex, diabetes, smoking status, hypertension, hyperlipidemia, prior myocardial infarction and prior PCI) using multivariable Cox proportional hazards regression, which accounted for clustering of patients within hospitals.

Results:
We identified 1950 patients (1465 [75.0%] women) with TS, 33727 patients (10256 [30.4%] women) with STE-ACS and 88659 patients (28768 [32.5%] women) with NSTE-ACS. The average age was similar among patients with TS (67.0 ± 11.4 years) and STE-ACS (67.1 ± 12.5, p=0.47), whereas patients with NSTE-ACS were older (67.9 ± 11.1 years, p=0.0003). The crude 30-day rate of all-cause mortality was 2.9% among patients with TS, which was higher than patients with NSTE-ACS (1.5%, p<0.0001) but lower than patients with STEMI (6.0%, p<0.0001). Five-year mortality for patients with TS (13.6.0%) was lower than patients with STEMI (20.8%, p<0.0001), and similar to patients with NSTE-ACS (17.4%, p=0.39). The adjusted 5-year risk of dying associated with TS remained lower than that of STE-ACS (adjusted hazard ratio [HR] 0.73, 95% confidence interval [CI] 0.62-0.87, p=0.0002) and similar to that of NSTE-ACS (adjusted HR 1.04, 95% CI 0.88-1.23, p=0.64).

Conclusions:
Patients with TS have short-term prognosis that is intermediate between NSTE-ACS and STE-ACS, with similar long-term prognosis as patients with NSTE-ACS.
Radial Artery Accesses is Associated with Lower Mortality in Patients Undergoing Primary PCI: A Report from SCAAR

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BACKGROUND:
The purpose of this observational study was to evaluate effects of radial artery access (RA) versus femoral artery access (FA) on risk of 30-days mortality (primary endpoint), in-hospital bleeding, stroke and cardiogenic shock (secondary endpoints) in patients with STEMI undergoing primary PCI.

METHODS and RESULTS:
We used data from SCAAR registry (Swedish Coronary Angiography and Angioplasty Registry) for procedures performed in Sweden between 2005-2016. We evaluated the primary and secondary endpoints in 44,125 patients with STEMI, n=24,119 in RA and n=20,006 in FA. The two groups were compared using multilevel logistic regression to account for hierarchical database. Adjustments for differences in baseline characteristics were made with propensity score. We used instrumental variable (IV) method (for adjustment of hidden bias) for sensitivity analysis with calendar year as the treatment-preference instrument. Regression modelling was performed before and after exclusion of patients with cardiogenic shock.

The two groups were different in baseline characteristics with RA patients having generally less traditional risk factors. There were 2,308 (5.2%) deaths, 889 (3.7%) in RA and 1,419 (7.1%) in FA. After adjustment, RA was associated with lower risk of death (OR 0.50, 95% CI 0.45 – 0.57, P <0.001), lower risk of in hospital bleeding (OR 0.46, 95% CI 0.39 – 0.54, P <0.001) and lower risk of cardiogenic shock after PCI (OR 0.50, 95% CI 0.42 – 0.59, P <0.001). IV analysis have shown similar risk estimates for death at 30-days and cardiogenic shock. Exclusion of patients with cardiogenic shock did not substantially change the estimated risk of death at 30 days.

CONCLUSIONS:
In patients with STEMI, primary PCI through radial artery access is associated with reduced risk of 30-days mortality, in-hospital bleeding and cardiogenic shock. Our study supports current ESC guidelines which recommend RA as the first choice for primary PCI.
Background:
Takotsubo Syndrome (TS) is an acute cardio-vascular condition characterized by a transient ventricular wall motion abnormality triggered by an episode of physical or emotional stress, in the absence of culprit lesions in the coronary arteries. In our rat model we have previously shown that manipulating hemodynamics, heart rate and inotropy can determine extent and morphology of TS-like akinesia. We have previously noticed that susceptibility to TS-like akinesia varied between sites and breeders within rat strains. In order to further understand the intracellular mechanisms behind TS, this hypothesis generating study was performed.

Methods:
We compared global gene expression profiles in apical and basal tissue from the left ventricle of rats in our isoprenaline based TS model. Comparisons where made between rats of the same strain, held at two sites each from a different breeder. Male and female and treated and untreated rats were also compared. Tissue was taken from 5 rats in each group and a functional enrichment analysis performed to find differently expressed genes.

Results:
Significant down regulation was found in apical compared to basal tissue in isoprenaline treated rats in several genes. The most downregulated genes were Myosin light chain 7 (-609 times) and Sarcolipin (-98 times), both proteins are part of the cardiomyocyte contractile mechanism. Genes related to cell survival (Apolipoprotein E) and inflammation (Reg3G) were also downregulated in the apex. Differences when comparing expression between groups was less significant.

Conclusion:
The mechanism causing ventricular cardiomyocytes to become akinetic following stress has long proven elusive. The downregulation of important proteins in the contractile apparatus, calcium metabolism and inflammatory pathways in the affected cardiomyocytes are promising leads for new studies to elucidate the mechanism behind TS.
Can biomarkers help to understand the pathophysiology in myocardial infarction with normal coronary arteries?

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Background:  
In contrast to myocardial infarction (MI) with coronary stenosis >50\% (MI-CAD), the pathophysiology of MI with stenosis <30\% (MINCA) is poorly understood. It is also largely unknown whether stable patients after an acute episode of MINCA differ from MI-CAD patients and healthy controls in biomarkers reflecting different potential pathophysiological pathways.

Purpose:  
To compare biomarker levels in patients with MINCA, MI-CAD and controls 3 months after the acute episode.

Methods:  
100 MINCA patients, together with age and sex-matched MI-CAD patients (n=100) and controls (n=100) were included between 2007 and 2011. Plasma samples were collected three months after the index event and 92 different biomarkers were analysed using a Proximity Extension Assay. The statistical method random forest was used to identify independent biomarkers that differentiate MI-CAD/MINCA, or MINCA/controls. The biomarkers that are most accurate in doing so are presented in biomarker importance plots (Figure). For each of the two comparisons there is a leading marker, with the other markers ordered in percentage in relation to the leading one. P-values reflect the probability that the biomarker levels are different between the groups.

Results:  
We identified 4 and 7 biomarkers differentiating MINCA/MI-CAD and MINCA/control, respectively, using a cut-off of 50\% on the biomarker importance plots (Figure). The levels of tPA, BNP and MPO were higher in MI-CAD compared to MINCA patients, whereas TRANCE levels were higher in MINCA patients. The levels of REN, NEMO, PAPPA, AgRP, NT-proBNP, suPAR and LOX-1 were all higher in MINCA patients versus controls.

Conclusions:  
The results indicate differences in the activation of several pathophysiological pathways between MINCA patients and healthy controls, and between MINCA and MI-CAD patients, three months after the index event. These pathways include inflammation, coagulation/fibrinolysis, renin-angiotensin system activation, arteriosclerosis and cardiac dysfunction. However, the results must be interpreted cautiously because of the small sample size.
Appropriate coronary revascularization can be accomplished if the myocardial perfusion is assessed

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Background:
Despite current guidelines that encourage the use of stress imaging as guidance for treatment decision-making, many patients undergo percutaneous coronary intervention (PCI) based on clinical symptoms and angiographic findings. The aim was to investigate if appropriate elective revascularizations are accomplished, based on their effect on myocardial perfusion, left ventricular function and exercise capacity, if the revascularization decision is made according to clinical routine, and to evaluate the additive value of assessing the myocardial perfusion invasively or non-invasively.

Methods:
Thirty-three patients (10 females) clinically referred to coronary angiography (CA) with possible revascularization, due to suspected stable coronary artery disease (CAD), were prospectively included. Blinded to the referring physician and the angiographer, stress/rest 13N-NH3 positron emission tomography (PET), cardiac magnetic resonance (CMR) and cardiopulmonary exercise test were performed 4±3 weeks before and 5±1 months after CA. Decision to perform PCI in conjunction with CA was based on available clinical data and CA findings. Coronary flow reserve (CFR), left ventricular ejection fraction (LVEF) and peak oxygen uptake were assessed before and after the CA.

Results:
PCI was performed in 19/33 patients. Effect of revascularization on myocardial perfusion in patients with normal and abnormal CFR at baseline is shown in Figure 1. For patients undergoing PCI, no significant change was found between baseline and follow-up regarding global CFR, LVEF or peak oxygen uptake. Of the 14 patients not undergoing PCI, 5 had abnormal PET in one or more coronary territories. Complete agreement between iFR/FFR and CFR by PET was found in 12/13 vessels where iFR/FFR was performed during CA.

Conclusion:
Appropriate coronary revascularization in patients with stable CAD can be accomplished if myocardial perfusion is assessed either by invasive flow measurements during CA or non-invasive cardiac imaging to guide treatment decision. If not, unnecessary revascularizations could be performed or stenotic arteries in need of revascularization left untreated.
Factors influencing long-term survival in patients with obstructive hypertrophic cardiomyopathy in Western Sweden: dose-related protection from beta-blocker therapy?

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BACKGROUND
We aimed to establish risk-factors for disease-related mortality in a geographical cohort of patients with hypertrophic obstructive cardiomyopathy (HOCM), and whether any therapy modified survival.

METHODS
Diagnostic data bases in all hospitals in the West Götaland Region were searched for in- and outpatients with diagnostic codes relating to a diagnosis of HOCM; 251 adult patients with HOCM were identified, 128 male, 123 female. Case-notes were reviewed for clinical data and results from ECG and ultrasound examinations. Mean follow-up was 14.4±8.9 (mean±SD) years. Risk-factors for disease-related death were evaluated by multi-variate Cox-hazard regression including treatment modalities used.

RESULTS
Significant independent risk-factors for disease-related death on multi-variate analysis were: Female gender (p=0.005), age at diagnosis (p<0.001), LVOT gradient ≥50 mm Hg at diagnosis (p=0.026) and at follow-up (p=0.001). 121 patients had medical therapy alone, 88 short atrio-ventricular-delay pacing, and 42 surgical myectomy. 71% received beta-blockers from diagnosis, with a median metoprolol-equivalent dose of 125mg/day, and at latest follow-up 86% received beta-blocker. Neither myectomy, pacing nor calcium-blocker therapy modified survival, but early and maintained beta-blocker therapy was associated with significant dose-related protection (p=0.030) in the multi-variate model. Kaplan-Meier survival curves analyzed in dose-bands <75, 75-149, and ≥150 mg metoprolol/day showed respective 10-year survival of 83.1%, 90.7% and 97.0% (p=0.00008, Fig). Even after successful relief of outflow-obstruction by intervention there was a survival benefit of metoprolol-doses ≥100 mg/day (p=0.01).

CONCLUSIONS
Survival-analysis suggests that beta-blocker therapy has a dose-related cardio-protective effect in HOCM, and should be continued long-term even after successful interventional relief of outflow-obstruction.
Kidney dysfunction and the risk of aortic stenosis - the Stockholm CREAtinine Measurements (SCREAM) project.

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Background
An increased AS prevalence has been observed in patients undergoing dialysis, but whether less severe CKD associate with AS in the greater community is currently unknown, with existing evidence being contradictory.

Methods
Included were 1,121,875 participants without a prior diagnosis of aortic stenosis from the Stockholm CREAtinine Measurements (SCREAM) project. Estimated glomerular filtration rate (eGFR, ml/min/1.73m²) was calculated from serum creatinine and follow-up was carried out for the occurrence of aortic stenosis diagnostic codes. The median age was 50 (interquartile range 36-64) years and 54% were women. Median eGFR was 96 (interquartile range 82-109) and 66,949 (6.0%) participants had manifest CKD (eGFR <60 ml/min/1.73m²). During a median follow-up time of 5.1 years (IQR 3.3 - 6.1), there were 5858 (0.5%) participants who developed AS (incidence rate (IR) 1.13 per 1000 person-years).

Results
Compared to eGFR>90 (IR 0.34 per 1000 person-years), each lower CKD stratum was associated with higher hazards of AS in fully-adjusted models: eGFR>60-90 IR 1.88; HR 1.12 (95% CI 1.03-1.21); eGFR>45-59 IR 4.61, HR 1.12 (95% CI 1.00-1.24); eGFR>30-44 IR 6.62; HR 1.13 (95% CI 0.99-1.29) and eGFR<30 IR 8.27; HR 1.42 (95% CI 1.18-1.71).

Conclusion
Kidney dysfunction is associated with increased risk of aortic stenosis. These results have implications for targeted cardiac assessment in persons with CKD, and identification of novel cardio-renal syndrome pathways.
Females have higher myocardial blood flow, myocardial blood volume and myocardial extracellular volume compared to males – both at rest and during adenosine stress cardiovascular magnetic resonance

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Background: Knowledge on sex differences in myocardial blood flow and blood volume in healthy individuals is scarce. Therefore, the aim of this study was to investigate sex differences in myocardial perfusion and myocardial blood volume (MBV) in healthy individuals at rest and during adenosine stress cardiovascular magnetic resonance imaging (CMR).

Methods: Healthy volunteers (n=41, mean±SD age 26±5 years, 51% female) underwent CMR at 1.5T (Siemens Aera). Quantitative myocardial perfusion [ml/min/g] and MBV [%] maps were computed by Gadgetron inline perfusion mapping software using first pass perfusion imaging during adenosine stress (140 microg/kg/min infusion) and at rest following an intravenous contrast bolus (0.05 mmol/kg, gadobutrol). A native midventricular short axis T1 map (MOLLI) was acquired before and during adenosine stress. The same midventricular short axis T1 map (MOLLI) was also acquired after administration of contrast (0.2 mmol/kg, gadobutrol), at rest and during adenosine stress. This rendered both rest and stress extracellular volume fraction (ECV) maps.

Results: Compared to males, females had higher rest and stress values for perfusion (rest 0.94±0.21 vs 0.79±0.16 ml/min/g, p=0.02; stress 3.8±0.55 vs 3.02±0.69 ml/min/g, p<0.001), Figure 1, MBV (rest 9.2±0.8 vs 8.6±0.8%, p<0.01; stress 12.5±1.0 vs 11.5±0.9%, p<0.01), Figure 2, and ECV (rest 29±2 vs 26±3%, p<0.01; stress 33±2 vs 28±3%, p<0.01), Figure 3. MBV and ECV were correlated (R² =0.35, p<0.001), and there was no difference in the rest-to-stress increase in MBV compared to the rest-to-stress increase in ECV (3.6±2.6 vs 3.1±1.2 % points, p=0.28).

Conclusions: Myocardial perfusion, MBV and ECV are higher in females compared to males, both at rest and during adenosine stress. ECV measures at rest and stress provide independent validation of the accuracy of stress-induced changes in MBV. Increased MBV contributes to the higher ECV found in females compared to males. Taken together, these findings provide mechanistic insight into sex differences in myocardial physiology.
Added value of right ventricular 3-chamber view in patients with pulmonary hypertension using a comprehensive right ventricular myocardial systolic strain analysis with Feature-Tracking cardiac magnetic resonance.

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Background:
Right ventricular (RV) dysfunction is key determinant of prognosis in pulmonary hypertension (PH). Cardiac strain is a sensitive measure of myocardial dysfunction, affected before RV ejection fraction (RVEF) decreases. RV strain is measured in 4-chamber view (4CH) using cardiac magnetic resonance (CMR). However, RV dilatation also occurs in anterolateral direction. Thus, relying solely on 4CH might yield an incomprehensive assessment of RV. RV3-chamber view (RV3CH) includes posterior and anterior free wall of RV. The aim was to evaluate if strain from RV3CH has incremental diagnostic value to 4CH and midventricular short-axis slice of RV (RV-SA), in relation to RVEF, systolic pulmonary arterial pressure (sPAP) and pulmonary vascular resistance (PVR).

Methods:
Fifty-one patients (60±16 years, 76% female), 34 with PH and 17 with scleroderma screened for but without PH, were prospectively included for RV evaluation using CMR. Longitudinal strain was analyzed in long-axis images acquired in 4CH and new RV3CH. Circumferential strain was analyzed in RV-SA. Endocardial RV was manually delineated in all views (Figure 1), and peak and post-systolic strain was calculated with feature-tracking in software Segment (Medviso AB, Lund).

Results:
Peak systolic strain from RV3CH correlated significantly to RVEF (Figure 2), sPAP and PVR (r=-0.75, r=0.51, r=0.65)(Table 1). Post-systolic contraction was detected in 17 patients in RV3CH, 12 in 4CH and 12 in RV-SA. Post-systolic contraction in RV3CH correlated significantly to RVEF, sPAP and PVR (r=-0.71, r=0.69, r=0.58)(Table 2, Figure3). Positive predictive value of post-systolic contraction in RV3CH to detect RVEF<50%, mPAP≥25mmHg and PVR>3WU, was 94%, 88% and 100% respectively. Post-systolic contraction in 4CH or RV-SA did not correlate with RVEF, sPAP or PVR.

Conclusion:
Peak systolic strain from RV3CH using CMR correlates strongly to RVEF, sPAP and PVR. Post-systolic contraction in RV3CH provides added predictive value of decreased RVEF, increased sPAP and PVR, while 4CH and RV-SA do not.
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**Exercise-ECG for detecting coronary artery disease with prognostic implication**

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**Background:**
Revascularization of stable coronary artery disease (CAD) decreases symptoms and in the case of three-vessel disease, left main stenosis or proximal stenosis of the left anterior descending artery also improves prognosis. Exercise-ECG is not recommended in the guidelines because of lower sensitivity than other methods for CAD in general. However, previous data show that Exercise-ECG has a high sensitivity when it comes to CAD with prognostic implication. We wanted to evaluate if exercise-ecg is useful in identifying patients with proven severe CAD.

**Methods:**
We used local data from the SCAAR-registry to identify all patients residing in Westerbotten county undergoing coronary angiography in Umeå 2013 where the results showed CAD with prognostic implication. All patients who had performed an exercise-ECG during the previous year were included. High-risk signs on exercise-ECG was determined as: ≥0.1mV ST-depression during exercise, ≥0.2mV ST-depression 2 minutes after exercise, chest pain of ≥5 on the Borg scale or break criteria of chest pain, or decrease in blood pressure of ≥15 mmHg at one measurement or ≥10 mmHg on two consecutive measurements.

**Results:**
A total of 335 patients fulfilled the criteria of CAD with prognostic implications. Of these, 104 patients had performed an exercise-ECG. 90 patients (86%) had high-risk signs on the exercise-test, 8 patients (8%) did not have high-risk signs but did not reach 85% of maximum predicted heart rate and 6 patients (6%) had a negative exercise test according to the definition.

**Conclusions:**
Exercise is a cheap and effective method for detecting CAD with prognostic implication. If the patient reaches 85% of expected heart rate and does not have high-risk signs on the exercise ecg our data indicate that there is little need for further diagnostic tests or revascularization unless the patient has severe angina.
Internet-based cognitive behavior therapy for symptoms of depression and anxiety among patients with a recent myocardial infarction: The U-CARE Heart randomized trial.

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Background:
Symptoms of depression and anxiety are common after a myocardial infarction (MI). Internet-based cognitive behavioral therapy (iCBT) may improve access to effective psychological treatment to reduce these symptoms. The aim of this randomized trial was to evaluate the effectiveness of an iCBT treatment to reduce self-reported symptoms of depression and anxiety among patients with a recent MI.

Methods:
In total, 3928 patients were screened in routine clinical care settings at 25 Swedish hospitals for study eligibility. Of these, 239 (33% women, mean age 60 years) with a recent MI (6-10 weeks) and symptoms of depression and anxiety were randomly allocated to a therapist-guided, tailored, 14 week iCBT treatment (n=117), or treatment as usual (n=122).

The iCBT treatment consisted of 10 eligible modules, designed for an MI patient population.

The primary outcome was the potential difference between groups in the total score of the Hospital Anxiety and Depression Scale (HADS) at follow-up 14 weeks post baseline. Treatment effect was evaluated according to the intention-to-treat principle, with multiple imputation performed to handle missing values. For the main analysis, a pooled treatment effect was estimated with a multiple linear model, controlling for age, sex, and baseline HADS.

Results:
There was a reduction in HADS scores over time in the total study sample (mean Δ = -5.1, p< 0.01). However, there was no difference in HADS score between the iCBT group and the control group at follow-up (β= -0.47 [95% confidence interval, -1.95 to 1.00], p=0.53).

Treatment adherence was low with 39% completing the introductory module only, and 15% completing additional modules.

Conclusions:
iCBT with MI patients recruited from routine cardiac care, did not result in lower levels of symptoms of depression or anxiety compared to treatment as usual. Reasons for low treatment adherence needs to be further explored.
A smartphone application for dispatch of lay responders to out-of-hospital cardiac arrests

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Background.
Dispatch of lay volunteers trained in cardiopulmonary resuscitation (CPR) and equipped with automated external defibrillators (AEDs) may improve survival in cases of out-of-hospital cardiac arrest (OHCA). The aim of this study was to investigate the functionality and performance of a smartphone application for locating and alerting nearby trained laymen/women in cases of OHCA.

Methods.
A system using a smartphone application activated by Emergency Dispatch Centres was used to locate and alert laymen/women to nearby suspected OHCAs. Lay responders were instructed either to perform CPR or collect a nearby AED. An online survey was carried out among the responders.

Results.
From February to August 2016, the system was activated in 685 cases of suspected OHCA. Among these, 224 cases were Emergency Medical Services (EMSs)-treated OHCAs (33%). EMS-witnessed cases (n=11) and cases with missing survey data (n=15) were excluded. In the remaining 198 OHCAs, lay responders arrived at the scene in 116 cases (58%), and prior to EMSs in 51 cases (26%). An AED was attached in 17 cases (9%) and 4 (2%) were defibrillated. Lay responders performed CPR in 54 cases (27%). Median distance to the OHCA was 560 metres (IQR 332–860 m), and 1280 metres (IQR 748–1776 m) via AED pick-up. The survey-answering rate was 82%.

Conclusion.
A smartphone application can be used to alert CPR-trained lay volunteers to OHCAs for CPR. Further improvements are needed to shorten the time to defibrillation before EMS arrival.
Supervised exercise but not physical activity on prescription improves physical fitness in elderly patients with permanent atrial fibrillation

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Background:
Elderly patients with permanent atrial fibrillation (AF) often have symptoms due to reduced physical fitness. Effects of Physiotherapist-led exercise within cardiac rehabilitation (PT-X) are in such patients unclear. Physical Activity on Prescription (PaP) does not include any supervised exercise and has not been evaluated in any group of patients with cardiac disease.

Aim:
To compare PT-X vs. PaP with special reference to physical fitness, physical activity level, health related quality of life (HR-QoL), and metabolic risk markers in patients with permanent AF.

Methods
We performed a randomized, multi-center study, comparing effects of 3 months of PT-X vs. PaP. Inclusion criteria were permanent AF and EF ≥ 45%. Exclusion criteria were significant valvular lesion, coronary event within 3 months, stroke with residual symptoms or pacemaker. A symptom limited ergometer cycle test, muscle endurance tests, HR-QoL (SF-36), physical activity level assessment and blood sampling were performed at baseline and after 3 months. PT-X consisted of two 60-minutes group sessions and two home-based exercise sessions per week. PaP consisted of active walking for 40 minutes, 4 times a week.

Results:
Ninety-six patients (28 women) were enrolled, age 74± 5 years. An intention to treat analysis showed that patients in PT-X (n=46) improved significantly compared to patients in PaP regarding exercise capacity (14 ± 12 vs. -3 ± 11 watt, p<0.0001), shoulder flexion (6 ± 10 vs. -1 ± 11 n.o, p=0.001), heel-lift (4 ± 6 vs. -1 ± 5 n.o, p=0.001) and shoulder abduction (15 ± 41 vs. -4 ± 33 s, p=0.011). PaP patients spent significantly more time in moderate and moderate to vigorous physical activity but did not improve physical fitness. There were no significant differences in HR-QoL or lab tests.

Conclusion:
PT-X should be offered to patients with permanent AF because it improves physical fitness and is safe.
Increasing exercise capacity of patients with heart failure through Wii gaming (HF-Wii study).

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Background:
Despite the beneficial effects of exercise for Heart Failure (HF) patients, such as improved functional capacity and favorable clinical outcomes, the level of daily physical activity in most patients with HF is low. It is a challenge to find effective methods that motivate patients with HF to become and to stay active despite barriers they might experience, such as symptoms, difficulty to travel to a rehabilitation center or challenges to be active outside. Exergaming (being physically active by a virtual game) may be a promising new approach to increase the physical activity of patients with HF at home. The aim of the HF-Wii study is to determine the effectiveness of the structured introduction and access to a Wii game computer in patients with HF to improve exercise capacity and level of daily physical activity, to decrease healthcare resource use, and to improve self-care and health-related quality of life.

Methods:
An investigator driven international multicentre randomized controlled study with two treatment groups included 600 patients with HF. Data were collected in 10 centers in Sweden, the Netherlands, Italy, Israel, Germany and the USA. In each center, patients were randomized (in a 1:1 ratio in each center) to either motivational support only (control) or structured access to a Wii game computer (Wii). Patients in the control group received advice on physical activity and were contacted by four telephone calls using a standard scenario. Patients in the Wii group also received advice on physical activity along with a Wii game computer, with instructions and training, home installation of the game-computer and four telephone calls.

The primary analysis consists of comparing the results of the change in 6 minute walking test (6-MWT) from baseline to 3 months between the group of patients in the Wii group compared with the control group. To achieve a 30m difference between the control group and the Wii group (which is described to be a clinically significant difference in HF patients) based on 80% power, 5% significance, 250 patients in the intervention group and 250 patients in the control group were needed. To ensure appropriate patient numbers at the end of the study, 2 × 300 patients were included. Secondary endpoints at 3 months include muscle function as measured by the muscle function test and exercise motivation measured with the Exercise Motivation Index. Additional data on 6-MWT, muscle function and readmission, exercise motivation, mortality and quality of life are collected after 1 year.

Results:
In total 2693 HF patients were screened and in total 606 patients were randomized in the 10 participating centers.

Study population:
Prior to randomization, patients had a mean age of 66.9 years (±11.7) range 25-94, 71% of patients were male, with a good balance between the groups. At inclusion 59% were NYHA II and 28% in NYHA III. Median time after HF diagnosis was 21 months, ranging from newly diagnosed to being diagnosed 17 years ago.

Status:
The 3 month follow up of the last patient was May 15 2017. Data are currently cleaned and analyzed, and the data on the primary endpoint (6-MWT) at 3 months, muscle function and exercise motivation will be available.

Conclusion:
The HF-Wii study, is a unique study and the largest study in this field of exergaming and HF patients. Results will allow insight on the effects of access and structured introduction of an easy applicable and available virtual reality application. There is a need for evidence on the long-term effects of cost-effective, affordable and available interventions that are both ‘patient friendly’ and easy to implement.
Substantial prevalence of a type-II left ventricular contraction pattern by feature tracking CMR in patients with non-specific intraventricular conduction delay

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Background:
Patients with non-specific intraventricular conduction delay (IVCD) show inferior response to cardiac resynchronization therapy (CRT) compared to patients with left bundle branch block (LBBB). A type-II contraction pattern in LBBB has been associated with improved CRT response. The aim of this study was to explore the prevalence of a type-II left ventricular (LV) contraction pattern in patients with IVCD.

Methods:
We retrospectively identified 38 patients with IVCD, defined as QRS duration ≥120ms and absence of fulfilling electrocardiographic morphologic criteria for left or right bundle branch block and available clinically acquired CMR images. CMR feature tracking (CMR-FT) was used to measure the earliest-to-latest segment delay (ELSD) in circumferential short-axis strain, a previously validated measure of dyssynchrony in LBBB. Contraction patterns were classified based on the absence (type-I) or presence (type-II) of a line of block in circumferential short-axis strain.

Results:
Among IVCD patients, 21/38 (55%) had a type-II contraction pattern and 17/38 (45%) had a type-I contraction pattern. In patients with a type-II pattern the mid-ventricular inferior segment was the most frequent site of latest mechanical activation (LMA) (8/24, 33% of cases) while, the lateral wall segments (anterolateral and inferolateral) together were the most frequent sites of LMA in patients with a type-I pattern (18/26, 69% of cases)

Conclusions:
Approximately half of patients with IVCD demonstrate a type-II contraction pattern identifiable using CMR-FT, which has previously been associated with favorable CRT response in patients with LBBB. The site of LMA in these patients is frequently located elsewhere than the LV lateral wall which is most frequently targeted for LV lead deployment at CRT implantation. Congruence between site of LMA and site of CRT lead deployment has previously been associated with favorable CRT response. These initial findings deserve further study with regards to the ability to predict CRT response in IVCD.
Increased all-cause mortality, total cardiovascular disease and morbidity in hospitalized octogenarians with orthostatic hypotension

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Background:
Orthostatic hypotension is a common finding in elderly patients and is associated with significant morbidity and mortality. Most of the knowledge on orthostatic hypotension and cardiovascular endpoints and mortality comes from prospective cohort data and there are few clinical studies performed in octogenarians (age 80 - 89 years old).

Methods:
From the year 2014 until May of the year 2017 a team composed of a physiotherapist and an occupational therapist supervised by a medical doctor visited newly hospitalized patients at Lund’s University Hospital. The team measured BMI, blood pressure, pulse, saturation and registered demographics at admittance. They were also able to register blood tests taken, the patients’ final diagnosis, the number of days in hospital, the number of medications at discharge, the number of re-hospitalizations and the number of deaths at follow-up after 6 months. Orthostatic blood pressure tests were taken in a total of 210 patients. These patients were divided into two groups, the orthostatic hypotension group (OH-group, n = 119) and the normotensive group (NT-group, n = 91).

Results:
During follow-up 14 of 91 patients died in the NT-group compared to 32 of 119 in the OH-group (p < 0,05). At discharge 41 of 91 patient had been diagnosed with cardiovascular disease in the NT-group compared to 70 of 119 patients in the OH-group (p < 0,05). The patients in the NT-group stayed at the hospital for a mean of 8,38 days compared to the patients from the OH-group whom stayed for a mean of 9,86 days (p < 0,05).

Conclusions:
This study has shown that there is increased cardiovascular disease, morbidity and mortality in elderly patients with orthostatic hypotension compared to patients without orthostatic hypotension in a hospital setting. The study results indicate the importance of taking orthostatic blood pressure tests in elderly patients.
Efficacy and safety of outpatient treatment with direct oral anticoagulation in pulmonary embolism.

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Background
Anticoagulant (AC) treatment of acute pulmonary embolism (PE) has traditionally been hospital-based. The lesser need for monitoring with the increasingly used direct acting oral anticoagulants (DOAC) in comparison to warfarin potentially facilitates outpatient treatment of PE with these drugs. This study aimed to evaluate efficacy and safety of outpatient treatment of PE with DOAC.

Methods
We extracted data from the Swedish quality registry for patients on oral anticoagulation (AuriculA) for all 245 patients in the southernmost hospital region in Sweden (1.3 million inhabitants) selected for outpatient treatment with of PE with DOAC during 2013-2015. Comorbidites, risk factors, and simplified pulmonary embolism severity index (sPESI) were evaluated at baseline, and death, recurrent venous thromboembolism (VTE), and bleeding was recorded during 6 months of follow-up. Outpatient treatment was defined as discharge from the emergency department (ED) within 24 hours.

Results
During 6 months of follow-up, one patient died during DOAC therapy, the cause of death was unrelated to VTE. No VTE recurrences occurred, whereas, one patient experienced major bleeding, and 5 patients experienced minor bleedings.

Conclusion
Outpatient treatment of PE with DOAC is efficient and safe in selected patients.
THE EFFECTS OF ANGIOTENSIN CONVERTING ENZYME INHIBITION AND ALPHA 1-ADRENERGIC RECEPTOR BLOCKADE ON HAEMOSTASIS AND INFLAMMATION IN HUMAN HYPERTENSION

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Objective
Hypertension is associated with oxidative stress and low-grade chronic inflammation, contributing to phenotypical alterations of the endothelium to a proconstrictive, proinflammatory, and prothrombotic phenotype. Antihypertensive therapy improves vascular structure and function. However, the relative contribution of antihypertensive therapy on vascular inflammation, thrombogenic mechanisms, and endothelial dysfunction remains unclear. We have previously demonstrated that antihypertensive treatment with ramipril, an ACE inhibitor, reduced thrombin generation compared to placebo. This study aimed to extend these observations and to investigate the possible contribution of blocking the RAAS on haemostasis and systemic inflammation beyond the effects of lowering blood pressure.

Design and method
We examined 59 individuals with mild-to-moderate hypertension randomized to receive double blind ramipril 10 mg od or the alpha 1-adrenergic receptor blocker doxazosin 8 mg od for 12 weeks. Haemostasis (plasminogen activator inhibitor-1 activity, tissue plasminogen activator antigen, thrombin-antithrombin complex, and thrombin generation by calibrated automated thrombogram) and inflammatory markers (interleukin-6, soluble interleukin-6 receptor, interleukin-8, tumor necrosis factor-alpha, monocyte chemoattractant protein-1, and C-reactive protein) were assessed.

Results
Treatment reduced blood pressure in both groups. Thrombin-antithrombin complex decreased by treatment, and this was dependent on a reduction in thrombin-antithrombin complex in the ramipril group alone (figure). Changes in thrombin-antithrombin complex by treatment did not relate to changes in blood pressure. There were no changes in plasminogen activator inhibitor-1 activity, while tissue plasminogen activator antigen increased by ramipril and decreased by doxazosin. Only minor changes were observed in systemic inflammation by treatment.

Conclusion
These results extend our previous findings to suggest that antihypertensive treatment with ramipril reduces thrombin generation beyond the effects on blood pressure reduction alone. Thus, drugs blocking the RAAS may reduce atherothrombotic complications beyond their effects to reduce blood pressure. Furthermore, doxazosin might have beneficial profibrinolytic effects. The antihypertensive effects on inflammatory markers by antihypertensive treatment, however, were small.
Short and long term prognosis of patients undergoing urgent TAVI

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Aim
The aim of this study was to investigate the short and long term prognosis of patients undergoing urgent compared to elective TAVI (transcatheter aortic valve implantation) procedure. An urgent procedure was defined as a procedure on a patient whom is not able to be discharged from hospital due to decompensated left ventricular function.

Methods and results
405 TAVI procedures were performed between May 2008 and December 2016. 79 (20%) of these were classified as urgent procedures. The patients (47% female, no difference between the groups) undergoing urgent procedures had similar age (average 81 years), similar weight (average 74 kg), worse kidney function (average S-Creatinin 139 vs 108 mmol/L, p<0.01), more atrial fibrillation (51% vs 37%, p<0.05), higher NT-proBNP level (average 13910 vs 5133 ng/L, p<0.01), lower left ventricular ejection fraction (EF<50% 62% vs 23%, p<0.01), higher right ventricular pressure (average 52 vs 44 mmHg, p<0.01) and a similar maximum pressure gradient over the aortic valve (average 82 mmHg) compared to the patients undergoing elective procedures. All patients in both groups were discussed in a multidisciplinary heart team meeting and TAVI was the recommended treatment.

The Kaplan Meier estimate for mortality at 30 days and at 365 days were similar between the two groups (6.3% vs 5.5%, log-rank test p=0.80 and 16% vs 11%, log-rank test p=0.22 respectively), see figure 1.

Conclusions
In this study, patients undergoing urgent TAVI procedures compared to elective procedures have similar short and long term outcome despite a higher frequency of high risk features at baseline. Although a trend towards higher mortality at 1 year, urgent TAVI procedures seem to be a reasonable approach to patients with decompensated left ventricular function due to aortic stenosis although further research in this area is warranted.
Native aortic and mitral valve infective endocarditis: a nationwide registry study on differences in patient characteristics, microbiology and determinants of survival

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Background
Native mitral valve infective endocarditis (MVE) and native aortic valve infective endocarditis (AVE) is usually grouped as one entity—left-sided native valve endocarditis—and differences between AVE and MVE have not been properly investigated. This study aims to compare MVE and AVE regarding patient characteristics, microbiology and determinants of survival.

Methods
A nationwide retrospective cohort study using the Swedish Registry on Infective Endocarditis on 1393 episodes in 1371 patients with either MVE (n=649) or AVE (n=744). Follow-up on survival was performed using the Swedish National Population Registry. Survival was estimated with the Kaplan-Meier method. Univariable and multivariable logistic regression and cox regression were used to identify predictors of surgery, in-hospital mortality, and long-term mortality.

Results
The mean age was 67 years and was similar in both groups. Females were 26% of AVE patients and 39% of MVE patients (p<0.001). Staphylococcus aureus was more common in MVE while enterococci and coagulase-negative staphylococci were more common in AVE. Abscesses were more common in AVE than MVE (8.5% versus 3.5%, p<0.001). Surgery was performed in 35% of AVE patients compared to 27% of MVE patients, and surgery was performed later in the disease-course in patients with MVE. Abscess was the strongest predictor of surgery in both groups. Staphylococcus aureus endocarditis was associated with decreased odds of surgery in AVE but not in MVE. The overall short-term and long-term mortality were similar between groups, except in patients that underwent surgery for IE, where patients with MVE had higher in-hospital mortality. Compared with Alpha streptococci, S. aureus and Enterococci were associated with higher in-hospital mortality in MVE. Microbiology did not predict in-hospital mortality in AVE.

Conclusions
We report several potentially clinically relevant differences between AVE and MVE and this may aid a more individualised care of patients with native valve infective endocarditis.
DENSE Outperforms HARP and Feature Tracking for Magnetic Resonance Torsion Assessment in Coronary Artery Disease.

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Background
The purpose of this study was to compare left ventricular torsion determined with three MRI based techniques - tagging, feature tracking and DENSE - in a population at substantial risk for coronary artery disease.

Methods
Forty-eight patients with suspected coronary artery disease (European Society of Cardiology Systematic COorony Risk Evaluation; ESC SCORE >15%) were included in this study. Cine SSFP, tagging and displacement encoding with stimulated echoes (DENSE) were used to assess left ventricular function, whereas late gadolinium enhancement (LGE) was used to detect presence of myocardial scarring. The end-systolic torsion was obtained using: FT, TomTec GmbH – for the cine SSFP images; HARP, Diagnosoft Inc - for the tagged images; and an in-house developed analysis tool - for the DENSE images. The FT torsion result was shown for endo- and epicardial as well as transmural measurements. Left ventricular end diastolic volume (LVEDV), end systolic volume (LVESV), left ventricular ejection fraction (LVEF), left myocardial wall mass (LVM) and scar as a percentage of the total myocardial mass were obtained from segmentations created using Segment (v2.0 R4434, Medviso AB).

Results
Of the 48 patients, out of which 33 were male (69%), 9 had >50% transmurality by late gadolinium enhancement, 20 had high blood pressure, and 11 had LVEF <55%. Eleven patients had normal LVM, blood pressure, LVEF, wall motion, and no signs of positive LGE. Average torsion (degrees/mm) derived from DENSE (0.40) and HARP (0.37) showed no significant difference. Torsion estimated by FT (0.17) was significantly lower than by DENSE (p<0.001) and by HARP (p<0.001) for all FT layers. There was no significant correlation between torsion and the extent of LGE.

Conclusion
Torsion derived from DENSE showed more significant and stronger correlations with LV parameters (LVM, LVEF, LVEDV, LVESV) than HARP and FT in patients with coronary artery disease.
Background

Polyvascular disease (PvD) is associated with an increased risk for cardiovascular (CV) events.

The Walking Impairment Questionnaire (WIQ) is a self-administered instrument to assess walking distance, speed and stair climbing in patients with Peripheral artery disease (PAD) and predicts future CV events and mortality but has not been evaluated in a population with recent myocardial infarction (MI).

Purpose

To evaluate whether WIQ score is useful to identify PAD and PvD in a MI population and how the WIQ score changes during two year follow up.

Methods

241 patients included in a single center study (REBUS) with recent MI. Atherosclerosis was evaluated with a coronary angiography, ankle-brachial index and carotid duplex ultrasound. PvD was defined as abnormal findings in all three arterial beds. Participants self-administered the WIQ forms 2-3 weeks after the MI (visit1) and after 2 years (visit 4). The calculated score, with a maximum of 100 (each category), was divided into quartiles with the lowest score in the first quartile.

Results

Table shows the improvement at visit 4 of all WIQ scores in the whole study cohort.

The lowest quartile in both distance- and speed score was associated with PAD at visit 1, also after adjustment for age, sex, congestive heart failure, atrial fibrillation and diabetes; distance, OR 3.9 (95% CI 1.6-9.2) and speed, OR 3.2 (95% CI 1.2-8.6) compared to the highest quartile with similar results at visit 4.

The lowest quartile in the all three categories was associated with PvD at visit 1, also after adjustment; distance, OR 5.4 (95% CI 1.8-16.1); speed, OR 7.4 (95% CI 1.5-36.5); stair climbing, OR 8.45 (95%CI 8.5 (1.0-73.6). The results at visit 4 attenuated after adjustment.

Conclusion

The WIQ questionnaire identifies MI patients with more widespread atherosclerotic disease. The WIQ scores improved for all patients and categories at follow-up.
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Myocardial perfusion during adenosine stress is decreased in healthy Iraqi immigrants compared to healthy native Swedes: analysis of quantitative CMR perfusion and coronary sinus flow

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Background:
Middle-Eastern immigrants constitute a growing proportion of the European population and previous studies in Sweden have shown that this immigrant group is more insulin resistant compared to Swedes, which can contribute to atherosclerosis. We aimed to study if myocardial perfusion, as an early sign of cardiovascular disease, differs between Iraqi immigrants and Swedes using cardiovascular magnetic resonance imaging (CMR).

Material and methods:
Ten Iraqi men (41[31-68] years) and five Swedish controls (53[37-58] years), all non-smokers, with no medical history of diabetes or cardiovascular disease were included. CMR was performed on a Siemens Aera 1.5T scanner. Quantitative regional myocardial blood flow (MBF) was assessed using a motion-corrected, saturation recovery SSFP dual-sequence protocol and flow maps were generated inline. Three short-axis slices were acquired. Global MBF was assessed by coronary sinus flow over the cardiac cycle and normalized for left ventricular mass. Perfusion was assessed during rest and adenosine hyperemia. Late gadolinium enhancement (LGE) images were also acquired. Non-parametric statistics were used for comparisons between groups.

Results:
Figure 1 shows quantitative pixel-based MBF analysis (mean±SD), demonstrating no difference in resting MBF between the groups (0.8±0.2 vs 1.0±0.4 ml/min/g, P=0.38) but lower MBF during adenosine in Iraqi men (3.1±0.5 vs 3.8±0.5 ml/min/g, P=0.02). Figure 2 shows MBF assessed by coronary sinus flow, where similar results were seen with no difference in resting MBF (0.9±0.2 vs 0.9±0.2 ml/min/g, P=0.41), but a lower MBF during adenosine in the Iraqi group (3.3±0.4 vs 4.0±0.6 ml/min/g, P=0.044). In Iraqi men, bias at rest between regional MBF and coronary sinus MBF was -0.05±0.1 ml/min/g and during adenosine -0.1±0.3 ml/min/g. For controls, bias between methods was 0.1±0.3 ml/min/g at rest and -0.2±0.8 ml/min/g during adenosine. LGE was not present in any subjects.

Conclusion:
Myocardial perfusion by quantitative pixel mapping and coronary sinus flow was lower in healthy Iraqi immigrants compared to Swedish controls, suggesting differences in microvascular function.
Background:
The diagnosis and assessment of stable coronary artery disease (SCAD) involves clinical evaluation (risk stratification, resting ECG, biomedical tests) and specific non-invasive cardiac investigations including exercise ECG, stress-echocardiography, coronary computed tomography angiography (CTA) and single photon emission computed tomography (SPECT). We aimed to validate the new portable acoustic device system for detection of CAD vs. stress-echocardiography and exercise-ECG.

Methods:
Patients referred to exercise-ECG, SPECT or stress-echocardiography (vasodilator/dobutamine) were pre to the test examined by the acoustic system. The system was placed in the fourth intercostal space with the patient in the supine position. Risk factors including age, hypertension and classification of chest pain (typical angina, atypical angina or non-anginal chest pain) were put into the system before starting the recording. The CAD-score was blinded to the reporting stress-echocardiography, SPECT and exercise-ECG physician.

Results:
40 patients (49% men) were enrolled (mean age 64 years). The acoustic CAD-score could not be obtained in 7 patients (18%). A CAD-score > 20 indicated CAD. At this cut-off, sensitivity was 75%, specificity 20%, positive predictive value 13% and negative predictive value 83% for diagnosing CAD vs. stress-echocardiography, SPECT and exercise-ECG.

Conclusion:
The portable acoustic-based system is a simple tool with a high NPV of 83% to rule-out CAD in low-intermediate PTP of CAD.
Differences in attenuation pattern in myocardial SPECT between CZT and conventional gamma cameras

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Background:
The aim of the present study was to compare the localization, extent and depth of attenuation defects in myocardial SPECT (MPS) for a cadmium zink tellurid (CZT) compared to a conventional gamma camera.

Methods:
Phantom and patient measurements were performed both on a CZT camera (GE NM 530c) and a conventional gamma camera (GE Ventri). All images were attenuation corrected with an externally acquired CT. The localization, extent and depth of the attenuation artifact was quantified by comparing attenuation-corrected and non-attenuation-corrected images.

Results:
The localization of the attenuation defect was shifted counter-clockwise from the inferolateral wall to the lateral wall for the CZT camera compared to conventional camera in both the patient and the phantom measurements. The extent of the attenuation defect differed significantly between the two cameras (23±5% vs 15±5%, p<0.001) for patients and 28% vs 19% for phantom measurements. Furthermore, the depth of the attenuation defect also differed significantly between cameras, both for phantom measurements (73% vs 67%) and patients (72±3% vs 68±4%, p<0.001).

Conclusions:
Attenuation defects have different location, extent and depth when comparing a CZT camera to a conventional gamma camera for MPS. This needs to be taken into consideration when evaluating MPS studies to avoid misinterpretation of myocardial perfusion distribution.
Ischemic events and bleeding, following percutaneous coronary intervention in patients on a P2Y12- inhibitor only, on top of long-term Oral Anticoagulation

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Background
Combination of oral anticoagulation (OAC) and dual antiplatelet treatment (triple therapy, TT) after PCI has been associated with high risk of bleeding. An alternative strategy using OAC and single P2Y12-inhibitor post PCI (dual therapy, DT), has been suggested. The aim of this study was to determine the incidence of cardiovascular events, and incidence and timing of bleeding events in PCI-patients treated with DT, and to investigate risk factors for bleeding.

Methods
This was a prospective observational cohort study. All patients in Dalecarlia, Sweden, on long-term OAC undergoing PCI between May 2015 and April 2016, were included (n=65). Patients were discharged with OAC in combination with a single P2Y12-inhibitor, and followed up at 6 months.

Results
Any bleeding occurred in 35% (n=23), including major 12% (n=8), according to PLATO bleeding criteria. No bleeding was life threatening. Apart from an accumulation of minor/minimal bleeds during the first 24 hours, bleeds occurred evenly distributed over time. The risk of bleeding was higher for patients >80 years (62% vs. 30%, p= 0.013), with GFR <60 (55% vs. 26%, p= 0.020) and a history of bleeding (57% vs. 27%, p= 0.014). PPI was associated with a lower risk of bleeding (20% vs. 49%, p= 0.028). The combined endpoint of cardiovascular-death, MI and stent thrombosis was found in 11% (n=7). Overall mortality was 6% (n=4).

Conclusions
This study of a real life population treated with DT after PCI showed a high incidence of bleeding. Major bleeding events were evenly distributed over time. Age, renal failure and prior bleedings/anemia were associated with increased bleeding risk, and the use of PPI with a lower bleeding risk. Rates of major bleeding and of ischemic complications were comparable with previous studies of TT. Further studies are needed to investigate the best strategy for PCI-patients on OAC.
Health related quality of life in patients with heart failure considered for treatment with Sacubitril-Valsartan

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Background:
Heart failure (HF) is a serious condition with a major impact on health-related quality of life (HRQoL). A new medication, Sacubitril-Valsartan, has shown additional effect on mortality, morbidity and hospitalization in patients with HF. As a result, Sweden’s municipalities and county councils has decided for a nationally planned introduction of the medication. HRQoL has been studied in patients with HF, but to our knowledge there are few studies describing HRQoL in patients considered for treatment with Sacubitril-Valsartan.

Aims:
The aim was to describe self-reported HRQoL in younger and older patients with severe HF, considered for treatment with Sacubitril-Valsartan. Furthermore to explore the association between HRQoL and agegroups, NYHA classification, systolic blood pressure and NT-proBNP.

Methods:
From June 2016 to June 2017 a total of 46 patients with HF and optimal medical treatment, were consecutively included. They were divided into a younger (63.5 ± 10.9 years) and older group (80.9 ± 3.9 years) by the median age of the group. HRQoL was assessed using the Kansas City Cardiomyopathy Questionnaire (KCCQ) and the EuroQoL 5-dimensions (EQ-5D)

Results:
There were no differences between the groups in all the domains of HRQoL measured by EQ5D and KCCQ, except for self-efficacy were the older patients reported lower scores compared to the younger ones; 62.5 ± 21.8 vs. 81 ± 18.8 (p = 0.005). A logistic regression model showed that higher NYHA-class was independently associated with impaired KCCQ Overall Summary Score (p=0.031).

Conclusion:
It is important to pay attention to the fact that self-efficacy may be lower within the elderly patients with HF, as self-efficacy may affect self-care and HRQoL adversely. Customized, individualized interventions can be one way to strengthen the patient’s confidence in self-care.
ANXIETY AND DEPRESSION AMONG PATIENTS WITH MYOCARDIAL INFARCTION WITHOUT OBSTRUCTIVE CORONARY ARTERIES

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Background
6–10 % of all patients with myocardial infarction have normal or non-obstructed coronary arteries also called Myocardial Infarction with Non-Obstructive Coronary Arteries (MINOCA). To be afflicted with suspected serious illness may bring emotions and reactions such as anxiety and depression.

Purpose
To compare self-assessed symptoms of anxiety and depression in patients with MINOCA with healthy subjects recruited from SCAPIS.

Methods
A comparative, descriptive study using Hospital Anxiety and Depression Scale (HADS) which consists of two 7-item subscales (range 0–21, HADS–A≥ 8 indicating signs of anxiety, HADS–D≥ 8 indicating signs of depression). MINOCA group answered HADS questionnaire at hospital admission. Healthy subjects were matched for age and sex.

Results
Fifty-two percent (n=33) of the patients with MINOCA (n=64) scored HADS–A≥ 8 whereas in the comparison group (n=89) it was 10% (n=9). Median value for anxiety was 8 for the MINOCA group versus 2 for the comparison group (p= .001). For depression, 28% of the patients with MINOCA scored HADS–D≥ 8 compared to 4% for the comparison group. Women that suffered from MINOCA scored higher in anxiety than men did and the women were older than the men in the same sample (56.3 ±8.4 years vs. 51.3 ±9.3, p=0.05).

In the MINOCA group, 22% scored high enough to be considered likely to suffer from both anxiety and depression.

Conclusions
In comparison with healthy individuals, patients with MINOCA have higher level of anxiety. Regardless of whether these symptoms are pathological or not, these patients may need special attention and support to be able to cope with their situation.

Key words: Myocardial infarction with non-obstructive coronary arteries (MINOCA), anxiety, depression, HADS
Smokeless tobacco, snus, at admission for percutaneous coronary intervention and future risk of death

Pontus Andell, Elmir Omerovic, Ole Fröbert

Background:
Cardiovascular disease risk is lower with smokeless tobacco than with cigarettes but data on prognosis following diagnosis of ischemic heart disease are few. We used the Swedish Coronary Angiography and Angioplasty Registry (SCAAR) to assess the risk of death following percutaneous coronary intervention (PCI) in patients using snus compared to patients not using snus at admittance.

Methods:
We studied all patients ≥18 years of age in Sweden undergoing a first PCI between 2011 and 2016 with the indications stable angina or acute coronary syndrome. Patients with a prior myocardial infarction, PCI or coronary artery bypass grafting were excluded. The primary endpoint was all-cause mortality at five years. We adjusted for age, sex, body mass index, smoking status and comorbidities using multivariable Cox regression models.

Results:
Snus users (n=4311, 9.1%) were younger (table 1), more often of male sex, had a higher body mass index and were more often current or previous smokers than patients not using snus (n=42886, 91.9%). Conversely, diabetes mellitus, hypertension and hyperlipidemia were less frequent in snus users and by average snus users had better renal function. After adjustment for confounders, snus use was associated with a significantly higher risk of death at five years (hazard ratio: 1.24 [1.04-1.48]). The risk was significantly more pronounced in snus users who also had diabetes (hazard ratio: 1.61 [1.16-2.22], interaction p-value: 0.04).

Conclusions:
Among patients undergoing a first PCI for stable angina or acute coronary syndrome, one in ten used snus at baseline. Snus use was associated with a significantly higher risk of death, which was significantly more pronounced in patients with diabetes.
Secondary preventive measures to decrease snus use may improve long-term survival after PCI and may be especially important for patients with diabetes.
Physical fitness in patients entering Cardiac rehabilitation - a comparison with healthy reference values

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Background
Data concerning physical fitness has been registered since year 1999 to 2015 in patients entering the Cardiac rehabilitation unit, Physiotherapy Department at Sahlgrenska University hospital (SU). The purpose of this study was to examine these data and compare it with published reference values of healthy individuals.

Methods
In this register 3968 patients were included, 73% men. Mean age: men: 62.3 ± 11.3 and women: 63.9 ± 12.4 years with the following diagnosis: myocardial infarction (MI) 50% (1971 patients), heart-surgery (coronary by-pass and/or valve-surgery) (HS) 34% (1348 patients), chronic heart failure (HF) 9% (345 patients) and transplanted 1.2% (49 patients) and other cardiac diseases 5.5% (218 patients).

Patients conducted an ergometer bicycle test and two muscle endurance tests and the results were compared with two Swedish reference materials.

Results
All patients, fig 1a, had a diminished exercise capacity compared to healthy references, (p<0.001) independent of sex and diagnosis. Exercise capacity was higher in men than in women but women showed higher relative values in relation to healthy references compared to men with the exception of transplanted patients, fig 1a and b.

For patients with MI and HS, but not HF, men performed a greater number of heel-rises than women (p<0.001). Compared to healthy references women with HF, but not MI and HS, performed a greater number of heel-rises than men (p=0.016).

On average exercise capacity and muscle endurance was diminished for all patients compared to healthy references. Men with MI and HS had a greater physical fitness than patients with HF. For women this was present only for exercise capacity.

Conclusion
Patients entering the Cardiac rehabilitation unit at SU have a diminished physical fitness compared to healthy references and indicates patients’ need of exercise in order to improve physical fitness and thereby reduce risks for future morbidity and mortality.
A randomised trial evaluating the effect of a smart phone-based patient support tool on treatment duration in patients prescribed rosuvastatin in China: results from eHelp

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Background:
To assess the impact of a mobile health patient support tool on statin treatment duration in patients at high cardiovascular risk.

Methods:
Patients newly prescribed rosuvastatin in China were randomised to receive: a smart phone-based patient support tool (active, n=431) or a control application (control, n=423). All patients regularly completed a rosuvastatin adherence questionnaire (RAQ) via their smart phone. Primary outcome was duration of statin treatment. Secondary outcomes included percentage of fully adherent patients and treatment adherence.

Results:
Baseline characteristics were similar between groups. From randomisation to last RAQ (169 days), 15.6% and 27.5% of patients in the active and control groups, respectively, had stopped rosuvastatin. Mean duration of treatment was 157 and 146 days in the active and control groups, respectively, log-rank test, p=0.0019. Two post-hoc sensitivity analyses were conducted. In the first (duration limited to time of first “no” to “over the past 4 weeks did you see a doctor to get your rosuvastatin prescription?”) mean duration was 105 and 99 days in the active and control groups, respectively (log-rank test, p=0.0972). In the second (169-day timeframe limitation removed) mean treatment duration was 134 and 128 days in the active and control groups, respectively (log-rank test, p=0.0891). None of the reported 43 adverse events were considered related to the application or rosuvastatin.

Conclusions:
Patients using the support tool had a prolonged mean duration of statin treatment, p-values ranging from 0.0019 to 0.097 depending on analysis. Further studies are needed to evaluate similar support tools and technologies.
Statin treatment after acute coronary syndrome: Persistence and reasons for non-persistence

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Background
Secondary prevention after acute coronary syndrome (ACS) is crucial to prevent recurrent events. Multiple studies however show that patients often end treatments and for reasons unknown. Our aims in this study were to perform a prospective follow-up of persistence to statin treatment in a population based patient cohort after ACS, to explore the reasons for discontinuation, and to determine whether a nurse-based follow-up could improve persistence.

Methods
We studied patients recruited between 2010-2014 in the ongoing NAILED-ACS study of patients admitted with ACS at Östersund Hospital. Patients were randomised either to an intervention group with nurse-based telephone follow-up or to a control group with follow-up by a general practitioner (usual care). The intervention group got yearly counselling on healthy living and titration of medicines to reach target values for blood pressure and blood lipids. In the control group blood pressure and lipid values were forwarded to the general practitioner for assessment. Each reason for treatment discontinuation were recorded and classified as temporary or permanent.

Results
Out of 963 patients, 89.3% (n=434) in the intervention and 82.0% (n=391) in the control group were persistent to statin treatment after a median of 3.9 years of follow-up (p=0.001). The most prevalent reason for permanent discontinuation in the intervention group was advanced disease (27.5%, n=14) while in the control group it was side effects without a compelling relation to treatment (32.8%, n=22). A total of 27.8% (n=135) of the patients in the intervention group and 20.5% (n= 98) in the control group discontinued treatment at some point during the period (p=0.009). The most common reasons for a first discontinuation were in both arms side effects without a compelling relation to treatment and lack of treatment motivation.

Conclusion
A nurse-based, long-term follow-up by telephone after an ACS results in a higher persistence to statin treatment than usual care.
Enhanced interleukin-6 expression and impaired cortisol response in patients with coronary artery disease

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Background
Residual inflammatory risk in patients with coronary artery disease (CAD) is an important predictor of recurrent events. Also, interleukin(IL)-6 pathway has been shown to have a causal role in CAD. Cortisol is a primary homeostatic regulator of the inflammatory response. We have previously shown that the hypothalamus-pituitary-adrenal axis responsivity is impaired in CAD patients, possibly contributing to a disrupted homeostasis. In the present study, we investigated whether IL-6 expression was related to the cortisol response in patients with CAD.

Methods
Four weeks after coronary intervention, 23 patients with high-dose statin treatment underwent a standardized bicycle ergometer test aiming to reach a very strenuous exercise level. Blood and saliva were collected before (basal) and 30 min after exercise (post-stress). Basal and post-stress levels of cortisol were measured in saliva by LC-MS/MS. IL-6 was measured in plasma by proximity extension assay (oligonucleotide-labelled antibody probe pairs binding to their respective target). Gene count of basal IL-6 mRNA levels in peripheral blood mononuclear cells (PBMCs) was assessed by poly-A selected NGS sequencing.

Results
We were able to divide patients into two distinct groups depending on cortisol change: 9 cortisol responders, +38 (18-104) %, and 14 cortisol non-responders, -40 (-63-(-26)) %. Physical exhaustion or exercise duration did not differ between groups, neither did heart rate or blood pressure responses. In cortisol non-responders, IL-6 in plasma increased from 6.7(3.5) to 7.5(3.9), p<0.05, while it did not change significantly in cortisol responders, from 5.6(2.9) to 5.3(1.2). The basal gene expression of IL-6 was generally very low, however higher in cortisol non-responders than in cortisol responders, 3.3(2.1) vs 1.3(1.1), p<0.05.

Conclusion
The lack of cortisol response in CAD patients was associated with stress-induced increase in plasma IL-6 and also with increased basal IL-6 mRNA expression. The findings indicate that IL-6 production is triggered by daily stressors without appropriate counter-regulation in cortisol non-responders. Disrupted homeostasis may be one of the mechanisms behind the residual inflammatory risk.
Clinical characteristics of an elderly population with screening-detected elevated NT-proBNP levels without previous diagnosis of heart failure or atrial fibrillation.

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Introduction:
High plasma level of NT-proBNP (>125 ng/L) indicates a high probability of heart failure (HF) diagnosis and is associated with poor prognosis in patients presenting with HF symptoms. We aimed to describe the clinical characteristics and systolic left ventricular ejection fraction (LVEF) in a 75/76-year-old population screened for NT-proBNP plasma levels and atrial fibrillation (AF).

Method:
Individuals aged 75/76 years residing in the Stockholm County were invited to participate in the study. In case of NT-proBNP >125 ng/L, AF screening was performed with handheld intermittent ECG monitoring (Zenicor) for 14 days. Individuals with NT-proBNP >900 ng/L and without previous HF were invited to further clinical evaluation including echocardiography.

Results:
6627 individuals have been screened of which 124 (1.9%) had NT-proBNP > 900 ng/L. In this population 17 had a previous history of HF, 6 had known AF, 99 had no history of HF or AF, of which 73 have completed the clinical investigations and 2 declined. In the investigated population (n=73), 38 (52 %) were females, median NT-proBNP was 1202 ng/L (q1-q3 1000-1725), GFR median 65 ml/min (45-74). AF was newly detected in 32%, a known diagnosis of hypertension in 74%, diabetes mellitus in 21%, vascular disease in 18% and ischemic stroke in 12%. LVEF assessed by echocardiography was >55% in 49 (67 %) patients, 40 - 55% in 13 (18%), and <40% in 10 (14%). The NT-proBNP levels were not statistically different between patients with newly detected AF compared to those without AF. Four patients had serious cardiac conditions leading to intervention, and three patients had significant cardiac disorders that warranted further investigations and follow up.

Conclusion:
Elderly individuals with incidental finding of high NT-proBNP levels > 900 ng/L without previous diagnosis of HF or AF are a high-risk population that needs further cardiovascular investigation.
Matrix Metalloproteinases in chronic obstructive pulmonary disease and smoking

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Background:
Matrix metalloproteinases (MMPs) are enzymes involved in the degradation of extracellular matrix proteins and they are known biomarkers COPD. Cigarette smoking plays an important role in the pathophysiology of COPD and is known to affect the concentration of MMPs systemically. Thus smoking could be an important confounder in this context, but the epidemiological data concerning this is limited.

Purpose:
To investigate the levels of circulating MMPs in relation to smoking habits and COPD.

Methods:
This was a cross sectional study of 450 subjects with well characterized smoking habits. All subjects were examined with comprehensive spirometry and biomarker analysis of MMP 1, 3, 7, 10 and 12. 28 subjects were excluded due to missing data. The remaining participants were classified according to smoking status and COPD.

Results:
The final study group consisted of 422 subjects (215 never smokers or ex-smokers and 207 current smokers) of which 124 had COPD. When comparing groups the levels of all MMPs were significantly higher among smokers (except MMP-3) and subjects with COPD (except MMP-7 and 10), all p-values <0.01. ANCOVA analysis with age adjusted p-values of MMP 1 and 12 regarding smoking and COPD are displayed in figure I and II. Smoking was associated with significantly increased levels of MMPs in all groups except for smokers with COPD (MMP 1). COPD was only associated with increased levels of MMP12 in smokers.

Conclusion:
Serum levels of MMPs (except MMP-3) are strongly affected by active smoking and in subjects with established COPD MMP-1, 3 and 12 are elevated. In depth analysis show that serum levels of MMP-1 and 12 are primarily influenced by active smoking with established COPD probably only playing a minor role. Thus smoking is an important confounder in the context of MMP biomarker assessment in COPD.
Validation of renal cortical and medullary volumes by non-contrast-enhanced magnetic resonance imaging: a step towards understanding the cardiorenal syndrome

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BACKGROUND:
Patients with renal dysfunction have a substantially increased risk of cardiovascular complications, a link called cardiorenal syndrome. By assessing renal volumes it may be possible to guide therapy in kidney disease. There are few validated non-contrast-enhanced and generally applicable methods for assessment of renal volume. The aim of this study was therefore to validate a widely available non-contrast-enhanced MRI method for assessment of renal cortical and medullary volumes in pigs, and to apply this validated method in humans.

METHODS:
In vivo MR images at 1.5T (Siemens) of six pig kidneys were acquired as short-axis stacks for validation. After euthanisation, kidneys were excised and medulla and cortex were separately measured by the water displacement method. For application in humans, ten kidneys were imaged in five healthy volunteers. Three blinded observers (1, 12 and 17 years MRI experience) manually delineated cortical and medullary borders. Agreement between MRI and the water displacement method and intra- and inter-observer variability were evaluated by the Bland-Altman method (bias ± 95% limits of agreement). The Wilcoxon signed-rank test was performed for assessment of statistically significant differences.

RESULTS:
Renal volumes by MRI agreed with the water displacement method without significant differences between observers (Table 1). Intra-observer variability was -2.6±6.2ml (total parenchymal volume), -1.0±4.9ml (cortical volume) and -1.6±2.4ml (medullary volume). Inter-observer variability was -1.7±3.5ml (total parenchymal volume), 0.1±2.3ml (cortical volume) and 1.9±2.3ml (medullary volume) (Figure 1). Intra-observer variability for measurements in human was 4.1±1.6ml (total parenchymal volume), 4.9±4.7ml (cortical volume) and -0.8±4.0ml (medullary volume) (Figure 2).

CONCLUSIONS:
The widely available non-contrast-enhanced MRI method agreed with the water displacement method for renal cortical and medullary volumes in pig and was accurate and in measuring renal volumes in healthy individuals. The method can potentially be used to further increase the understanding of the cardiorenal syndrome.
Patients with myocardial infarction using a lifestyle-focused smartphone application show improved risk factor profile at two weeks follow-up: preliminary results from a multi-centre randomized controlled trial

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Background:
We aimed to assess the efficacy of a web-based smartphone application (app) designed to support adherence to lifestyle advice and medication, as a complement to traditional cardiac rehabilitation (CR) for improving risk factors in patients with myocardial infarction (MI).

Methods:
In this multi-centre randomized controlled trial, 150 patients with MI who are confident internet users will be included. In addition to participating in CR, patients randomized to the intervention arm receive access to the app for six months. Here we report changes in dietary habits, physical activity, self-rated health and systolic blood pressure (SBP) between baseline and two weeks follow-up for the first 103 included patients (80% men, 60.1+-8.8 years). T-test (unadjusted) and UNIANOVA (adjusted for age, sex, baseline risk factors and prior disease history) were used to assess differences in means.

Results:
Compared to patients receiving usual care (UC), patients in the intervention group (IG) more often had prior ischemic heart disease (20% vs 9%, p=0.11) and slightly higher baseline SBP (156 vs 148 mmHg, p=0.17). At two weeks patients in the IG had increased their healthy diet score (range 0-12 points) by 2.5 points compared to 1.3 points for UC patients (p=0.03, adjusted p=0.006), mostly due to higher consumption of fruits and fish. Patients in the IG improved their SBP more than UC patients (-29 vs. -17 mmHg, p=0.04, adjusted p=0.07). A higher percentage of smokers were smoke-free at two weeks in the IG (67% vs. 17%, p=0.07). Both groups reported increased self-rated health (visual analogue scale 0-100: IG +18 vs. UC +15, p=NS) and increased number of days/week performing at least 30 minutes of moderate physical activity (IG +3.0 vs. UC +2.6 days/week, p=NS).

Conclusions:
Complementing traditional CR with a smartphone app supporting adherence to lifestyle advice and medication can improve risk factors after an MI.
Background: One reason for the high Cardiovascular disease (CVD) mortality in patients with schizophrenia may be lack of risk factor treatment, such as glucose-lowering treatment with metformin. Diabetes is 2-3 times more common in patients with schizophrenia. Another reason might be lack of treatment with statins to lower lipids.

Recent study have shown a surprisingly high cardiovascular mortality in patients with schizophrenia. One reason for the high Cardiovascular disease (CVD) mortality in patients with schizophrenia may be lack of risk factor treatment, such as glucose-lowering treatment with metformin. Diabetes is 2-3 times more common in patients with schizophrenia. Another reason might be lack of treatment with statins to lower lipids.

Objective: To determine the prevalence of treatment with glucose-lowering treatment and lipid lowering treatment in patients with and without schizophrenia in Stockholm, Sweden.

Material and methods: 6347 patients with schizophrenia were compared with 2,062,112 without schizophrenia. The prescription of metformin and insulin were compared in 5-year age groups from 30 to 75 years of age.

Results: As shown in figure the prescription of metformin in age groups under 60 years were approximately 2 to 8 times more common in patients with schizophrenia, in patients over 60 the corresponding figures were 1.5 to 3 times. In contrast a low proportion of patients with schizophrenia over 60 were treated with statins.

Conclusion: Our results indicate that lack of treatment with metformin is not a reason for the increase cardiovascular mortality in patients with schizophrenia.
The Impact of Overweight and Obesity on Left Ventricular Systolic Function in Patients with Type 2 Diabetes

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Background
Obesity is associated with left ventricular (LV) diastolic dysfunction and heart failure but the relation to systolic function is unclear. The aim of the study was to explore the impact of obesity on the LV function in patients with type 2 diabetes mellitus (T2DM).

Methods
We prospectively investigated 384 patients with T2DM, who participated in the CARDIPP study. The investigations included medical history and laboratory analyses of HbA1c, triglycerides, cholesterol and microalbuminuria. Echocardiography was performed at baseline and after four years. The patients were grouped according to body mass index (BMI) (normal < 25, overweight 25-29, and obese if BMI > 30).

Results
Univariate linear regression showed that LV ejection fraction, LV mass and LV diastolic function expressed as E/é (i.e. the ratio between early diastolic transmitral flow and mitral annular motion velocities) was associated with BMI, (βLVEF = -0.40 vs. βLV mass = 0.50 vs. βE/é = 0.16 and pLVEF < 0.001 vs. pLV mass < 0.001 vs. pE/é < 0.01). Patients with overweight and obesity had augmented LV size, LV mass and impaired LV systolic and diastolic function compared to patients with normal weight (Table). A worsening LV ejection fraction, E/é or LV mass of ≥ 20% was observed after four years in patients who had increased their BMI further.

Conclusion
Overweight and obesity as measured by BMI is associated with impaired LV systolic and diastolic function expressed as LV ejection fraction, LV GLS, E/é and LV mass in patients with T2DM.
A theoretical platelet activation and hemolysis study in the extra corporeal membrane oxygenation circuit

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Background:
Complications related to blood clots and hemolysis are rather common in patients on artificial circulation. Here, a numerical model is used in an attempt to assess the relative importance of ECMO-components, both regarding the potential for platelet activation as well as the level of hemolysis.

Methods:
The flow in the different components is simulated. The simulated data provide information about the forces (stresses) acting on the platelets and red blood cells (RBCs) as they move through the ECMO circuit. The level of platelet activation is modeled by accumulating the effect of the stresses over time, reflecting the history of motion of the platelet in the ECMO circuit. The hemolysis model is based on an empirical power law relation. From this expression the Normalized Index of Hemolysis (NIH) is computed. Both models are calibrated through in vitro experiments.

Results:
The flow in the magnetically levitated centrifugal pump is complicated characterized by strong variations in the stresses. Significant variation in platelet residence time is also found at different locations within the pump. Flow separation bubbles occur not only in the pump, but also in the connectors between the different segments of the tubing. Platelets reside during relatively longer times in these regions whereby there is an enhanced risk for platelet activation. Hemolysis calculations are yet to be finalized.

Conclusions:
The results show a strong risk for platelet activation as well as hemolysis in regions of components with longer residence times in addition to regions with strong shear stress with short residence times. Specifically, the region near the pump outlet, the center region of the pump house and the gap between the central magnet and the pump hose are such areas as described above. According to the simulations, flow through the small holes of the cannula and separation bubbles created in the pipe connectors also contribute to these effects but to a lesser degree. The methodology used herein can be used to improve the design of the components of ECMO systems as well as the entire circuit composition.
Myocardial Infarction and Mild Cognitive Impairment (MIMCI): A Feasibility Study

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BACKGROUND:
With an aging population, more patients afflicted by Myocardial Infarction (MI) will also suffer from Mild Cognitive Impairment (MCI). MCI is the intermediate stage of cognitive function between healthy cognitive aging and dementia. Preliminary studies indicate a relatively high prevalence of MCI among MI patients. One main limitation in these studies has been insufficiently precise screening tools. Successful secondary prevention after MI is likely affected by cognitive status. A fully powered study to sufficiently assess the detailed status and development of MI patients cognition through full neuropsychological assessment is needed, namely MIMCI. The present pilot study examined the feasibility of MIMCI procedures, including psychoemtric testing of MI patients at the hospital.

METHOD:
Patients > 65 years having had a MI were tested with an extensive neuropsychological test battery two months after their MI. The study design was almost identical to the planned main study. The outcome was the feasibility of the test battery in a clinical setting and the study procedures concerning recruitment, data collection, attrition and safety. The study was approved by the Regional Ethics Board.

RESULT:
During 43 days, 39 potentially eligible patients were identified. Twenty-nine of these were asked for consent and 19 consented. One patient later declined participation rendering 18 assessed patients. In total 8 out of 342 (2.3%) test results, from 5 patients, were incomplete. Test results adjusted for age but not for estimated cognitive ability indicated MCI in 10 (55%) patients. When also adjusting for estimated cognitive ability, MCI was indicated in 3 (17%) patients.

CONCLUSION:
The findings support the efficacy and safety of MIMCI’s study design. The results indicates that MCI seems relatively frequent in this patient group. It is likely that presence or absence of comorbid MCI will impact the success of secondary preventive rehabilitation in MI patients.
Low dose-high frequency cardiopulmonary resuscitation retraining in health care professionals - a pilot study

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Background:
Survival after in-hospital cardiac arrest varies markedly. High-quality cardiopulmonary resuscitation (CPR) remains essential to improving outcomes.

It is known that CPR skills deteriorate within months after training, therefore annual retraining strategies may not be frequent enough. Optimal intervals are not known, but some evidence indicate that “low dose–high frequency” retraining may be beneficial.

Aim:
To investigate if “low dose-high frequency” training increase health care professionals practical CPR skills.

Methods:
Personnel (n=67) from the emergency ward, Motala hospital, Östergötland, Sweden, were included in an intervention group and retrained CPR, with feedback, two minutes every work shift for four weeks. Measurement of CPR skills with a pre- and post-test without feedback. A control group of personnel (n=21) from the geriatric emergency ward at the same hospital did only the pre-and post-test without feedback and no training intervention.

Primary endpoint was the overall total score of the practical skill test. Secondary endpoints were individual variables as compressions; depth, rate, count, complete release and correct hand position, ventilations; volume and count, we also measured hands-off time.

For skill measurement and feedback training we used Laerdals Resusci Anne QCPR and SimPad SkillReporter.

A result of 75% overall score was considered approved.

Results:
There was no significant difference between the intervention- and control group in the overall median score at the pre-test (46% vs 41% \( p = 0.74 \)). At post-test the intervention group had a significantly higher overall median score (92% vs 58%, \( p<0.001 \)). The intervention group had also significantly improved, compared to the control group, in the following variables: compression; depth, rate and count, correct hand position and ventilation count.

Conclusions:
“Low dose-high frequency” retraining with a CPR feedback system are useful for improving overall score, compression depth, compression rate, compression count, correct hand position and ventilation count.
High-sensitivity Cardiac Troponin T in Patients with Myocardial Infarction – a Swedish nationwide study on incidence and outcome

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Background
In order to improve the diagnosing of myocardial infarction (MI), high-sensitivity cardiac troponin T (hs-cTnT) has been introduced in Swedish healthcare. However, there is a lack of knowledge of how hs-cTnT has affected the incidence of MI, the prognosis of patients with confirmed MI, and, resource utilization (e.g. coronary angiography and revascularizations) of patients with confirmed MI.

Method
This study was a nationwide cohort study, including patients with first MI, from all emergency hospitals in Sweden during 2009-2013. In total, the study included 87,879 MI patients of whom 47,133 were diagnosed with conventional troponin (cTn) while 40,746 patients were diagnosed with hs-cTnT. Cox regression was used to estimate hazard ratios (HR) with 95% confidence intervals (CI), for the association between being tested with cTn (reference), compared with tested with hs-cTnT for the outcomes all-cause mortality, reinfarction, coronary angiography, and revascularization.

Results
The study showed that the number of patients diagnosed with MI increased by 5% (95% CI 0%-10%) after the introduction of hs-cTnT. There were 33,492 deaths with no difference in the risk of all-cause mortality (adjusted HR 1.00, 95% CI 0.97-1.02). An 11% reduced risk of reinfarction was found in patients diagnosed with hs-cTnT (adjusted HR 0.89, 95% CI 0.86-0.91) among in total 15,766 reinfarctions. The use of coronary angiographies (adjusted HR 1.16, 95% CI 1.14-1.18) and revascularizations (adjusted HR 1.13, 95% CI 1.11-1.15) increased in the hs-cTnT group.

Conclusions
The introduction of hs-cTnT in Sweden is associated with an increased incidence of MI without survival impact. Furthermore, we found a reduced risk of reinfarction, together with a slight increase in coronary angiographies and cardiac revascularizations.
The relative contributions of myocardial perfusion, blood volume and extracellular volume to native T1 and native T2 at rest and during adenosine stress in normal physiology

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Background
Several heart diseases can cause disturbances in the myocardial blood volume (MBV), myocardial perfusion and the myocardial extracellular volume fraction (ECV). Recent studies suggest that native myocardial T1 mapping can detect changes in MBV during adenosine stress, without the use of contrast agents. This could potentially be performed with native T2 mapping as well. Therefore, the aim of this study was to explore the relative contributions of myocardial perfusion, MBV and ECV to native T1 and native T2 at rest and during adenosine stress.

Methods
Healthy volunteers (n=41, mean ± SD age 26 ± 5 years, 51% females) underwent 1.5T cardiovascular magnetic resonance imaging. Quantitative myocardial perfusion [ml/min/g] and MBV [%] maps were computed from first pass perfusion imaging at adenosine stress (140 microg/kg/min infusion) and rest following an intravenous contrast bolus (0.05 mmol/kg, gadobutrol). Native T1 and T2 maps were acquired before and during adenosine stress. T1 maps at rest and stress were also acquired following a 0.2 mmol/kg cumulative intravenous contrast dose, rendering rest and stress ECV maps [%], Figure 1.

Results
During adenosine stress, myocardial native T1, native T2, perfusion, MBV, and ECV all increased (p<0.001 for all), Figure 2. Myocardial perfusion, MBV and ECV all correlated with both native T1 and native T2, respectively (R² 0.35 to 0.61, p<0.001 for all), Figure 3.

Multiple regression revealed that ECV and perfusion together best explained the change in native T2 (ECV beta 0.21, p=0.02; perfusion beta 0.66, p<0.001, model R²=0.64, p<0.001), and native T1 (ECV beta 0.50, p<0.001; perfusion beta 0.43, p<0.001, model R²=0.69, p<0.001).

Conclusions
Myocardial native T1, native T2, perfusion, MBV, and ECV all increase during adenosine stress. Changes in myocardial native T1 and T2 during adenosine stress in normal physiology can largely be explained by the combined changes in myocardial perfusion and ECV.
Validation of fully automated quantitative myocardial perfusion by cardiovascular magnetic resonance compared to coronary sinus flow at 1.5T and 3T

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Background
Quantitative CMR myocardial perfusion evaluation has been limited in part due to the moderate accuracy of the currently available qualitative and semiquantitative methods used to assess myocardial perfusion, and due to the lack of efficient absolute quantitative methods. We recently developed a software infrastructure for fully automated post-processing of first pass perfusion CMR images into quantitative color maps showing myocardial perfusion in the unit ml/min/g. The aim of this study was to validate quantification of MBF by quantitative perfusion color maps compared to an independent method of quantifying MBF by phase contrast coronary sinus (CS) flow imaging.

Methods
Fifteen healthy subjects (mean age 26 years, 67% females) underwent CMR imaging at 1.5T and 22 healthy subjects (mean age 26 years, 50% females) underwent CMR imaging at 3T, including CS flow imaging and first-pass perfusion in 3 short-axis slices, prior to and during adenosine stress. First-pass perfusion images were analyzed by drawing regions of interest (ROIs) over the whole myocardium in the 3 short-axis slices in quantitative perfusion maps. Average myocardial perfusion was obtained in mL/min/g. CS flow was determined by drawing an ROI in the coronary sinus in the velocity-encoded phase-contrast images. Coronary sinus flow in mL/min was divided by the left ventricle (LV) mass to obtain myocardial blood flow in mL/min/g. Linear regression analysis was performed to compare MBF from the quantitative perfusion maps with the MBF calculated from the CS phase-contrast images.

Results
Quantitative myocardial perfusion at 1.5T from color maps at rest (meanSD, n=15, 0.890.2 mL/min/g) and stress (n=15, 4.080.53 mL/min/g) correlated with MBF quantified as CS flow per gram LV mass (n=30, y=1.09*x + 0.35, R²=0.85, p<0.001, meanSD bias -0.530.65 ml/min/g). Quantitative myocardial perfusion at 3T from color maps at rest (meanSD, n=21, 0.76 0.19 mL/min/g) and stress (n=22, 3.60 0.66 mL/min/g) correlated with MBF quantified as CS flow per gram LV mass (n=43, y=0.87*x + 0.54, R²=0.80, p<0.001, bias -0.290.70 ml/min/g).

Conclusion
Automatic quantification of myocardial perfusion from first-pass perfusion CMR is feasible in clinical workflow at a 1.5T and 3T scanner, and shows a good correlation compared to the independent measure of CS flow per gram of LV mass.
Background
The association between socioeconomic status and incidence of out-of-hospital cardiac arrest (OHCA) is not fully understood. The aim of this study was to investigate if socioeconomic differences, measured as income and education, were associated with incidence of OHCA.

Methods
We included OHCA s that occurred in the Stockholm metropolitan area between 1st of January 2006 and the 31st of December 2015. We linked the home address of residents in Stockholm to a matching basic area (census tract) with available socioeconomic and demographic information. We use zero-inflated negative binomial regression to calculate adjusted incidence rate ratios (IRR).

Results
8 764 OHCA s were included in the analysis. In the mutually adjusted analysis we observed a statistically significant gradient of effect for income (p for trend =<0.001). The IRR highest vs. lowest area income= 0.52, 95% CI = 0.42 - 0.65). Education level was not significantly associated with incidence of OHCA (p for trend =0.409). In sex-stratified analyses, we saw similar patterns for men and women with decreasing IRR with higher levels of education. The IRR (highest vs. lowest) for income in men was 0.67 (95% CI=0.52-0.87) and 0.48 (95% CI= 0.36-0.64) for women. Education did not affect the risk of OHCA in either sex.

Conclusion
Areas characterized by higher median income have a significantly lower incidence of OHCA with similar implications for both men and women. Area level education is not independently associated with increased incidence of OHCA in Stockholm.
Ticagel is not superior to clopidogrel in patients with acute coronary syndrome:

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Background
The PLATO trial has shown that ticagrelor compared to clopidogrel improves survival and decreases risk for stent thrombosis in patients with acute coronary syndrome. The aim of this study was to investigate whether treatment with ticagrelor is superior to clopidogrel in patients with acute coronary syndrome in “real-world”.

Methods
We used data from the SCAAR registry (Swedish Coronary Angiography and Angioplasty Registry) for the PCI procedures performed in Västra Götaland County in Sweden. The database contains information about all PCI procedures performed at five hospitals (~20% of all SCAAR data). All consecutive procedures between 2005 and 2015 for UA/NSTEMI and STEMI were included. We used multilevel modeling based on complete–case mixed-effects logistic regression to adjust for hierarchical database due to clustering of observations. The following variables were used for adjustment of risk estimates: age; gender; hypertension; hyperlipidemia; smoking status; diabetes; calendar year; indication for PCI; prior MI, CABG and/or PCI; cardiogenic shock; severity of coronary artery disease; number of implanted stents; completeness of revascularization; type of stent. The primary combined endpoint was death or stent thrombosis at 30 days. The secondary end points were death at 30-days and death at one-year.

Results
The total of 12,168 patients were included in the study of which 2,929 (19%) were treated with ticagrelor. 44% had STEMI. There were 555 events at 30-days of which 53 (9.5%) were stent thromboses. 844 patients were dead at one-year. Treatment with ticagrelor was not associated with lower risk for primary endpoint (OR 0.97; 95% CI 0.66 - 1.43; P=0.887). Estimated risk of death at 30-days (OR 1.02; 95% CI 0.59 - 1.76; P=0.937) and one-year (OR 1.01; 95% CI 0.68 - 1.47; P=0.992) was not different between the groups.

Conclusions
In this observational study, treatment with ticagrelor was not superior to clopidogrel in patients with acute coronary syndrome treated with PCI.
Coronary calcium scoring in patients with takotsubo syndrome  Is takotsubo protective against coronary atherosclerosis?

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Background:
Takotsubo syndrome is an increasingly recognised clinical entity with signs and symptoms similar to acute myocardial infarction and acute heart failure. Coronary artery calcium (CAC) score reflects the severity of coronary artery disease and is a predictor of future coronary events. The aim of this study was to evaluate CAC score in patients with takotsubo syndrome.

Method:
We included 73 patients diagnosed with takotsubo syndrome at Sahlgrenska university hospital (Gothenburg, Sweden) between 2005 and 2013. All patients underwent CT examination on a multi-slice CT scanner (Siemens Definition Flash). In addition to calcium scoring, we also performed contrast CT angiography (Omnipaque 350 mg/ml, 325 mg iodine/kg) in 43 patients without contraindications. The CT scans were performed during a breath hold and with ECG-gating. Each coronary vessel was identified with a multiplanar reconstruction technique. Calculation of total CAC score was done according to the standard scoring system. The area (mm2) of each calcified lesion was multiplied by a density factor depending on the maximum computed number Hounsfield units (HU) in the lesion; 1= 130-199 HU, 2= 200-299 HU, 3= 300-399 HU and 4= ≥ 400 HU. The total CAC score was determined by calculating the sum of all calcifications in each patient.

Results:
The mean age was 65.7 years and 9 (12%) were male. The distribution of the traditional risk factors for coronary artery disease was similar to age and gender matched population. Successful CT examination was achieved in 72 (99%) patients. Of these, 35 patients (49%) had no calcifications in coronary arteries. The median total calcium score was 1.5. This value is lower than median calcium score (~8) reported previously in healthy volunteers in Sweden. Only 5 patients (7%) had a total CAC score of >400. We found significant stenosis (>50%) in two (4.6%) patients.

Conclusions:
Patients with takotsubo syndrome have low total CAC score when compared to healthy subjects. The takotsubo phenotype may confer protection against progression of atherosclerosis in coronary arteries.
Gender related response to bivalirudin and unfractionated heparin in patients with acute myocardial infarction undergoing percutaneous coronary intervention

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Aims
To evaluate the effect of gender on anticoagulant treatment outcomes during percutaneous coronary intervention (PCI) in acute myocardial infarction (AMI) patients.

Methods
A gender analysis of the VALIDATE-SWEDEHEART trial, in which patients with AMI were randomised to bivalirudin or unfractionated heparin (UFH) during PCI. The primary outcome was the composite of death, MI or major bleeding at 180 days.

Results
The incidence of the primary outcome was lower in women assigned to bivalirudin than to UFH (13.6% vs 17.1%, HR 0.78, 95% CI 0.60-1.00) with no difference in men (11.8% vs 11.2%, HR 1.06, 95% CI 0.89-1.26, p for interaction 0.05). The observed difference was primarily due to lower risk for major bleeding (BARC 2,3,5) associated with bivalirudin in women (8.9% vs 11.8%, HR 0.74, 95% CI 0.54-1.01 in women and 8.5% vs 7.3%, HR 1.16, 95% CI 0.94-1.43 in men, p for interaction 0.02). Conversely, no significant difference in the risk for BARC 3 or 5 bleeding, associated with bivalirudin, was found in women (4.5% vs 5.4% (HR 0.84, 95% CI 0.54-1.31) or men 2.9% vs 2.1% (HR 1.36, 95% CI 0.93-1.99). Bivalirudin significantly reduced the incidence of access site bleeds in women (3.6% vs 6.1%, HR 0.59, 95% CI 0.37 - 0.95) but not in men (1.8% vs 1.7%, HR 1.06; 95% CI 0.67 - 1.66). The incidence of death or MI did not significantly differ in men and women with bivalirudin or UFH.

Conclusion
In women, treatment with bivalirudin was associated with a lower incidence of adverse outcomes, compared to UFH, primarily due to a reduction in BARC 2 bleeding complications.
The S100A8/A9 alarmin stimulates myeloid cell responses and promotes cardiac repair after myocardial infarction

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Background

The innate immune response plays an important role in mediating cardiac inflammation and repair following an acute myocardial infarction (MI). The pro-inflammatory alarmin S100A8/A9 is released in high amounts locally and systemically during acute coronary events. We aimed to evaluate the role of S100A8/A9 on cardiac function and repair post-MI.

Methods

We induced MI by permanent left coronary artery ligation in C57BL/6 mice, which were subsequently treated with the specific S100A8/A9 blocker ABR-238901 (30mg/kg) or with buffer for 21 days. Left ventricular function was assessed by echocardiography. Immune cell populations in the myocardium, blood, bone marrow and spleen were analyzed by flow cytometry.

Results

Left ventricular systolic function progressively deteriorated and left ventricular volumes increased in ABR-238901-treated mice compared with controls, suggestive of defective repair and negative myocardial remodeling. After 21 days of treatment, infarction size was significantly higher in mice receiving S100A8/A9 blockade (16.1 ± 5.4% vs. 9.9 ± 3.4%, P=0.03). ABR-238901 inhibited the MI-induced proliferation of hematopoetic stem cells in the bone marrow and potently reduced the numbers of neutrophils and monocytes in blood and heart post-MI. Conversely, neutrophils and monocytes accumulated in the bone marrow and spleen of mice receiving S100A8/A9 blockade, demonstrating an important role of S100A8/A9 in immune cell trafficking from the myeloid compartments to the ischemic myocardium. In consequence, the presence of reparatory macrophages was potently decreased in the myocardium by day 7 post-MI compared to controls (36 820 ± 2 538 vs 72 371 ± 4 482 cells/heart, P<0.001). In turn, this led to impaired clearance of apoptotic and necrotic cardiomyocytes from the ischemic heart, which may explain the deleterious effects of the treatment on cardiac recovery.

Conclusions

S100A8/A9 plays an important role in myeloid cell trafficking and function after MI. Long-term S100A8/A9 blockade impairs efferocytosis and myocardial repair, leading to detrimental remodeling and heart failure.
Trends over time in the incidence of the takotsubo syndrome in Västra Götaland

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Background:
Takotsubo syndrome (TS) is an important differential diagnosis to acute coronary syndrome (ACS) that predominantly affects women. It is important to distinguish TS from ACS because anti-thrombotic treatment is not indicated in TS, and TS may be triggered by intracerebral bleeds and other somatic conditions in which antithrombotic treatment is contraindicated. We sought to assess whether the incidence of TS diagnoses increased in Västra Götaland over the last years, and whether regional differences exists across the regions’ percutaneous coronary intervention (PCI) centers.

Methods:
Using data for Västra Götaland from the Swedish Coronary Angiography and Angioplasty Registry on procedures performed between 2009 and 2016 we compared the trend over time in the incidence of TS among suspected ACS. We further report the trend separately by sex, age groups and hospital.

Results:
Over the course of the study period we identified a total of 546 patients (377 [69.1%] women) with TS. The incidence of TS increased from 1.0% (29/2861) in 2009 to 4.7% (130/2778) in 2015 (ptrend<0.0001). The proportion of women decreased from 86.2% (25/29) and 85.9% (71/81) in 2009 and 2010 to 62.8% (59/94) and 51.5% (67/130) in 2015 and 1016 (ptrend < 0.0001). The age of patients with TS was similar each year (66.0±13.0 years in 2009 and 67.5±9.76 years in 2015, ptrend=0.21). Among the regions’ PCI centers the incidence of TS was 3.4% (298/8822) at Sahlgrenska, 2.3% (24/1059) at Östra, 1.5% (42/2781) at Skövde, 3.2% (110/3359) at Norra Älvsborgs Länsjukhus and 2.1% (72/3380) at Borås (pchisq<0.0001).

Conclusions:
The incidence of TS in Västra Götaland is increasing yearly, with an increasing proportion of men among TS patients. Variations in the incidence of TS diagnoses across the different PCI centers were noted.
The associations between psychological distress and health-related quality of life in patients with non-cardiac chest pain

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Background & aim:
Patients with non-cardiac chest pain (NCCP) may have had Cardiac Disease (CD). NCCP may affect health-related quality of life (HRQoL). The aim was therefore to describe HRQoL in patients with NCCP, with or without history of CD, and to explore the association between HRQoL and cardiac anxiety, depressive symptoms, fear of body sensations and somatization.

Methods:
The study had a cross-sectional design. In total, 552 patients discharged with NCCP from four hospitals in Southeast Sweden completed the EQ-5D, Cardiac Anxiety Questionnaire, Patient Health Questionnaire-9, Body Sensations Questionnaire, and Patient Health Questionnaire-15.

Results:
Half of the study population (n=277) reported at least moderate problems regarding pain/discomfort and 25 % (n=136-139) reported at least moderate problems in the HRQoL dimensions mobility, usual activities, and anxiety/depression. Patients with NCCP, who had history of CD, reported significantly lower HRQoL (p≥ 0.05) compared to patients with NCCP without CD. In the total study population, cardiac anxiety, depressive symptoms, and somatization had weak significant negative associations (beta=0.187-0.284, p<0.001) with HRQoL. In patients with history of CD, the association between depressive symptoms and HRQoL was moderate (beta=-0.339, p<0.001), whereas this association was weak in patients without CD (beta=-0.193, p<0.001). Vice versa, in patients with no history of CD the association between cardiac anxiety and HRQoL was stronger (beta=-0.229, p<0.001) than in those with history of CD (beta=-0.156, p=0.05). Still, none of the differences in strength of the associations were significant using Fisher r-to z transformation, p=0.08 and p=0.40.

Conclusions:
Patients with NCCP, in particular those with history of CD, reported low levels of HRQoL, which was associated with psychological distress. This highlights the diversity of the NCCP group and that different aspects of psychological distress may be influenced by previous experience of CD. This should be considered in the care of these patients.
Effect of flexible diuretics regimen on sudden weight changes

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Background:
OPTILOGG® is a homebased tool for patients with heart failure (HF), which monitors symptoms, titrates diuretics and educates the patient about living with HF. Weight is monitored daily, and controls a flexible diuretics regimen. If the weight is increased by >2 kg in 3 days or less, the dose is increased to a patient specific higher level. If this dose returns the weight to baseline, the dose returns to the lower level, otherwise the patient is alerted and encouraged to contact his/her health care provider (HCP). The purpose of this analysis was to investigate how often the increased diuretics dose could reverse the weight increase.

Methods:
The tool automatically registers when the threshold for a weight increase event is exceeded, and also whether the subsequent dose increase returned the weight to the level before the onset of the rapid weight gain, with a tolerance of +/-0.6 kg.

Results:
Data stored in 87 OPTILOGG® systems was analyzed and the systems had been actively used by patients for 6 months in different parts of Sweden. 33 % of the patients were female and the mean age was 74. There was a total of 130 dose increases, spread out over 46 patients (53 % of the patients) and on average there were 1.5 alerts per patient. 45 % of the increased dose of diuretics managed to return the weight to within +/- 0.6 kg of the weight prior to the sudden weight increase, and the remaining 55 % resulted in an alert.

Conclusions:
In 45 % of the cases where a potentially deleterious rapid weight gain occurred, the OPTILOGG®-based flexible diuretics regimen successfully returned the weight back to the baseline level. This suggests that adherence to a flexible diuretics regimen should be encouraged, as it may ease suffering and save health care resources.
Echocardiographic right ventricular strain from multiple apical views is superior for assessment of right ventricular systolic function in patients with pulmonary hypertension

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Background:
Right ventricular (RV) systolic function is an important determinant of outcome in patients with pulmonary hypertension (PH). Assessment of RV function with echocardiography predominantly estimates longitudinal contractility from an apical 4-chamber view. Recently, RV global longitudinal strain measurement (RVGLS), derived from three RV focused apical views has been described. However, this method has not been compared with RV ejection fraction (RVEF). The aim of this study was to evaluate which echocardiographic method correlates best with RVEF measured by cardiac magnetic resonance imaging (CMR).

Methods:
Fifty-five patients evaluated for PH underwent RV assessment with echocardiography and CMR. Conventional echocardiographic parameters of RV function include tricuspid annular plane systolic excursion (TAPSE), tricuspid annular systolic velocity (S´), RV fractional area change (RVFAC) and RV index of myocardial performance (RIMP). RV free wall strain (RVfree) was calculated by averaging each of three regional peak systolic strain values along the lateral wall in the 4-chamber view. RVGLS was measured from the 4-chamber, RV 2-chamber and RV 3-chamber views using a 17-segment model. Correlation of echocardiographic parameters with RVEF was evaluated by Pearson correlation coefficients.

Results:
Assessment of RVGLS was feasible in 29 patients (53%), whereas other measures were available in all 55 patients. Correlation with RVEF was strong for RVGLS (r=0.814, p<0.001) and RVfree (r=0.778, p<0.001). A modest correlation was seen with RVFAC (r=0.681, p<0.001), TAPSE (r=0.592, p<0.001) and RIMP (r=0.521, p<0.01). S´ had a weak correlation with RVEF (r=0.385, p<0.01).

Conclusion:
This study shows that RV strain imaging could improve current methods in assessing RV function compared to conventional echocardiographic parameters. The results also suggest that strain derived from multiple RV focused views can further improve assessment of RV function, especially in patients with pulmonary hypertension.
Comparison of methods for quantitative assessment of left ventricular mechanical dyssynchrony by CMR feature tracking - a multicenter derivation/validation study

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BACKGROUND:
We sought to find an optimal and automated index for identifying mechanical dyssynchrony in left bundle branch block (LBBB) using cardiovascular magnetic resonance (CMR) feature tracking.

METHODS:
We retrospectively identified patients (n=80), with left ventricular ejection fraction (LVEF) ≤35%, no scar by late gadolinium enhancement, and either normal electrocardiographic (ECG) QRS duration and normal frontal plane electrical axis (control, n=36), or LBBB (n=44) defined by Strauss’ strict criteria. Patients were randomized into a derivation cohort (n=40; LBBB n=22, control n=18) and a validation cohort (n=40; LBBB n=22, control n=18). CMR cine images in a midventricular short-axis plane or four chamber long-axis plane were assessed for presence of delay in time to first peak strain between the early and late activating segments, or using the uniformity ratio estimate for circumferential (CURE) or radial (RURE) strain using dedicated software. Indices (n=28) were optimized in the derivation cohort, and applied to the validation cohort. The lower limit of the 95% confidence interval (CI) of the area under the receiver operating characteristic curve (AUC) in the validation set were used to rank performance.

RESULTS:
The best index was short-axis septal-to-lateral wall delay (SLD) with peak strain criteria expressed as an optimal percentage point of circumferential strain (SLDpoint, AUC=0.93 (95% CI 0.84-0.99)). The optimal cutoff was 208ms, yielding 94% sensitivity and 82% specificity. For comparison with prior published methods, SLDpoint had diagnostic performance not differing from CURE (AUC=0.86 (95% CI 0.72-0.97), p=0.28) or earliest-to-latest segment delay (ELSD, AUC=0.84 (95% CI 0.69-0.96), p=0.23).

CONCLUSIONS:
The SLDpoint index has excellent accuracy for detecting LV dyssynchrony in patients with LBBB, severely reduced LVEF and no myocardial scar. Diagnostic performance of CURE and ELSD did not differ from SLDpoint. An added advantage of ELSD is its potential use for LV contraction pattern characterization in non-LBBB intraventricular conduction abnormalities.
Cardiac amyloidosis (CA) is associated with poor prognosis and a 2-year survival rate of less than 30%. As a semi-malignant disease, CA has been considered to be a contraindication for heart transplantation (HTx). New treatment regimens, however, when combined with HTx may offer improved long-term outcome. In AL-amyloidosis, chemotherapy and autologous stem cell transplantation (ASCT) are necessary. In TTR-amyloidosis (ATTR), where the liver is the source of the pathologic protein, liver transplantation (LTx) is recommended after HTx.

METHODS AND RESULTS:
All patients with systemic amyloidosis and heart failure that received a heart transplant during 1998 - 2015 were included in this retrospective cohort analysis. Interdisciplinary treatment protocols were developed. For patients with AL amyloidosis, HTx was followed by high-dose chemotherapy and ASCT; and for hereditary amyloidosis, HTx was followed by LTx. Survival of the transplanted amyloid cohort was compared to survival of patients undergoing HTx for other indications.

RESULTS:
Four patients with AL amyloidosis (mean age 57 years) and four patients with ATTR (mean age 59 years, hereditary ATTR n= 3, “wild type” ATTR were successfully transplanted with an actual survival rate of 88%. One patient with AL died 2.5 years after HTx due to recurrence of amyloidosis. The other three AL patients showed complete remission. The mean wait time to HTx was 22 days (5-56 days). Three patients with hereditary ATTR received a LTx within a range of 3-21 months after HTx. Short-term survival did not differ between patients transplanted due to CA and those undergoing HTx for other reasons.

CONCLUSIONS:
Cardiac amyloidosis is a potentially curable disease when treated with HTx combined with either chemotherapy and ASCT or LTx depending on the type of the amyloidosis. Due to the natural course of CA, early assessment for HTx after cardiac manifestation is needed in selected cases. With this approach, excellent good survival rates can be attained.
Ticagrelor in misdiagnosed aortic dissections – does double antiplatelet therapy worsen prognosis?

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Background
Acute Aortic Dissection (AAD) shares many features with the more common Acute Coronary Syndrome (ACS). Misdiagnosis of AAD and subsequent treatment Double Antiplatelet Therapy (DAPT) is common. DAPT is a combination of acetylsalicylic acid and a P2Y12-inhibitor where Ticagrelor has largely replaced Clopidogrel in recent years. DAPT may increase mortality and bleeding in patients with AAD that require emergent surgery but data on actual risks is scarce. Clopidogrel-based DAPT has been associated with higher short-term mortality, but Ticagrelor-based DAPT has not. The study aimed to assess the negative effects of Ticagrelor-based DAPT in patients with AAD.

Methods
This retrospective study included all patients treated for AAD in Umeå University Hospital in 2012 to 2016 (n=123). DAPT treated patients were compared to the controls at up to one year after the incident. Group characteristics were also compared. The outcome variables included mortality and bleeding parameters.

Results
The risk of misdiagnosing AAD with ACS with subsequent treatment with DAPT was 13.8% (n=17). No significant difference in mortality in-hospital, at 30 days or at one year was found. The amount of intraoperative bleeding was higher in the DAPT-group, 2950 vs 2094ml (p=0.033). The need for surgical revision was 33.3% in the DAPT group and 16.7% in the control group. This difference was however not statistically significant. The DAPT-group had significantly longer time on extra corporeal circulation and thoracic intensive care unit. The groups did not differ in patient characteristics or clinical presentation.

Conclusions
Ticagrelor-based DAPT given to misdiagnosed patients with acute aortic dissection was not associated with higher mortality at up to one year. DAPT did however have a negative impact on surgical complications such as bleeding and the need for longer procedures and more time in the thoracic ICU.
The effect of preoperative hemodynamic state on the outcome in patients after surgery of acute type A aortic dissection

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Background
A handful of studies have shown that preoperative hemodynamic instability has a negative impact on the outcome after surgery. Patients who experience cardiac arrest before surgery are considered to have very poor prognosis but there is limited data in the literature. This study is to examine if the preoperative hemodynamic state affects the outcome in patients after surgery due to an acute type A aortic dissection (ATAD). This can help in selection of candidates for surgery by defining clinical subsets of patients who have high postoperative mortality rates.

Methods
The study was conducted as a retrospective single-centre study. Data from 253 consecutive patients who underwent surgery for acute Aortic dissection type A during the period January 2009 to April 2017 at Sahlgrenska University Hospital, Gothenburg was collected and examined. Data was analyzed for risk factors with special focus on hemodynamically unstable patients.

Results
The overall 30-day mortality was 17%. 32% were hemodynamically unstable. The 30-day mortality rate in the hemodynamically unstable patients was 33% compared to 10% in the stable group (p<0.001). Five patients had ongoing CPR when surgery was initiated, one was alive at 30 days postoperatively. Patients with preoperative elevated lactate concentrations (>2.2 mmol/L) had a 28% 30-day mortality rate compared to 11% in patients within the normal range (0.4-2.2) (p=0.006).

Conclusion
This study has shown that preoperative hemodynamic instability is a significant risk factor for 30-day mortality in patients undergoing surgery for ATAD. Patients with ongoing CPR at the start of surgery have a dismal prognosis except for one long term survivor. Lactate has not been investigated earlier in ATAD and could help identifying patients with elevated risk for postoperative mortality. This study might provide additional insight when selecting which patients with this life-threatening condition to operate on.
Increased Survival in Out-of-Hospital Cardiac Arrest Presenting With Asystole/PEA After The Change From Therapeutic Hypothermia to Target Temperature Management

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Background:
Therapeutic hypothermia (TH) of 33°C has been used in clinical practice after the publication of two randomized controlled trials that demonstrated improved neurologic outcome in patients with ventricular fibrillation and non-perfusing ventricular tachycardia. Patients with non-shockable rhythms are less studied. In 2013, Nielsen et al showed that OHCA patients receiving target temperature management (TTM) with a target temperature of 36°C had similar neurologic outcome as patient receiving TH. The aim was to study outcome after Asystole or Pulseless Electric Activity (PEA) after the shift from TH 33°C to TTM 36°C.

Method:
We included OHCA patients with a presenting rhythm of Asystole/PEA, and who were admitted to Intensive care units (ICU) and recorded in the Swedish registry for Intensive Care during the study period between the 1st of January 2010 to the 31st of December 2015. ICUs were asked to fill an inquiry answering if and when they had shifted from TH to TTM. Data was then adjusted according to these dates and changes in 6-month survival following the shift were studied.

Results:
In total, 1130 patients were included and information regarding shift from TH to TTM was obtained from 59 out of 64 ICUs. Six-month survival of all OHCA with presenting rhythm of Asystole/PEA was 11% before the start of TTM and 17% after start of TTM, OR 0.67 [CI 0.49 to 0.90]. Among OHCA with Asystole/PEA with active temperature control the figures were 19% survival before TTM and 21% after, OR 0.55 [CI 0.32 to 0.93].

Conclusion:
The 6-month survival of OHCA patients with presenting rhythm of Asystole/PEA has increased significantly during the study period. This survival increase could be connected to the introduction of TTM 36°C but this needs to be further studied.
Long-Term Effects on Cardio-Pulmonary Exercise Testing Parameters in Young Adults Treated with Stem Cell Transplantation in Childhood

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Background:
Stem cell transplantation (SCT) including preparative regimes with chemotherapy and total body irradiation is an accepted treatment of many malignant disorders. The treatment can, however, have side-effects and especially very long-term consequences have been insufficiently studied. We have previously reported that long-term survivors have reduced lung function, cardiac function and exercise capacity compared to healthy individuals. Cardiopulmonary exercise testing (CPET) is a sensitive instrument for identifying the limiting factors during physical exertion and the aim of this study was to further investigate these differences between patients and healthy controls.

Methods:
CPET, spirometry and echocardiography was performed in 17 patients (41 % females), aged 17–37 years, at a median of 17.7 years after SCT including TBI. The patients were compared with 17 healthy gender- and age-matched controls that performed the same examinations.

Results:
Patients, compared with healthy controls, had reduced peak oxygen uptake (VO2peak), oxygen pulse (O2-pulse), peak tidal volume (TVpeak), peak ventilation (VEpeak), peak breath reserve (BRpeak) and ventilation efficiency at anaerobic threshold (VE/VCO2@AT) (p<0.05). (Table I). A significant correlation, assessed by Spearman’s rank correlation, was found between VO2peak, O2-pulse, BRpeak, VE/VCO2@AT, on one side, and forced expiratory volume in 1 s (FEV1), total lung capacity (TLC) and diffusing capacity of lungs for carbon dioxide (DLCOc), on the other side, in all participants (n=34). Significant correlations were found between VO2peak and O2-pulse and mitral annular plane systolic excursion (MAPSE) and tricuspid annular plane systolic excursion (TAPSE) in all participants (n=34).

Conclusions:
Almost two decades after chemotherapy and total body irradiation, our study showed significantly reduction in CPET estimates of peak oxygen uptake, oxygen pulse, ventilatory efficiency and peak breathing reserve. These reductions appear to relate to both lung and cardiac function when doing pooled analyses of patients and controls.
Acute pulmonary embolism and 1-hour dynamic change in cardiac troponin T

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Background:
Pulmonary embolism (PE) is a condition that is difficult to diagnose. One common chief complaint is chest pain and PE may mimic the presentation of ACS. A 0h/1h algorithm with high-sensitivity cardiac troponin (hs-cTnT) enabling a fast rule-out of ACS has recently been introduced in the emergency department but the 1-hour dynamic change in acute PE has not been reported systematically. This study aimed to examine whether the level of 1-hour dynamic change in hs-cTnT in patients with acute PE differed compared to unselected chest pain patients (i.e. other diagnoses than PE or AMI) and patients with AMI.

Material and Methods:
Retrospective case-control study in 1444 patients with suspicion of ACS with two measurements of hs-cTnT and the second troponin obtained within >30–≤90 minutes. Levels of hs-cTnT, and 1-hour dynamic change were analysed and compared between chest pain patients diagnosed with PE (n=27), unselected chest pain patients (n=1331), AMI (n=58) and acute PE with other chief complaints than chest pain (n=28).

Results:
The initial hs-cTnT level as well as delta hs-cTnT were higher in PE with chest pain compared to unselected chest pain patients, whereas they were lower compared to patients with AMI (Table). 56% of PE patients with chest pain had an elevated initial hs-cTnT compared to 79% of patients with PE and other chief complaints and 90% of patients with AMI. PE patients with other chief complaints tended to have higher initial hs-cTnT and delta hs-cTnT compared to PE patients with chest pain (Table).

Conclusions:
Dynamic 1-hour changes in hs-cTnT are higher in patients with PE compared to unselected chest pain patients but lower compared to AMI patients. A considerable proportion of PE-patients, in particular those having other chief complaints than chest pain, have elevated hs-cTnT and dynamic 1-hour changes that may mimic ACS.
Validation of the Swedish translation of the Symptom Checklist – Frequency and Severity

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Background:
The Symptom Checklist: Frequency and Severity Scale (SCL) is a disease-specific instrument that measures patient's perception of the frequency and severity of arrhythmia-related symptoms. Worldwide, the SCL is one of the most used disease-specific instruments. Up until now, there has not been a valid Swedish translation of the SCL. This study evaluated the psychometrics properties of the Swedish translated version of the SCL using the Rasch rating scale model.

Methods:
Participants were included in clinical studies and referred for ablation of atrial fibrillation, atrial flutter, or paroxysmal supraventricular tachycardia. The translation of the SCL followed four steps recommended from the World Health Organization. The last step was a pre-test on a target population with paroxysmal supraventricular ablation. They were interviewed with the “think aloud method” and asked to evaluate the intelligibility of the questions. Psychometric properties of the instrument were evaluated using a Rasch rating scale model.

Results:
The forward-backward translations using the WHO's recommendations yielded no differences in the descriptions of the items in the SCL and a decision on an agreed version of the SCL was made after the pre-test. The Rasch analysis on the instrument demonstrated acceptable functioning of the rating scale, internal scale validity, and person response validity and reliability of the SCL according to Rasch model. The principal component analysis could not support the evidence of unidimensionality in this sample.

Conclusion:
Our results show evidence that the Swedish version of the SCL is reproducible and valid but not unidimensional according to the Rasch model. The SCL should be used with the interpretation of the measurement problems in mind. Until now, validation and reliability tests of the SCL are not well-described in the literature. This study might shed some light on the psychometric properties of the SCL.
Improved Long-Term Outcome in Catheter Ablation of Atrial Fibrillation: Data from the Swedish National Catheter Ablation Registry

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Background:
Ablation catheters and techniques are continuously evolving, aiming at improving long-term procedural success. Data on the clinical impact are scarce and often limited by size and follow-up. Using a national ablation registry, the present study explored the trends in long-term success of catheter ablation of atrial fibrillation (AF).

Methods:
The Swedish National Catheter Ablation Registry covers virtually all (>97%) catheter ablations performed in Sweden since 2005 and comprises 42,192 ablations on 32,237 patients. For the purpose of this analysis, patients undergoing de novo AF ablation 2009–2015 were included. The rates of acute success (i.e., all veins isolated) as well as of repeat AF ablation were analyzed.

Results:
A total of 6,880 AF ablations were performed (mean age 60±9.9 years, 71% men). Overall, the acute success rate was 97% and the need for repeat AF ablation within 1 or 3 years were 20% and 41%. The number of AF ablations doubled between 2009 and 2015 (616 vs. 1,238 patients). While the acute success rate was unchanged over time (P=0.40), a decrease in the need for repeat ablation was seen (Figure; P<0.0001 for both comparisons).

Conclusion:
In the setting of a universal healthcare system, a progressive decrease in the rates of repeat AF ablation was observed. Although the precise underlying mechanism for this observation needs to be determined, increased operator experience and the availability of improved ablation catheters and techniques are likely to be pivotal factors.
Physiotherapist-led exercise within cardiac rehabilitation induced improvement in physical fitness is “perishable goods” in patients with permanent atrial fibrillation

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Background:
Patients with atrial fibrillation (AF) have reduced exercise capacity which strongly influences symptoms and prognosis. We have recently shown that a 3 months physiotherapist led group based exercise (PT-X) program improved physical fitness in patients with permanent AF while Physical Activity on Prescription (PaP) did not. The effect of abstaining from continued training (detraining) in patients with AF has not been studied. The aim of this study was to investigate the impact of 3 months detraining on physical fitness, physical activity level and Health Related Quality of Life (HR-QoL) in patients with permanent AF.

Method:
This study was a prospective follow-up after a randomized multi-center study comparing the effects of 3 months of PT-X vs. PaP in patients with permanent AF. The patients followed earlier randomization and were asked not to participate in any organised exercise during the follow-up period of 3 months. Exercise capacity, muscle function, physical activity level and HR-QoL were assessed using symptom limited ergometer cycle test, muscle endurance tests, Short Form (SF-36), International Physical Activity Questionnaire (IPAQ) and an accelerometer as in the intervention part.

Results:
Eighty of the 87 patients completing the intervention study (92%) participated (22 women), age 74± 5 years. Physical fitness decreased significantly in the PT-X group (n=38) compared to the PaP group (n=42), in exercise capacity (-9 ± 11 vs. -2 ± 12 watt, p<0.0001), in shoulder flexion (-4 ± 8 vs 2 ± 7 n.o, p=0.001), and in HR-QoL SF-36, Role Emotional (RE) function (-13 ± 39 vs. 6 ± 27 points, p=0.006).

Conclusion:
Detraining negatively impacts physical fitness improvement achieved by PT-X and had a negative effect on HR-QoL. This highlight the need to provide possibilities for patients to continue exercising after cessation of PT-X.
Clinical decision support for stroke prevention in atrial fibrillation: A cluster randomized trial in the primary care setting

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Background
Atrial fibrillation (AF) is associated with substantial morbidity, in particular stroke. Despite good evidence for the reduction of stroke risk with anticoagulant therapy, there remains a significant under treatment. The main aim of the current study was to investigate whether a clinical decision support tool for stroke prevention (CDS) integrated in the electronic health record (EHR) could improve adherence to guidelines for stroke prevention in patients with AF.

Methods
We conducted a cluster randomized trial where all 43 primary care clinics in the county of Östergötland, Sweden (population 444 347) were randomized to be part of the CDS intervention or to serve as controls. The CDS produced an alert for the responsible physicians of patients with AF and increased risk for thromboembolism (according to the CHA2DS2VASc algorithm) without anticoagulant therapy. The primary endpoint was adherence to guidelines after one year.

Results
After randomization, there were 22 and 21 primary care clinics in the CDS and control groups, respectively. There were no significant differences in baseline compliance regarding anticoagulant therapy between the two groups (CDS 70,3 ± 3,8 %, control 70,0 ± 4,9 %). After 12 months, analysis with linear regression with adjustment for primary care clinic size and compliance rate at baseline revealed a significant increase in compliance rate in the CDS vs the control group (73,0 ± 4,3 % vs 71,2 ± 5,3%, p = 0,013 with a beta value of 0,016 (95% CI 0.003-0.028)).

Conclusion
The present study demonstrates that a clinical decision support tool can increase guideline compliance for anticoagulant therapy in AF patients. This is the first randomized study indicating beneficial effects with a clinical decision support tool in patients with AF.
**10 years follow-up of video-assisted epicardial pulmonary vein isolation and vagal denervation in patients with atrial fibrillation**

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**Background**

The effects of video-assisted epicardial pulmonary vein isolation (EpicPVI) for atrial fibrillation (AF) regarding outcomes and safety on long-term is unknown. The purpose was to describe freedom from AF, quality of life (QoL), symptoms and safety 10 years after EpicPVI.

**Methods**

A total of 39 out of 43 patients with symptomatic drug-refractory AF, who underwent epicPVI, ganglionated plexi ablation, division of the ligament of Marshall and left atrial appendage excision were followed with 12-lead ECG, 24-hour Holter recording and symptom related spot ECG recording to assess freedom from AF or atrial tachycardia (episodes >30 seconds) at 10 years. Symptoms by symptom severity questionnaires (SSQ) and QoL by shortform-36 were also analyzed.

**Results**

After 10.8±0.7 years (mean±standard deviation), there were still 36% of patients free from AF and atrial tachycardia as compared to 71% at previous 12 month follow-up. The QoL remained improved as compared to baseline for the mental component score (48.19±12.22 versus 40.44±12.32, p=0.011) and almost so for the physical component score (43.44±12.31 versus 39.41±9.40, p=0.053). QoL remained at the same level as a Swedish normal population in 5/8 subscales at follow-up (Figure). The SSQ scores remained improved versus baseline (12.89±4.27 versus 15.19±4.01, p=0.036). Strokes occurred in 4 patients during follow-up.

**Conclusions**

Symptoms and QoL are still improved 10 years after an EpicPVI procedure, despite a marked decline in AF freedom from the one year follow-up. Larger randomized trials can predict the optimal target population and risk benefit ratio. Stroke was not prevented by left atrial appendage excision.
Arterial Stiffness in Ankylosing Spondylitis: Feasibility, method and potential applications for 2D assessment of circumferential strain in the common carotid artery

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Background:
Subclinical indicators for cardiovascular disease (CVD) are becoming increasingly important for early prevention, screening, and clinical management. Ankylosing spondylitis (AS) is a chronic inflammatory rheumatic disease associated with increased risk of CVD due to endothelial cell damage caused by the inflammatory process. As there is no cure for AS, development of management strategies and non-invasive, cost-effective and accessible longitudinal methods to monitor and detect subclinical structural and functional changes, is essential for prevention of complications.

Aims:
Assess common carotid arterial (CCA) circumferential strain (CS%) bilaterally, using B-mode ultrasound 2D speckle tracking, to attempt to determine any subclinical indicators of vascular involvement in a group of AS patients; assess feasibility, reliability and reproducibility of 2D speckle tracking in the CCA for assessment of arterial stiffness in patients with AS and controls; assess the feasibility of using pre-existing ultrasound technology, developed for echocardiography, for the assessment of arterial stiffness.

Methods:
88 carotid duplex scans from AS patient were acquired. Patients were divided into 2 groups; with hypertension (HT) (n=44, 14 female, mean 55±9 years) and without HT (n=44, 14 females, mean 51±13 years). HT was defined as currently diagnosed and/or on antihypertensive treatment. Carotid duplex scans from 23 adults (17 females, mean 50 ± 9 years), and 16 young adults (reference group) (8 females, mean 23±3 years) with no known HT from the general population were collected. Scans were analyzed using TOMTEC. Inter-observer variability testing was performed by two specialized operators.

Results:
AS patients had stiffer arteries then aged-matched controls. AS patients with HT had stiffer arteries than patients without HT. CCA CS% decreased with age in controls. Inter-observer reliability was 11.7% suggesting it was feasible to collect images and perform reliable analysis with the available technology and that the method used was reproducible.

Conclusion:
2D speckle tracking, using pre-existing technology, for assessment of CCA was a feasible, reproducible and a reliable method for the assessment of arterial stiffness in the AS population. These results agree with the limited existing studies, further confirming this.
Post-mortem interpretation of CIED as a forensic tool.

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Introduction:
Most CIEDs store data describing the heart rhythm and device activity: Heart rate histograms, trends of electrode impedance, pacing thresholds, sensing of intrinsic electrical activity, data about body movement and episodes with EGM. These can be retrieved post mortem. Together with knowledge about the device and the patient, the information may indicate the time of death and contributing arrhythmias.

Case presentation:
We describe a choice of cases where information about time and mode of death was derived from post mortem interrogation.

Case 1. Man, 86 years, with atrial fibrillation, VVI-pacemaker, suffering witnessed sudden death. Stored electrogram showed fast irregular ventricular arrhythmia with decreasing amplitude. The arrhythmia was considered fatal, autopsy was not deemed necessary.

Case 2. Man, 68 years, congestive heart disease, atrial fibrillation, VVI-CRT pacemaker and previous AV-nodal ablation, found dead. Increase in both pacing electrode impedances was recorded on February 17. The last automatic recording of normal electrical activity was on February 16. On February 17, episodes of fast ventricular activity around 200 bpm and decreasing amplitude were recorded. The pattern indicates death occurring on February 17. The arrhythmia was assumed to be the cause of death.

Case 3. Woman, 89 years, DDD-pacemaker, found dead, with suspected cause being murder. On October 14 at 13:11 PM an episode of irregular atrial activity was recorded. Daily measured ventricular electrode impedance rose from a stable level around 500 ohms to around 1700 ohms on October 15 at 4 AM. The activity sensor indicated body movement on October 14 and no movement on October 15. The patient was thus alive on October 14 13:11 PM and dead on October 15 04 AM. A news report later stated that the woman was seen alive around 13 PM and found stabbed to death around 13:30 PM.

Conclusion:
Relevant data can be extracted by a post mortem interrogation. Preferably the interrogation should be done in situ. Useful support can be obtained from the manufacturer.
Suspected acute ischemia due to T wave changes caused of cardiac memory.

Catarina Lysel-Begrström, Slawomir Liszewski

Introduction:

Cardiac memory (CM) is persistent changes in myocardial repolarization upon resumption of normal ventricular conduction sequence after a period of abnormal ventricular activation (pacing, transient conduction abnormalities, ventricular arrhythmias, preexcitation, etc.). CM believed to reflect adaptation of the heart to the new activation sequence and is triggered by changes in myocardial strain causing local release angiotensin II. Manifestation of CM is typical pattern of the T wave changes on the ECG- T wave direction follows the direction of the preceding aberrant QRS complex. CM makes ECG diagnostic of ischemia difficult.

Case presentation:

A 71-year-old man, with medical history of atrioventricular conduction disorders that were the cause of pacemaker implantation, arrived at the Emergency Unit because of uncharacteristic chest pain. The initial ECG showed sinus rhythm with negative T-waves in several leads (fig.1). Coronary disease was excluded. Hs-troponin was negative. The ekg record was typical for CM:

1. T-waves follows the direction of the pacemakers QRS complex (fig.1).
2. Positive T-waves in aVL (fig.2)
3. Positive (or isoelectric) T in I (fig.3)
4. Amplitudes of negatives T: max. negative T in V1-V6 more negative than negative T in III (fig.4).

Conclusion:

Cardiac memory, because increasing number of patients with a pacemaker, is an increasingly problem when assessing patients with suspected ischemia. In clinical practice knowledge of the criteria for typical cardiac memory may be helpful.
A young patient with heart failure and malnutrition – a holistic approach. Which is the chicken and which is the egg?

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Introduction:
Malnutrition and anxiety are seen in heart failure at the end stage disease. However, malnutrition as a possible underlying cause of heart failure is rarely seen in developed countries and therefore both evidence and recommendations are lacking.

Case presentation:
A 42 year old man, smoker, admitted to hospital with a feeling of malaise, chest pain, fatigue, dyspnea, dysphagia. Historically HLA-B27 positivity and idiopathic, recurrent hydrothorax were known. Also suffered from gastroesophageal reflux disease, certain grade of anxiety. No hypertension or diabetes were found. The physical examination showed tachypnea, cachexia with BMI 18 kg/m2, poor physical condition and severe panic attacks. Investigations revealed a severely dilated cardiomyopathy (with ejection fraction 10-15 %) without presentation of coronary artery disease, myocarditis, arrhythmias or myocardial infiltrative disease. Standard medical therapy failed to improve physical performance and ejection fraction. Transplantation was denied because of the poor performance status (NYHA IV) and mental health issues (severe anxiety and panic syndrome). Complementary therapy with enteral nutrition (tube feeding), treatment of anxiety and the addition of angiotensin receptor blocking nepriyisin inhibitor (ARNI) improved the patient’s overall health, functional capacity and fully reversed the heart failure.

Conclusions:
Conventional treatment of heart failure often leads to improved cardiac status in most cases. However, it is important to recognize complicating conditions like malnutrition and severe anxiety (reason for the dysphagia) which may impede recovery. By complementing traditional heart failure treatment with additional therapies (as above) and by using a new medical therapy (ARNI) the patient’s severe heart failure was fully reversed in this case and heart transplantation was no longer needed.
Acquired Gerbode Defect Following Valve-in-Valve Transcatheter Aortic Valve Replacement

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Introduction
Gerbode’s defect is a rare form of VSD that allows for communication between the LV and RA. Two types of LV-to-RA communication are described: supravalvular and infravalvular, depending on whether the defect in the membranous septum is above or below the tricuspid valve. Gerbode defect following transcatheter aortic valve replacement (TAVR) are an uncommon and barely described complication. To our knowledge only two cases with communication between left ventricle and the right atrium (Gerbode type defect) after TAVR have been reported and this is the first case after valve-in-valve implantation.

Case presentation
An 77-year-old male patient with severe symptomatic AS and a past medical history of ischemic coronary disease (chronic total occlusion of the RCA), stroke, hypertension, hyperlipidemia, asthma, atrial fibrillation and bleeding episodes from colon angiodysplasia referred to our institution with symptom of worsening dyspnea on exertion, New York Heart Association functional class III. A trans-thoracic echocardiographic examination performed before the procedure revealed severe aortic stenosis with a mean pressure gradient of 49mmHg and an Aortic Valve Area of 0.68 cm2, mild tricuspid regurgitation and an estimated systolic pulmonary pressure of 51mmHg. The patient was considered at high risk for surgical aortic valve replacement and was referred for Transcatheter Aortic Valve Replacement (TAVR) using a transfemoral approach. His maximal aortic annulus diameter was 24 mm and diameters at the sinotubular junction were 26 X 29 mm on multislice computed tomography (MSCT). An Evolute R 29 mm CoreValve (Medtronic) was initially implanted. Aortic root angiography after deployment showed a significant paravalvular leak. Despite balloon re-dilatation of the valve prosthesis significant leakage remained and in the presence of extensive native valve calcification a valve-in-valve implantation of a second TAVR prosthesis was performed with another Evolute R 29 mm prosthesis, sealing the paravalvular leak. In his postoperative course he developed a high-degree atrioventricular block (AV-block II Mobitz II) and a permanent pacemaker was implanted. Transthoracic color Doppler echocardiography 4 days after the procedure revealed a novel finding of a left-to-right shunt from the left ventricular outflow tract to the right atrium, immediately superior to the septal leaflet of the tricuspid valve, consistent with an acquired Gerbode defect. (Figure 1B,C). An ECG-gated MSCT (Figure 2 D,E) was used to accurately delineate the shunt. To avoid overestimating right ventricular systolic pressure by mistaking the shunt for an eccentric jet of tricuspid regurgitation, it is important to accurately differentiate the two. The patient remained asymptomatic and the Qp/Qs ratio was assessed by cardiac catheterization yielding a value of 1.3. The patient was managed conservatively with scheduled serial follow-up TTE.

Conclusions
Acquired aseptic intracardiac shunt following TAVR is a rare procedural complication. Decisions on treatment strategy have to be tailored to the patient and involve a multidisciplinary team. Medical treatment is associated with poor outcomes (30-day mortality rate 25%), especially in symptomatic patients and in those with higher Qp/Qs ratios (1.9 ± 0.6). Conservative approach seems appropriate in patients without evidence of worsening symptoms or volume overload.
Univentricular hearts and Computational Fluid Dynamics

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Background
We present two related cases in children with Fontan circulation where Computational Fluid Dynamic (CFD) simulations were used to predict the outcome of an invasive interventions. In both cases, hepatic blood is only flowing to one lung, resulting in pulmonary vascular lesions (Figure 1A and Figure 3A). Lessons learned from the clinical outcome of the first case (Y-graft inserted to split the hepatic flow) were applied in the nearly identical second case, and the design of a novel endovascular device.

Methods
CMR acquisition of anatomy and flow was used as input to CFD simulations. Post-interventional anatomical changes were modelled and internal blood flows were simulated using CFD. In the second case, data obtained from testing of a novel endovascular flow reducer (Figure 2B) in ethically approved animal experiments was also used in the predictive patient simulation. The device was designed in collaboration with Occlutech (Occlutech GMBH, Germany).

Results
CFD simulation of the first patient predicted that there would be no flow in the right branch of the Y-graft (Figure 1B), which was confirmed by 4D CMR (Figure 1C). Consecutive follow-up CMR measurements over three years showed a continuous shift in Fontan inflows resulting in an increasing fraction of blood flowing in the right Y-graft branch (Figure 2). In the second case, animal testing with the device inserted in vena cava inferior resulted in vascular remodelling, which when applied to the patient case results in a beneficial hepatic flow to both lungs (Figure 3C).

Conclusions
The first case shows that acute post-op hemodynamics could be accurately predicted with CFD simulation based on pre-op CMR information, but changes probably due to circulatory adaptation affected the medium-term redistribution of flows. In the second case, longer term circulatory adaption is being accounted for with concomitant CFD simulations and animal testing.
Low compliance to correct dose reduction criteria when using apixaban

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Background
Apixaban is a direct Factor Xa inhibitor with a standard dose of 5 mg twice daily when used as stroke prevention in patients with atrial fibrillation (AF) or atrial flutter (AFL). Specific dose reduction criteria (two of: age ≥80 years, weight ≤60 kg, serum creatinine ≥133 μmol/l or single criterion, creatinine clearance of 15-29 ml/min) are based on pharmacokinetic studies. Previous studies have demonstrated incompliance to these criteria. The aim was to explore the proportion of patients at the anticoagulant facility, Helsingborg Hospital, treated with reduced dose of apixaban, not meeting the dose reduction criteria and compare them to those who did.

Method
A retrospective observational registry study was conducted. Patients with AF or AFL registered in Auricula who received treatment with reduced dose of apixaban on October 6th, 2016, were included and followed from initiation of treatment to death or last follow-up date (January 31st, 2017). The cohort was divided in two groups; correct and incorrect dose reduction, and were compared in aspects of baseline characteristics and adverse events.

Results
The study included 226 patients, of whom 135 (59.7%) were on reduced dose without meeting the dose reduction criteria. The groups were similar regarding risk factor profile, baseline medication and medical history. The group with correct dose reduction was older, weighed less, and had lower creatinine clearance (all p<0.001). Two-thirds of the patients with incorrect dose reduction met only the age criteria. The groups did not differ regarding adverse events or patients’ event-free-occurrence.

Conclusion
Almost 60% of patients treated with reduced dose of apixaban did not meet the dose reduction criteria. Actions are needed to increase the compliance to these criteria. This study could not conclude whether incompliance to the criteria leads to any consequences for the patients. To further explore this, larger studies are required.
Pacemaker and implantable cardioverter defibrillator treatment in patients with type 2 diabetes mellitus

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Background:
Patients with Type 2 Diabetes mellitus (T2DM) have an increased risk for cardiovascular disease. Arrhythmias, both brady- and tachycardia, and the need for pacemaker (PM) or implantable cardioverter defibrillator (ICD) have attracted attention in this context.

Aim:
To study whether patients with T2DM have an increased risk for PM/ICD compared to an age- and sex-matched control population without DM and to investigate which patient characteristics are associated with increased risk of receiving a PM/ICD.

Materials and method:
A registry-based study comprising 416,014 patients with T2DM from the Swedish national diabetes registry. For each patient five controls (n= 2,080,070) were selected from the Swedish population.

Results:
The prevalence of arrhythmias were significantly higher in patients with T2DM. The prevalence and incidence of PM and ICD was higher in T2DM patients compared to controls. Prevalence of PM 1.54% vs 0.98% (P < 0.0001), prevalence of ICD: 0.26% vs 0.12% (P< 0.0001). T2DM was associated with a significant increased risk for PM Hazard ratio, (HR) 1.69, 95% CI [1.60-1.69] P< 0.0001 and remain increased after adjustments for several cofounders (age, sex, marital status, educational level and country of birth (Sweden, Europe, outside Europe and coronary heart disease) HR= 1.56, 95% CI [1.51-1.60]. The risk for ICD was also significantly increased unadjusted HR 2.28, 95% CI [2.12-2.45] P=<0.0001, and adjusted 1.60, 95% CI [1.49-1.73]. Risk factors for receiving a PM was increasing age, diabetes duration, blood pressure- and lipid lowering medication. Risk factors for ICD were elevated HbA1c or treatment with blood pressure- and lipid lowering medication.

Conclusion:
Patients with T2DM more often have arrhythmias and they have an increased risk for PM and ICD implantations compared to matched controls, which should be acknowledge when assessing their cardiovascular risk.
Ablation of ventricular tachycardia from right and left ventricular outflow tract

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Background: Ventricular arrhythmias (VAs) occurring in structurally normal hearts represent 10% of all VAs. Most of them originate from the right (RV) and left (LV) ventricular outflow tracts (OT). We aimed to assess the prevalence and anatomical distribution of OTVAs.

Methods: Forty-nine consecutive patients (57±17 years) who underwent 58 ablation procedures for OTVAs between August 2014-May 2017 were studied.

Results: Ablation was acutely successful in all patients. Twenty-four patients (49%) had arrhythmias requiring ablation in RVOT and 25 (51%) necessitated ablation in LVOT. In the latter group, 4 (16%) patients had VAs originating in the left coronary cusp, 3 (12%) in the right coronary cusp, 3 (12%) at the junction between the right and left coronary cusps, 1 (4%) in the preaortic region, 6 (24%) at the aortomitral continuity, and 4 (16%) in the left ventricle summit. In 4 (16%) the localization could not be inferred from the ablation protocol. Of the entire cohort, 32 were ablated for premature ventricular contractions (PVCs) and 17 for ventricular tachycardias (VTs). In PVC patients who underwent Holter ECG monitoring (27 patients before and 17 after ablation) the PVC burden decreased from 25±16% to 2.8±4.1%, (p=0.0001). In the 15 PVC patients where Holter monitoring was not performed, all but one reported symptom improvement. In the 17 patients who had VT as indication for ablation, 10 did not have documented VT recurrence after ablation, 2 had non-sustained VT and 2 had sustained VT. The remaining 3 patients reported symptom improvement.

Conclusions: LVOT is an important arrhythmogenic substrate. Consequently, LVOT mapping should be considered early during the procedure (depending on the 12-lead ECG and the findings provided by RVOT mapping). Most of these VAs originate in the aortic sinus cusps and AMC. Ablation is usually successful.
Increasing Ablation Volumes and a Shift Towards More Complex Arrhythmias: Data from the Swedish National Catheter Ablation Registry

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Background:
Catheter ablation has become the treatment of choice for many tachyarrhythmias. The ablation techniques are continuously refined and the indications expanded, enabling treatment of more complex substrates. Hence, the spectrum of treated arrhythmias is likely to have changed over time, but compelling data on this are lacking.

Methods:
The Swedish National Catheter Ablation Registry covers virtually all (>97%) catheter ablations performed in Sweden since 2005 and comprises 42,192 ablations on 32,237 individual patients. In the present analysis, all ablations performed between 2005 and 2016 were included.

Results:
In 2005, there were 7 ablation centers in Sweden performing a total of 1,584 ablations (226/center; 175 million inhabitants). In 2016, 11 ablation centers performed 5,022 ablations (457/center; 502/million inhabitants). Ablation of atrial fibrillation increased from 326 ablations (21\% of all ablations) in 2005 to 2,063 (41\%) in 2016. Although, the number of ablation procedures for ventricular tachycardia and premature ventricular contractions is increasing, it is still on a relatively modest level (Figure). In contrast to other reports, there is no apparent decline in the number of accessory pathway ablations.

Conclusion:
In the setting of a universal, single-payer healthcare system, the number of ablations more than tripled over a 10-year period. Ablation of atrial fibrillation is the main driver behind this increase and accounted for 41\% of all ablations in Sweden in 2016.
Mass Screening for Atrial Fibrillation using N-terminal pro b-type natriuretic peptide – preliminary results from the STROKESTOP 2 study

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Background
Atrial fibrillation (AF) is common among the elderly and a significant risk-factor for embolic ischemic stroke. AF is often asymptomatic and therefore undiagnosed. We have previously reported a yield of 3% of newly diagnosed AF using intermittent ECG screening in a 75-year-old population. N-terminal pro b-type natriuretic peptide (NT-proBNP) levels are elevated in patients with AF, and prior studies indicate that NT-proBNP elevation can predict development of AF. In patients with known AF, NT-proBNP levels seem to be in proportion to stroke risk. We aim at reporting preliminary data on the yield of systematic screening for AF in a 75/76-year-old population using NT-proBNP and handheld ECG recordings in a stepwise screening procedure.

Methods
All individuals born in 1940 and 1941 residing in the Stockholm region (n= 28,712) were randomised in a 1:1 fashion to be invited to a screening program for AF or to serve as a control group. Participants free of AF (n=6127) had NT-proBNP analysed. Individuals with NT-proBNP ≥ 125 ng/L (n=3636, 59 %) were offered extended ECG-screening whereas individuals with NT-proBNP <125 ng/L (n=2491, 41%) had a single one-lead ECG recording.

Results
In participants with NT-proBNP ≥ 125 ng/L 169 (4.6%, 95% CI 4.0-5.4) were diagnosed with AF, of these 32 (24%) were diagnosed on their first ECG recording. One participant with NT-proBNP <125ng/L was diagnosed with AF on a single-lead ECG. Oral anticoagulation (OAC) treatment was initiated in 93% of those with new AF. In the population randomized to screening OAC treatment was commenced in 1% (158/13845).

Conclusions
NT-proBNP-enriched systematic screening for AF identified a significant proportion of participants with untreated AF. Oral anticoagulation treatment was highly accepted in the group diagnosed with AF.
Pulse palpation and history of palpitations in atrial fibrillation screening – preliminary results from the STROKESTOP 2 study

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Background
Atrial fibrillation (AF) is a significant risk-factor for embolic ischemic stroke, with a prevalence that increases with age and often an asymptomatic presentation. The ESC AF guidelines recommend opportunistic screening for AF by pulse palpation in patients >65 years of age. We aimed at comparing one-lead ECG with pulse palpation in a systematic AF screening program, and in addition find if symptomatic patients were more likely to be diagnosed with AF.

Methods
All 75/76-year old individuals in the Stockholm region (n= 28,712) were randomised to an AF screening program invitation or to serve as a control group. Palpation of the radial pulse was performed for 30 seconds in all participants free of AF and classified as regular vs. irregular before a one-lead ECG was taken for comparison. In addition, participants reported symptoms of palpitations.

Results
In total, 6150 of 6696 participants were included, the remainder had previously known AF. Irregular pulse was detected in 7.6% (465/6150), of whom 26 were confirmed having AF on one-lead ECG. Among 5685 participants with regular pulse, 6 were diagnosed with AF on a one-lead ECG, resulting in a sensitivity of 0.81 (95% CI: 0.63-0.93) and a specificity of 0.92 (CI: 0.92-0.93), positive predictive value 0.06 (CI: 0.05-0.07) and negative predictive value 1.00 (CI: 1.00-1.00). In 1826 participants reporting palpitations, 47 (2.6%) were diagnosed with AF on either index-ECG or during 2 weeks of screening whereas 89 (2.1%) of 4288 participants without palpitations were diagnosed with AF.

Conclusions
Pulse palpation, as recommended by ESC-guidelines has a very low positive predictive value resulting in a high proportion of false positive results. Sensitivity for pulse palpation was modest. Palpitations were not associated with AF diagnosis during screening.
Radio Frequency Ablation in Children is Safe and Efficient: Data from the Swedish National Catheter Ablation Registry

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Background:
Radio frequency (RF) ablation is widely used to treat adult and pediatric patients of a variety of tachyarrhythmias. AV-nodal reentrant tachycardia (AVNRT) and AV-reentrant tachycardia (AVRT) are two of the most frequently treated arrhythmias in a pediatric population. Data comparing the efficacy and safety of RF ablation between adult and pediatric patients are limited.

Methods:
The Swedish National Catheter Ablation Registry covers virtually all (>97%) catheter ablations performed in Sweden since 2005. In this study, patients undergoing de novo RF ablation of AVNRT or AVRT between 2005 and 2015 were included. Pediatric (i.e., age < 18 years) ablations are routinely performed by adult electrophysiology teams in Sweden. The rates of acute success as well as of repeat ablation and rates of adverse events were compared between adult and pediatric patients.

Results:
A total of 935 ablations were performed in children between 2005 and 2015 in Sweden (AVRT 578 [66%]; AVNRT 299 [34%]), of which 688 were RF ablations (AVRT 516 [75%]; AVNRT 172 [25%]). In adults, 3,413 AVRT and 4,798 AVNRT ablations were performed using RF (in total, 3,715 and 7,289 respectively). The only significant difference observed regarding the acute efficacy and safety parameters was a lower incidence of adverse events in pediatric AVRT ablations (see Table).

Conclusion:
Pediatric RF ablations performed by adult electrophysiology teams seems to be at least as safe and equally effective as similar RF ablations performed in adults.

Table: (Data showing acute success and rates of adverse events for adult vs pediatric patients)
Cryoblation of the Cavotricuspid Isthmus is Safer but less Efficient Compared with Radiofrequency Ablation: Data from the Swedish National Catheter Ablation Registry

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Background:
Cavotricuspid isthmus (CTI) ablation for the treatment of typical atrial flutter can be performed using either cryo or radiofrequency (RF) ablation. Cryoablation has been shown to be less painful than RF ablation, but single center experiences indicate that the relapse rates may be higher. The present study set out to compare the safety and efficacy of cryo and RF-ablation for treatment of typical atrial flutter using complete national registry data.

Methods:
The Swedish National Catheter Ablation Registry covers virtually all (>97%) catheter ablations performed in Sweden since 2005 and comprises 42,192 ablations on 32,237 unique patients. In this study, patients undergoing de novo ablation of CTI-dependent atrial flutter between 2009 and 2015 were included. The rates of acute success (i.e., bidirectional isthmus block) as well as of repeat ablation and rates of adverse events were compared between the two groups.

Results:
A total of 3,651 CTI ablations in patients with a mean age of 62±12 years (79% male) were performed at 11 centers. RF energy was used in 2,536 (69%) whereas cryo was used in 1,115 (31%) patients. Patients in whom cryoablation was used was marginally older (63±12 vs. 62±12, P=0.007), but the gender distribution was similar (79% for both groups). The procedural time (skin-to-skin) was slightly longer for cryoablation (117±44 vs. 110±46 minutes, P<0.001), but the fluoroscopy time was shorter (11±9.6 vs. 19±15 minutes, P<0.001). Although the acute success rate was high for both groups (95% vs. 96%, cryo and RF respectively, P=0.09), the likelihood of a repeat CTI ablation was higher for patients undergoing cryoablation both within 1 year (9.6% vs. 6.3%, P=0.001) and 3 years (14% vs. 9.7%, P=0.002). Although, acute adverse events were infrequent, they were less common in patients treated with cryoablation (0.7% vs. 2.1%, P=0.003).

Conclusion:
The number of repeat ablations following CTI ablation is higher for cryoablation compared with RF ablation. However, the advantage may be a lower risk for periprocedural adverse events. Although the use of cryoablation may prolong the procedural time somewhat, the opposite seems to be true for fluoroscopy time.
Markedly Reduced Fluoroscopy Time in Catheter Ablation: Data from the Swedish National Catheter Ablation Registry

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Background:
With the advent of sophisticated 3D-mapping systems, catheter ablation of increasingly complex tachyarrhythmias has expanded. Although fluoroscopy is still essential for visualization of catheters in real-time, increasing operator experience as well as the utilization of the 3D-mapping systems, is likely to have decreased the need for fluoroscopy.

Methods:
The Swedish National Catheter Ablation Registry covers virtually all (>97%) catheter ablations performed in Sweden since 2005 and comprises 42,192 ablations on 32,237 unique patients. In this study, the mean fluoroscopy time per year for 4 different types of catheter ablations performed between 2005 and 2016 were analyzed: (1) atrial fibrillation (AF); (2) premature ventricular contraction or ventricular tachycardia (PVC/VT); (3) supraventricular tachycardia (SVT, i.e., atrial tachycardia, AVNRT, accessory pathway or CTI-flutter) and (4) AV-nodal ablation (AVN).

Results:
A total of 41,853 ablations were analyzed (14,139 AF; 1,441 PVC/VT; 22,809 SVT and 2,363 AVN). Overall, the mean fluoroscopy time in 2005 was 31±28, compared to 13±11 minutes in 2016 (P<0.001). Decreasing trends were seen for all subgroups (Figure, P<0.0001 for all trends), with the most pronounced decrease seen in AF ablation.

Conclusion:
A dramatic decrease in the fluoroscopy time is seen, with a more than 50% reduction in fluoroscopy time over the past decade. For AF ablation, the mean fluoroscopy time today is only a third of the time a decade ago.
Correlation between N-terminal probrain natriuretic peptide and heart rhythm before and after outpatient electrical cardioversion

Samira Rezaei, Johan Engdahl

Background:
Atrial fibrillation is the most common arrhythmia and associated with increased risk of death, stroke and heart failure. If symptoms of atrial fibrillation are significant, attempt can be made to restore heart rhythm to normal sinus rhythm by electrical or pharmacological cardioversion. Previous studies have been inconsistent regarding the relationship between NT-proBNP and successful electrical cardioversion as well as the relationship between NT-proBNP levels and the chance to maintain sinus rhythm after successful cardioversion.

Methods:
We studied patients scheduled for outpatient electrical cardioversion at the Department of medicine, Halland Hospital Halmstad within a prospective study. NT-proBNP was analyzed 1-2 days before cardioversion and also at follow up one month after cardioversion. Heart rate and rhythm were determined by ECG. Patients with impaired left ventricle function (LVEF <50%) were excluded.

Results:
One hundred and ninety three patients underwent 227 cardioversion, 74% of the patients were men and mean age was 69 years. Distribution of NT-proBNP was positively skewed. Before cardioversion, median NT-proBNP was 1068 ng/l. Within two hours after cardioversion, sinus rhythm was achieved in 194/227 (86%) of patients. There was no difference in NT-proBNP levels between patients with and without immediate conversion (median NT-proBNP 1062 vs. 1263 ng/l, p=n.s). Analyzing patients with immediate conversion to sinus rhythm, there was no difference in median NT-proBNP (1022 ng/l vs. 1141 ng/l) among patients with sinus rhythm (n=108) vs. patients with arrhythmia recurrence (n=81). Patients in sinus rhythm at 30 days had significantly lowered their median NT-proBNP (404 vs. 1022 ng/l, p<0.001).

Conclusion:
NT-proBNP was elevated among patients with normal ejection fraction scheduled for outpatient cardioversion. NT-proBNP decreased significantly in those with sinus rhythm after 30 days. NT-proBNP did not predict immediate or late relapse to atrial fibrillation.
Short-term results of pulmonary vein isolation in a middle-size center – Can the same results be achieved as in high volume center?

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Background:
The catheter ablation of atrial fibrillation (AF), pulmonary vein isolation (PVI) has previously been introduced as an effective treatment method of symptomatic AF. Most data concerning the PVI efficacy come from high volume centres. However, since PVI has become more widespread and affordable there is as well a need to evaluate data from middle-size centres. The goal of our pilot study was to evaluate retrospective data of patients undergoing PVI and assess the acute effectivity, complications rate and different outcomes during the follow-up (FU).

Methods:
192 patients with paroxysmal or persistent AF undergoing PVI between 2009 and 2011 were studied. The baseline, periprocedural and the follow-up data were collected retrospectively. FU was performed at 3, 6 and 12 months. 12-leads ECGs and at least one long-term ECG at 3 months after ablation were obtained, and clinical history was taken.

Results:
Patients enrolled to the study had dominantly paroxysmal AF (83.3%) and were dominantly men (69%). The population was relatively young (mean age: 57.6±9.0 years) with low median CHA2DS2-Vasc Score 1. 64% of patients had AF on ECG and 49.8% were on antiarrhythmic therapy at admission. Successful complete PVI was performed in 93% patients. The rate of periprocedural complications was low (pericardial tamponade 2,6% and femoral hematoma 5,2% ) and no cardiovascular death or stroke was reported. The loss of follow-up was higher between 7 – 12 months. The recurrence of atrial fibrillation was between 13.8– 34.2 %, and mostly between 7 – 12 months. Twenty-five patients underwent redo PVI within 12 months.

Conclusions:
The altogether complications rate was very low. Our results show, when compared to literature, the similar effectivity of PVI as in high-volume centers. A longer FU is needed in order to improve the management of AF.
High yield of atrial fibrillation detected in patients with very short episodes of atrial fibrillation (micro-AF) using continuous event recording

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Background
Atrial fibrillation (AF) is defined as an irregular heart rhythm without p-waves lasting at least 30 seconds, according to the European Society of Cardiology’s guidelines. This definition of AF duration is based on expert opinion, not scientific data. Lately an association between supraventricular runs and AF has been demonstrated.

We aimed to evaluate the yield of AF using prolonged screening in patients with very short lasting episodes of AF (micro-AF).

Methods
In the ongoing STROKESTOP II study, a Swedish mass screening study for AF in 75- and 76 year olds, participants with NT-proBNP ≥125 ng/L performed intermittent ECG recordings 30 seconds twice daily for 2 weeks. Participants from the STROKESTOP II study with micro-AF (abrupt onset of irregular tachycardia with episodes of ≥5 consecutive supraventricular beats and total absence of p-waves, lasting for less than 30 seconds) were invited to undergo extended AF screening using continuous event recording for 2 weeks. A control group in the STROKESTOP II study without micro-AF was also screened using both methods.

Results
Of the 3,636 participants in the STROKESTOP II study with NT-proBNP ≥125 ng/L n=218 (6%) were found to have micro-AF. 183 of those have performed continuous monitoring. AF was detected in 29/183 (16%) of the participants with micro-AF. In the control group 5/224 (2%) were found to have AF. (p<0.001)

Conclusions
Identification of very short episodes of micro-AF indicates an increased risk for undetected AF, and continuous screening could thus be considered in patients with an increased risk for stroke.
Performance evaluation of automatic symptom-ruled, real-world arrhythmic recordings

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Background:
Detection of treatment-demanding paroxysmal arrhythmias can be difficult. Patient engaged, symptom-ruled, real-world recordings can therefore be of significant clinical value.

Methods:
The Coala Heart Monitor (Coala) system was evaluated by manual interpretation of 1,000 consecutive anonymous printouts of chest- and thumb-ECG waveforms, without any exclusion. The anonymized printouts contained three 10 s. strips of ECG at 25 mm/s, including mean heart rate, RR median and any user-provided annotation but with personal identification and algorithm analysis results removed (blinded), apart from gender and age within a 10-year span.
The recordings were derived from actual Coala users in Sweden with no training, control or influence, under a defined time period. The prevalence of cardiac conditions in the user population was unknown.
The blinded recordings were manually interpreted by a trained cardiologist. The interpretation was compared with the automatic analysis performed by the algorithm in the Coala Cloud to evaluate ECG signal performance and calculate performance metrics.

Results:

<table>
<thead>
<tr>
<th>Metric</th>
<th>Result/Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalence of AF in the recordings</td>
<td>14.4 % (143 of 990 recordings)</td>
</tr>
<tr>
<td>Sensitivity for detecting AF</td>
<td>0.972 (95% CI = 0.930 – 0.992)</td>
</tr>
<tr>
<td>Specificity for detecting AF</td>
<td>0.946 (95% CI = 0.928 – 0.960)</td>
</tr>
<tr>
<td>Negative predictive value for detecting AF</td>
<td>0.995 (95% CI = 0.987 – 0.999)</td>
</tr>
<tr>
<td>Positive predictive value for detecting AF</td>
<td>0.751 (95% CI = 0.683 – 0.812)</td>
</tr>
<tr>
<td>Kappa coefficient</td>
<td>0.818 (95% CI = 0.769 – 0.866)</td>
</tr>
</tbody>
</table>

Conclusion:
Based on 1,000 real-world recordings the overall ECG signal quality and accuracy for detecting atrial fibrillation (AF) for the Coala was been found to be high (sensitivity of 0.97, specificity of 0.95) and supportive of the intended use of the device. The combination of chest- and thumb-ECG yields 99.2% of recordings that can be used for manual interpretation and was found to be superior to either thumb- or chest-ECG only.
Background
Advantages have been demonstrated with structured care in patients with atrial fibrillation (AF), with less hospitalization, reduced mortality, and improved health-related quality of life (HRQOL). We present one way to implement structured care in clinical routine and to evaluate the outcome.

Aim
To describe implementation and evaluation of structured care in patients with AF.

Method
Patients participate for three months and are registered in a database, structured according to present treatment guidelines. Blood samples and ECG are taken. Patient-reported outcomes (PROMs) are followed; ASTA assessing arrhythmia-specific symptoms and HRQOL, SF-36 and EQ-5D for HRQOL and HADS for anxiety and depression. Patients are interviewed regarding healthcare consumption, answer questions about AF and work with a six-step web-based interactive educational program.

Results
The first included patients are 4 women and 11 men, age 39-82 years, where 10 patients have completed the educational program. Patients are newly diagnosed, treated with catheter ablation or have permanent AF. The database was used during visits and the outcome of the ASTA assessments were used for discussions and comparisons over time.

After the educational program patients reported that; they got insight in AF and the treatment, knew more about how to contribute to better treatment outcomes, including lifestyle changes. They learnt that AF is not life-threatening but how important it is to get accurately treated. Patients felt more in control, and were less anxious after the education.

Conclusions
Well-educated patients feel more secure, involved in the care and encouraged to perform self-care strategies. Optimizing care require useful tools such as a guideline-based database, web-based disease-specific PROMs making it easy to follow patients over time, valuable for discussions at visits. Internet-based education, always available, empowers patients to better self-management, the aim of the AMADEUS project.
How often is the severity of aortic stenosis reclassified when assessing velocities from the right parasternal view?

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Background:
Aortic stenosis (AS) is the most common valvular heart disease in the developed countries and increases in prevalence with aging. Correct assessment of AS severity is crucial since the discussion whether recommend aortic valve surgery or follow up is mostly based on the echocardiographic findings. The aim of this study was to determine how often AS severity is reclassified when measuring Vmax from the right parasternal view (RPV).

Methods:
Echocardiograms were obtained from 36 patients referred to our echocardiography laboratory for the assessment of AS severity. The jet velocity was assessed from apical five chamber view and the RPV using the same transducer (SMSc, Vivid E9) and gain settings.

Results:
The highest jet velocity was most frequently (67%) obtained from the RPV. In 33% percent of the cases the AS severity was reclassified to a more severe degree when determined from the RPV. In 25% of the cases the AS degree was reclassified from moderate to severe when assessed from the RPV. Mean Vmax and mean pressure gradient was significantly higher from RPV compared to apical five chamber view (3.8m/s vs. 3.5m/s and 35mmHg vs. 29 mmHg respectively, p<0.05).

Conclusion:
In this small study the highest jet velocity was located in 67% of the cases outside the apical imaging windows. Neglecting the RPV would have resulted in misclassification of AS severity in 33% of patients. We strongly recommend determination of jet velocity from non-apical windows in AS patients.
Predicting neurological intact outcome after in-hospital cardiac arrest – validation of the GO-FAR score

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Background

Approximately 2600 in-hospital cardiac arrests (IHCA) occur annually in Sweden and the prognosis for those affected is poor with 30% survival to hospital discharge. A do-not-attempt-resuscitation order is issued when it is against the wishes of the patient that cardiopulmonary resuscitation is performed, or when the chance of good quality survival is minimal. Therefore it is essential for physicians to objectively make a prearrest prediction of outcome after IHCA. The Good Outcome Following Attempted Resuscitation (GO-FAR) score was developed in 2013 with Cerebral Performance Category score (CPC) 1 as outcome (patient is able to work, may have minor psychologic or neurologic deficits). It has not been validated on a population basis outside the index population.

Methods

This external validation study was based on a cohort of adult IHCA in Stockholm County 2013 to 2014 identified through the Swedish Cardiopulmonary Resuscitation Registry. The registry provides patient and event characteristics and CPC at discharge. Data for the GO-FAR variables was obtained from manual review of electronic patient records. Model performance was evaluated by quantifying discrimination, calculating the area under the receiver operating curve (AUROC) and evaluating the calibration plot.

Results

The final cohort included 717 patients with a 30-day survival of 28% and neurologically intact survival at discharge of 22%. In complete case analysis (523 cases) AUROC was 0.82 (95% CI 0.78 to 0.86) indicating good discrimination. However the calibration plot showed that the GO-FAR score systematically underestimates the probability of neurologically intact survival (Figure).

Conclusions

The GO-FAR score shows satisfactory discrimination but dissatisfactory calibration in a cohort representing a Swedish population. It has the ability to distinguish a patient with neurologically intact survival from a patient with adverse outcome, but neurologically intact survival is systemically underestimated. Recalibration of the GO-FAR score is suggested before taken into clinical practice in Sweden.
Reproducibility and clinical reliability of new and conventional echocardiographic parameters of left ventricular systolic function

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Background:
Inter-observer variability, spontaneous biological variation, and measurement error influence test-retest variability, which is crucial for the clinical reliability of left ventricular (LV) function parameters, since a large variability makes it impossible to distinguish effects of disease from the variability in the measurement technique. Limited data on test-retest variability has been published, mainly in patients with normal LV function.

Purpose:
To investigate test-retest variability of LV strain measurements in relation to the conventional functional parameters of LV systolic function.

Methods:
In a group of 30 patients with different degrees of impairment of LV ejection fraction (EF), echocardiographic studies of the left ventricle were acquired independently and in a blinded fashion by two different, experienced echocardiographers during the same examination. All studies were then analyzed off-line by two independent, blinded readers. The following measurements were obtained: LV EF, end-diastolic and end-systolic volumes (LV EDV and LV ESV), mitral annular plane systolic excursion (MAPSE) and strain (global longitudinal (GLS) and circumferential (CS) [from mid-papillary short-axis view segments]). Reliability of measurements was measured by the Intraclass Correlation Coefficient (ICC) for single measures, and for each parameter the minimal difference detectable with a less than 5% chance of error was determined.

Results:
An excellent reliability was found between all measurements. For ICC, their 95% CI and intra-subject SDs, see table. The smallest detectable change in the studied echo parameters was: 1.7% (corresponding to 14.7% relative change) for GLS, 3.6% (35.6% relative change) for CS, 6.7% (14.4% relative change) for LV-EF and 1.1mm (10.7% relative change) for MAPSE.

Conclusion:
In the clinical setting, reproducibility of all echocardiographic parameters of left ventricular function was excellent in a wide range of ejection fraction. Surprisingly, reproducibility of volume based measures of LV-function, as well as AV-plane displacement was higher than previously reported and only slightly lower than for GLS. The smallest detectable change of EF, MAPSE and GLS ranged between 11-15%, while it was much higher for CS, ranging 35%.
Differences in intracellular lifetime of water between patients with and without concentric and eccentric left ventricular hypertrophy cannot be detected in a clinical setting at 1.5T

Magnus Lundin¹, Sara Demirtas¹, Andreas Sigfridsson¹, Peder Sörensson ¹, Martin Ugander¹

¹ Karolinska Institutet, CMR group

Background
Measurement of the myocardial extracellular volume fraction (ECV) assumes a dynamic equilibrium with rapid exchange between myocardium and blood manifested by a linear relationship between 1/T1 (R1) of myocardium and R1 of blood. This relationship has been shown to be non-linear for high R1 values in mice, and this has been used to calculate the intracellular lifetime of water (tau) and thereby estimate myocardial cell size. We sought to determine whether it is possible to detect differences in myocardial cell size using tau in patients with and without hypertrophy in a clinical setting.

Methods
Patients referred for cardiovascular magnetic resonance of suspected heart disease were prospectively enrolled. T1-mapping was undertaken at 1.5T using a modified Look-Locker inversion recovery (MOLLI) sequence before and approximately 4, 14 and 25 minutes after an intravenous bolus of a gadolinium-based extracellular contrast agent (gadoteric acid, 0.2 mmol/kg). Patients were categorized by left ventricular (LV) mass index (LVMi) and thickness to volume-ratio (TVR), defined as mean LV end-diastolic wall thickness divided by LV end-diastolic volume index. Patient groups were defined as normotrophic (normal LVMi, normal TVR), concentric hypertrophy (high LVMi, high TVR), and eccentric hypertrophy (high LVMi, normal TVR). Tau was calculated using non-linear fitting of myocardial R1 and R1 in blood at different contrast concentrations using published methods, see Figure.

Results
The intracellular lifetime of water (tau) was (median [interquartile range]) 110 [65-163] ms for the normotrophic group (n=19), and did not differ for concentric hypertrophy (n=23, 66 [9-119] ms, p=0.14 vs normal) or eccentric hypertrophy (n=19, 93 [5-116] ms, p=0.08 vs normal).

Conclusions
It is not possible to detect differences in the intracellular lifetime of water in patients with and without concentric or eccentric left ventricular hypertrophy using MOLLI T1-maps at 1.5T and a double dose bolus of a clinical contrast agent.
Background: Smartphone technology for assessment of acute myocardial ischemia by the generation of “smartphone 12-lead ECG” has recently been introduced. In the smartphone 12-lead ECG either the right or the left arm can be used as reference for the chest electrodes instead of the Wilson central terminal. These leads are labeled “CR leads” or “CL leads” (Fig. 1). We aimed to compare chest-lead ST-J amplitudes, using either CR or CL leads, to those present in the conventional 12-lead ECG, and to determine sensitivity and specificity for the diagnosis of STEMI for CR and CL leads.

Methods: 500 patients (74 patients with ST elevation myocardial infarction (STEMI), 66 patients with non-ischemic ST deviation and 360 controls) were included in the study. Smartphone 12-lead ECG chest-lead ST-J amplitudes were calculated for both CR and CL leads.

Results: ST-J amplitudes were 9.1 ± 29 V larger for CR leads and 7.7 ± 42 V larger for CL leads than for conventional chest leads (V leads). Sensitivity and specificity were 94 % and 95 % for CR leads and 81 % and 97 % for CL leads when fulfillment of STEMI criteria in V leads was used as reference. In ischemic patients who met STEMI criteria in V leads, thus excluding patients with ST elevation in limb leads only, STEMI criteria were met with CR leads in 92 % and CL leads in 90 %.

Conclusions: Regarding accuracy in STEMI detection, CR or CL leads can be applied with little loss of diagnostic information, but adjustment of STEMI criteria for smartphone leads should be considered.
Assessment of ventricular dimensions from computed tomography in a prospective cohort study: the SCAPIS Malmö-cohort

Johanna Backe, Anna Gilland, Andreas Martinsson, Einar Heiberg, Gunnar Engström, J. Gustav Smith, Ellen Ostenfeld

Background:
Left ventricular (LV) dimensions are associated with heart failure and mortality. LV dimensions can be accurately measured using coronary computed tomography angiography (CCTA). A rapid automated tool for robust assessment of CCTA-images is necessary for large cohorts. This study aimed to quantify LV mass (LVM) and end-diastolic volumes (EDV) in participants of a large prospective cohort study (The Swedish CardioPulmonary bioImage Study [SCAPIS], n=30,000).

Method:
Iodine contrast enhanced CCTA-images were obtained from 200 randomly selected participants of the Malmö-cohort of SCAPIS. The software Segment (Medviso, Lund) was optimized for automated delineation of chambers from CCTA-images and calculation of LVM and EDV. Estimates were compared to calculations from manual delineation. We calculated the inter- and intra-observer reliability for manual delineations using intraclass correlation coefficients (ICC), Pearson correlation coefficients (r) and Bland-Altman and Student’s t-test for gender differences.

Results:
Automated as compared to manual delineations reduced the image assessment times from 18.5 minutes to 4.8 seconds (99.6%). Manual measurements of LVM and EDV displayed both low inter- and intra-observer variability (ICC>0.99). Correlations and bias between automated and manual delineations were for LVM r=0.96 (p<0.001) with bias 18.3±10.6 g, and for EDV r=0.97 (p<0.001) with bias -4.7±6.8 mL. Mean LVM and EDV were 102.8±26.7 g and 122.3±30.0 mL. Men had larger LVM and EDV than women (120.6±22.5 vs 84.1±15.3 g and 132.4±31.4 vs 111.7±24.6 mL, p<0.001 for both).

Conclusion:
We describe a rapid, automated method to determine LV dimensions from CCTA-images. Further software optimization will reduce the observed systematic bias towards overestimation of LVM and underestimation of EDV, after which the method could be applied to the entire SCAPIS cohort. We also report sex-specific distributions of LVM and EDV from manual delineations in a general population cohort.
Measuring myocardial tissue velocity with single breath hold Golden-Angle radial high temporal resolution phase contrast magnetic resonance imaging: A comparison with pulsed wave tissue Doppler echocardiography

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² Department of Molecular and Clinical Medicine, Institute of Medicine, Sahlgrenska Academy, Gothenburg University

Background:
Myocardial velocity is typically measured by Doppler echocardiography. Obtaining high enough temporal using MRI is challenging, but highly undersampled radial imaging could potentially reach sufficient temporal resolution. The aim was to determine the temporal resolution and temporal footprint needed to measure myocardial velocities phase contrast MRI using a radial acquisition, and compare to Doppler echocardiography.

Methods:
Clinical patients (n=10, age 64±10 years, 60% female) referred for both CMR and echocardiography were scanned at 1.5T with a novel radial phase contrast (PC) pulse sequence with segmented golden-angle ordering. Short axis phase–contrast images were with through-plane shared velocity encoding at 200 frames per second. Relevant imaging parameters were TE/TR 2.0/6.8ms, VENC 30 cm/s, voxel size: 5x5x5mm³ and a breath hold duration of 12 heartbeats. Images were reconstructed in a sliding–window with a temporal resolution of 6.8ms and footprint ranging from 13.6ms to 86.4ms. Velocity within a region of interest was measured in the lateral wall using Segment (Medviso, Lund, Sweden). Echocardiographic velocities were obtained with pulsed–wave Doppler as a part of the clinical routine. Velocities were compared with the paired t-test, p<0.05 was considered statistically significant.

Results:
PC-CMR showed correlation with Doppler across all footprints. The velocity did not differ between PC-CMR and Doppler for footprints of 27.2–40.8ms with the lowest mean at 34ms (R²=0.87, mean difference±2SD 0.2±2.0cm/s), see Figure 1. With temporal footprints <27.2ms the velocity was higher when measured by PC-CMR.

Conclusions:
Lateral wall velocity measured with PC-CMR has excellent agreement with Doppler. The data suggest that a temporal footprint of <40.8 ms is required for accurate measurement of myocardial tissue velocities when compared to Doppler.
Exercise ECG in firefighters – true positive vs false negative results

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BACKGROUND
Exercise electrocardiography (ExECG) for detection of ischemic heart disease (IHD) in low-risk populations is discouraged because of low sensitivity and specificity. Nevertheless, it is still used in the mandatory evaluation of firefighters. We therefore aimed to evaluate the prevalence and predictive value of different ExECG responses in firefighters.

METHODS
Incremental ramp cycle ergometry to exhaustion was performed in 521 male firefighters. ST and heart rate (HR) data were collected during exercise and 3 minutes of recovery. Analysis of ST depression and the ST/HR recovery loop was performed. Age-adjusted odds ratio (OR) for future IHD was calculated with 95% confidence interval (CI), for ExECG variables from all leads except V1 and aVL. Positive predictive value (PPV) was calculated.

RESULTS
During 8.4±2.0 years of follow up, 10.4% were referred for myocardial scintigraphy or catheterization and 22.2% of those (age 51.5 ±5.5 years) were diagnosed with IHD. The remaining 509 subjects (44.2±10.1 years) had no imaging proof of IHD. Any-lead end-exercise ST depression ≥0.1 mV was found in 20% of the participants but was not associated with increased risk for IHD (OR 1.5, CI 0.4-5.2). The highest PPV of ST depression was found in V4 (16.7%), OR 9.6 (CI 2.3–40.0). Two thirds (8/12) of those who eventually developed IHD did not exhibit ST depression in any lead. In all analysed leads except V2, aVF and III, a clockwise-rotated ST/HR recovery loop was associated with significantly increased risk for IHD compared to counter-clockwise loops. Lead V5 had the highest PPV for clockwise-oriented loops, 50%.

CONCLUSIONS
Exercise-induced ST depression in this low-risk population was a blunt tool for prediction of future IHD, with a low PPV and a high rate of false negative results. ST/HR recovery loop analysis yielded higher, although still low, PPVs. We question the value of ExECG screening in firefighters.

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Background:
Electrocardiographic Decision Support – Myocardial Ischemia (EDS-MI) is a graphical decision support for detection and localization of acute transmural ischemia (Fig. 1). A recent study indicated that EDS-MI performs well for detection of acute transmural ischemia. However, its performance has not been tested in patients with non-ischemic ST-deviation. We aimed to optimize the diagnostic accuracy of EDS-MI in patients with verified acute coronary occlusion as well as patients with non-ischemic ST deviation and compare its performance to STEMI criteria.

Methods:
We studied 135 patients with non-ischemic ST deviation (perimyocarditis, left ventricular hypertrophy, takotsubo cardiomyopathy and early repolarization) and 117 patients with acute coronary occlusion. EDS-MI and STEMI criteria were applied to all patients. In 63 ischemic patients, the extent and location of the ischemic area (myocardium at risk (MaR) was assessed by both cardiovascular magnetic resonance imaging (CMR) and EDS-MI.

Results:
Sensitivity and specificity of STEMI criteria were 85 % (95 % confidence interval (CI) 77, 90) and 44 % (CI 36, 53) respectively. Using EDS-MI sensitivity and specificity increased to 92 % (CI 85, 95) and 81 % (CI 74, 87) respectively (p=0.035 and p<0.001).
Agreement was good (83 %) between CMR and EDS-MI in localization of ischemia. Mean myocardium at risk (MaR) was 32% (± 10) and 32 % (± 11) according to EDS-MI when the estimated infarcted area according to Selvester QRS scoring was included in MaR estimation.

Conclusions:
EDS-MI increases diagnostic accuracy and may serve as an automatic decision support in the early management of patients with suspected acute coronary syndrome. The added clinical benefit in a non-selected clinical chest pain population needs to be assessed.
Effects of the oral, direct factor Xa inhibitor edoxaban (Lixiana®) on routine coagulation assays, lupus anticoagulant and anti-Xa assays.

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Introduction:
Edoxaban (Lixiana®) is an oral direct factor Xa inhibitor for prophylaxis and treatment of thromboembolic disorders. The effects on common coagulation assays are clinically valuable information and in certain clinical situations a quick assessment of the anticoagulant is wanted.

Objectives:
To investigate the effect of edoxaban on routine coagulation methods and evaluate anti-Xa assays for specific determination of the drug concentration.

Material and Methods:
Edoxaban was spiked to plasma samples from healthy subjects in the concentration range 0 - 742 µg/L and analyzed using different reagents for activated partial thromboplastin time (APTT) and prothrombin time (PT). Assays for antithrombin, activated protein C resistance, lupus anticoagulant and chromogenic anti-Xa assays were also included.

Results:
Edoxaban displayed similar effects in vitro to other oral direct Xa inhibitors. The concentration needed to double the coagulation time varied between assays and reagents; 539 - 758 µg/L for the APTT and between 329 and 2505 µg/L for the PT. Edoxaban gave, as expected, false high antithrombin activities in assays based on Xa-inhibition, but no effect on thrombin-based assays. Two integrated assays for lupus anticoagulant, both based on activation with dilute Russell’s viper venom, displayed different results. Chromogenic anti-Xa assays displayed linear dose-response curves with edoxaban up to approximately 500 µg/L.

Conclusions:
Therapeutic concentrations of edoxaban variably affect different coagulation assays, and even different reagents within an assay group. APTT will be within normal range for most patients and the PT method used in Sweden is very insensitive and thus both methods are not at all useful for estimation of edoxaban concentration. Lupus anticoagulant methods may show false positive results. For measurement of edoxaban concentration in plasma it’s possible to use the chromogenic anti-Xa assays.
Adults with Complex Congenital Heart Disease have altered body composition despite normal Body Mass Index

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Background:
Adults with Congenital Heart Disease (CHD) is a growing population due to advances in child heart surgery and medicine. Previous research has shown that adults with CHD have impaired muscle endurance capacity. This, together with the finding that especially men with complex lesions tend to be slightly shorter and weigh less than their healthy peers, suggests an altered body composition. Therefore, we hypothesized that adults with complex CHD have less muscle mass and more fat mass, compared to a healthy control population.

Methods:
The body composition was examined, using Dual-Energy X-ray Absorptiometry (DXA), in 54 adult patients (mean age 35.7±14.1, women n = 14) with complex CHD and 54 healthy age and gender matched controls.

Results:
No differences were found between patients and controls regarding height, weight or BMI. However, patients with CHD had lower total lean mass, arm lean mass and leg lean mass compared to the controls (48.7±8.7kg vs. 53.8±9.3kg, p=0.004, 5.8±1.7kg vs. 6.7±1.8kg, p=0.012, 15.9±3.3kg vs. 18.5±3.3kg, p≤0.001). Furthermore, the patients had a higher percentage of tissue body fat compared to the controls (30.9±9.4% vs. 26.5±9.0%, p=0.015). Despite this, there were no differences in amount of visceral adipose tissue (0.96±0.67kg vs. 0.79±0.96kg, p=0.3).

Conclusions:
Although they had a normal BMI, the patients with complex CHD had lower lean mass i.e. muscle mass compared to the controls. In addition, they had a higher proportion of body fat, however not distributed around the visceral organs. This implies that the use of traditional body measurements can be misleading in this population and therefore an extended investigation of true body composition with DXA might be indicated. The functional significance and prognostic implication of these findings are unknown and will be further investigated.
Geographical variation in and predictors of physical activity level in adults with congenital heart disease

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Background
Physical activity is important to maintain and promote health. This is of particular interest in patients with congenital heart disease (CHD) where acquired heart disease should be prevented. The World Health Organization (WHO) recommends a minimum of 2.5 hours/week of physical activity exceeding 3 metabolic equivalents (METS) to achieve positive health effects. It is unknown whether physical activity levels (PAL) in adult CHD patients differ by country of origin.

Methods
4028 adults with CHD recruited from 15 countries over 5 continents completed self-reported instruments, including the Health Behaviour Scale (HBS-CHD), within the APPROACH-IS project. For each patient, we calculated whether WHO recommendations were achieved or not. Associated factors were investigated using Generalized Linear Mixed Models.

Results
On average, 27% reached the WHO recommendations but with a great variation between geographical areas (Japan: 9% – Norway: 49%). Predictors for PAL in line with the WHO recommendations, with country of residence as random effect, were male sex (OR 1.68, 95%CI 1.43-1.97), NYHA-class I (OR 2.79, 95%CI 1.54-5.06) and less complex disease (OR 1.28, 95%CI 1.02-1.62). In contrast, older age (OR 0.97, 95%CI 0.97-0.98), lower educational level (OR 0.41, 95%CI 0.26-0.65) and being unemployed (OR 0.58, 95%CI 042-0.78) were negatively associated with reaching WHO recommendations.

Conclusions
A significant proportion of patients with CHD did not reach the WHO physical activity recommendations. There was a large variation in PAL by country of origin. Based on identified predictors, vulnerable patients may be identified and offered specific behavioural interventions.
Early real-world implementation of sacubitril/valsartan in Sweden

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Introduction
Sacubitril/valsartan (s/v) improves outcomes in heart failure (HF) with reduced ejection fraction, is recommended in international guidelines, and reimbursed in Sweden since April 2016. However, information on its real-world use is scarce.

Purpose
To assess temporal trends in s/v use, dose titration strategies, background medications and demographic factors in the Swedish population who were prescribed s/v.

Methods
The Swedish Prescribed Drug Register covers all drug dispensations in Sweden. In patients with ≥1 dispensation of s/v, we collected data on demographics, prior HF medications, and dose trends for consecutive dispensations on a national level and for the four (out of 21 in total) geographic regions with the highest dispensation numbers.

Results
Between January 2016 and August 2017, there were 1358 patients with ≥1 dispensation of s/v, 1119 patients with ≥2; 944 patients with ≥3; and 741 patients with ≥4 s/v dispensations. Mean age of all patients was 68.0 years, 30.3% were ≥75 years, 3.3% were ≥85 years, and 19.1% were female. Prior to the first s/v prescription 92.9% had a RAAS inhibitor (ACE inhibitor/ARB), 93.9% a beta-blocker and 75.4% a mineralocorticoid receptor antagonist. The majority of the first dispensations were 24/26 and 49/51 mg doses but also a large proportion of subsequent dispensations were at low doses. Some regions started s/v and continued it at lower doses whereas others generally initiated treatment at the highest dose (Figure 1).

Conclusions
In this nationwide study with complete coverage of actual dispensations, a majority of patients were treated with guideline recommended HF medications prior to the first s/v dispensation. The following trends were observed: (1) lower use of HF medication in women and elderly; (2) insufficient s/v dose uptitration; and (3) highly variable s/v dosing between regions.
Why do patients not receive triple therapy? Obstacles to mineralocorticoid receptor antagonists in a community based heart failure population in northern Sweden

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Background
Previous studies and national assessments indicate an undertreatment of mineralocorticoid receptor antagonists (MRA) in heart failure with reduced ejection fraction (HFrEF). This study aims to investigate why MRA is not used to full extent.

Methods
A community based heart failure population in Sweden was studied. Approximately 90 variables were collected, and the medical records were scrutinized to identify reasons for not prescribing MRA.

Results
Of 2029 patients, 812 had EF ≤ 40 %, 553 patients (68%) tried MRA at some point but 184 (33%) of these discontinued therapy. There were 259 patients that never tried MRA of which 177 had a listed explanation or contraindication. 82 patients, 10% of the total HFrEF population, had no clear contraindications. They were older and had less HF hospitalizations compared to patients on MRA (p <0,05) and 32% did not have any follow up at the cardiology clinic. Contraindications to MRA were renal dysfunction (92 patients), hypotension (28 patients) and hyperkalemia (25 patients). Only six patients had hyperkalemia without renal dysfunction. Of the patients with renal dysfunction, 66 (72%) had eGFR > 30 ml/min.

Conclusions
The reasons why MRA are underutilized were mainly because of contraindications. However, the data indicate that the physicians are overly cautious about moderately reduced kidney function. There seems to be a 10% avoidable under treatment with MRA, especially for elderly patients that are admitted to the hospital for other reasons than heart failure. This suggests that patients with heart failure would benefit from routine follow up at a cardiology clinic.
Are target doses relevant for women with heart failure? - Implications for Sacubitril-Valsartan

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Background:
In the PARADIGM-HF trial sacubitril-valsartan reduced heart failure hospitalizations and cardiovascular death by 20% compared to enalapril. The proportion of women in the study was only 21%. Previous work has shown that in a community based heart failure population the proportion of women eligible for sacubitril-valsartan is only 16%. This is surprising since the total heart failure population is evenly distributed.

Purpose:
To investigate why so few women are eligible for treatment with sacubitril-valsartan.

Methods:
We applied the PARADIGM-HF main entry criteria to a community based heart failure population in northern Sweden and statistically compared the women and men cohort.

Results:
Of the whole heart failure population of 1924 patients, 43% were women. After applying PARADIGM-HF entry criteria, only 15 women were eligible for the trial, corresponding to 16% of eligible patients. The most common reason for not fulfilling the criteria was failure to reach ACE inhibitor/ARB target dose. In patients with heart failure and reduced ejection fraction (HFrEF) women were older, had lower body weight, lower eGFR, and higher systolic blood pressure (p <0.05). Besides lower doses of ACE inhibitor/ARB, heart failure therapy did not differ between the genders except that women were more often prescribed loop-diuretics and less likely to have an implantable cardioverter defibrillator or cardiac resynchronization therapy defibrillator.

Conclusions:
Fewer women suffer from HFrEF and tolerate target doses of ACE inhibitor/ARB, and are consequently less eligible for sacubitril-valsartan. Women probably tolerate target doses to a lesser degree owing to age, lower volume of distribution, and renal function. Though, we cannot exclude that women are treated differently because of gender bias. Target doses as entry criteria in clinical trials favors men, and consequently current guideline target doses are mainly based on men, we therefore suggest more individualized doses to women with heart failure.
Population wide introduction of novel heart failure treatments - Experience with Sacubitril-Valsartan in a community based heart failure population in northern Sweden

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Background:
Heart failure is a chronic disease where many patients do not have regular contact with cardiologists. When novel treatments arrive the introduction phase often takes several years before all eligible patients have been considered. With the computerization of medical records and emergence of quality registries we wanted to investigate the feasibility of using local registries for mass screening of patients eligible for Sacubitril-Valsartan and introducing treatment on all appropriate patients.

Methods:
All patients with a diagnosis of heart failure that had had at least one contact with the dept of cardiology or internal medicine at Umeå University Hospital between 2010-2016 were identified. All patients who were eligible for treatment were identified and summoned to an out patient visit.

Results:
Out of 2029 patients with heart failure, 622 had ejection fraction (EF) ≤ 40%, 250 of these tolerated at least half dose ACE-inhibitor/ARB and fulfilled other formal criteria for inclusion in the PARADIGM-HF study. After discussion with the local pharmaceutical committee, for budget reasons we decided to summon all patients who were on maximum dose ACE-inhibitor/ARB and had EF ≤ 35%, a total of 95 patients. After excluding patients with other terminal illness, whose condition had changed, a total of 76 patients were summoned.

Conclusion:
Using a local registry for mass screening was feasible and helped identify patients in need for treatment. Even with a strict interpretation of the study criteria, Westerbotten county had the fastest introduction of Sacubitril-Valsartan in Sweden. Using this method patients receive the benefit of novel treatments considerably faster than the conventional way of identifying patients when they present themselves in the clinic. It is also likely that this approach helps with the cost effectiveness of new treatments guaranteeing that strict criteria is used in the selection process.
Cardiac resynchronization therapy with- or without defibrillator, a single center observational study

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Introduction
Using cardiac resynchronization therapy on patients with heart failure there is a choice whether or not to add a defibrillator function (CRT-P or CRT-D). There is not much data showing a survival benefit with CRT-D vs CRT-P and defibrillators on their own have shown to be of little use in NYHA class I or IV. Guidelines do not give clear guidance on the matter and there are large regional variations in ratio between CRT-P vs CRT-D. There is a clear need for more robust guidelines in which patients who should receive CRT-P or CRT-D in order to avoid unnecessary sudden death, but also unnecessary suffering at end of life. A simple clinical score, the Goldenberg score has shown to correlate with survival in these patients. We aimed to investigate if this score system could be useful in clinical practice in choosing between CRT-P or CRT-D.

Methods
The Goldenberg score gives one point each for; age>70, atrial fibrillation, QRS>120 ms, eGFR<60 and NYHA-class >2. A high score denotes high morbidity. We retrospectively applied this score on a community based heart failure population with CRT-P or CRT-D.

Results
A high Goldenberg score was associated with a higher mortality (p >0.001) and there was a good correlation (68%) with the Clinical decision of CRT-P or CRT-D. Patients with a high Goldenberg score who still received CRT-D did not have a mortality benefit.

Conclusion
Our data show that patients with a high risk score do not seem to benefit from adding a defibrillator to their CRT. The data also indicate that a restrictive use of CRT-D may be prudent. The Goldenberg score seems to be a useful tool in deciding which patients to select for CRT-P vs CRT-D. Using a score system could be helpful in detecting unfounded local practices.
The European cardiac resynchronization therapy survey II: a sub analysis of the Swedish data

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Aims
In recent ESC HF Guidelines CRT is recommended in wide QRS > 130 ms and LBBB as well as to patients expected to need full extent of RV pacing. Yet therapy implementation and quality of care differs across geographies which was studied in the European cardiac resynchronization therapy (CRT) Survey II. The results of the CRT survey II encompassing 10,088 new CRT implantations or upgrades in 42 ESC member countries were recently published. We compare the Swedish patients included in the survey to the entire study population.

Methods and results
Of 10,088 patients included in the CRT Survey II 255 were included in Sweden across 7 centres. The main findings regarding patients demographic, choice of device and underlying rhythm disturbances are presented in table 1. In the Swedish patients group evidence of dyssynchrony on echocardiography was rarely evaluated prior to CRT implantation (0.4% vs 11.8%, P<0.00001) but the QRS morphology on the 12 leads ECG was a typical left bundle branch block in only 57.9% of the cases while in the general population this figure was 73.1% (P<0.00001).
Swedish patients were more likely to receive a multipolar left ventricular lead (71.4% vs 56.7%, P<0.00001) and they had a shorter hospital stay (5.6±13 days vs 6.3±11 days, P<0.00001).

Conclusions
Swedish patients were older and more often were given CRT-P rather than CRT-D. Patients were more often treated due to high degree AV block than the full CRT Survey II cohort and less often had LBBB. The mean hospital stay was remarkably shorter. This analysis showed some relevant differences in choice of device and patient selection between the CRT Survey II study population and the Swedish patients included in the survey. The observed variation might reflect differences in local policies and patient population.
How often do heart failure patients need to adjust their diuretics dose?

Andreas Blomqvist

Background:
A novel m-Health tool titrates heart failure (HF) patients’ diuretics dose based on weight changes. Little has been published on how often these patients need to adjust their diuretics. The purpose of this analysis was to investigate how often the condition “≥2 kg in ≤3 days” was met during 6 months, and if it was affected by age, gender or NYHA-class.

Methods:
Data from 41 patients from Hemse, Gotland who were equipped with the tool for 6 months was analyzed. The mean age was 77+/-8, 70% were male, 10% NYHA-class I, 41% NYHA-class II and 49% NYHA-class III. Every time the weight change condition was met, the patient was recommended a higher dose and this was registered in the tool. Negative binomial regression was used to investigate the influence of age, gender and NYHA-class on the number of dose increases. Other tests used were logistic regression, Mann-Whitney-U test and chi-2 test.

Results:
NYHA-class III predicted more dose increases (p = 0.04). The median number of dose increases for NYHA-classes I and II was 1, and for NYHA-class III the corresponding number was 3 (p = 0.02). 70% more patients with NYHA class III received a dose increase compared to patients in the other classes (p = 0.03). Gender did not have any influence (p = 0.3). There was a non-significant tendency that younger patients had more dose increases (p = 0.17). 24% of the patients never had a dose increase.

Conclusions:
Sudden weight changes are more prevalent among patients with more severe HF. A flexible diuretics regimen may be an important part in treating these patients.
Should we monitor absolute or relative weight changes in heart failure patients when trying to define thresholds for intervention?

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Background:
In European guidelines, a weight change of ≥2 kg in ≤3 days, has been proposed as a trigger for an increased dose of loop-diuretics. It has been suggested that this recommendation is not appropriate and that a weight change relative to the patient’s body weight, used as a trigger would be preferable. A novel mHealth-tool evaluated in the primary care setting on Gotland, recorded the patients’ daily weights, and the purpose of this analysis was to use that data to investigate whether there is any correlation between the patients’ weights and absolute or relative weight changes, to guide future recommendations.

Methods:
Data from 41 patients with daily weight registered during 6 months was available. The mean age was 77+/-8, 70 % were male, 10 % NYHA-class I, 41 % NYHA-class II and 49 % NYHA-class III.
The correlation analysis was performed using linear regression.

Results:
The mean weight was 92+/-22 kg (females 73+/-16, males 100+/-19).
The difference between the highest and lowest weights registered was 6.6+/-2.0 kg, or 8.3 % +/- 3.8 % in relation to the body weight. The correlation between body weight and absolute weight change was |R| = 0.07, p=0.7 and between body weight and relative weight change |R| = 0.6, p<0.001.

Conclusions:
Absolute weight changes do not correlate with body weight, but relative changes do. A relative weight threshold seems to require patient specific calibration, so the absolute threshold should probably be maintained. This analysis does not provide insight to which kind of trigger that has the highest predictive value, in terms of identifying an imminent exacerbation.
Increased all-cause mortality in newly diagnosed patients with heart failure between 2006 and 2012: a retrospective, population-based study in Sweden

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Background:
Evidence of decreasing incidence and increasing prevalence of heart failure (HF) over time in Sweden suggests a changing composition of patients’ characteristics. Factors influencing these trends were studied in newly diagnosed patients.

Methods:
Patients with HF were identified from the National Patient Register (NPR) linked to the Cause of Death Register. Patients ≥18 years with ≥2 diagnoses of HF between 2006 and 2012, and an ICD-10 diagnostic code of I50 (inclusive of granular codes), I42.0, I42.6, I42.7, I42.9, I11.0, I13.0 or I13.2 (any position) were included. Date of first diagnosis was the index date. ICD-10 codes identified comorbidities occurring in the 5 years before index. A 10-year look-back was used to exclude prevalent HF cases. A Cox proportional hazards model estimated hazard ratios (HRs; adjusted for age, sex and year of diagnosis) and 95% CIs for all-cause mortality at 1 year post-index for years 2006–2012.

Results:
Overall 141,607 patients were identified as newly diagnosed with HF in the NPR during 2006–2012 (median age: 80 years; 47% women; 80% first diagnosed in an inpatient setting). Patients’ mean age was constant at 77 years, their Charlson comorbidity index increased (1.4 to 1.6, P<0.0001) and the proportion of patients with previous myocardial infarction decreased (14% to 12%, P<0.0001) during the study period. One- and three-year mortality increased over time (Figure); the risk of mortality 1 year post-index increased (HR [95% CI] vs 2006: 2007, 1.06 [1.01,1.10]; 2008, 1.04 [1.00,1.08]; 2009, 1.07 [1.02,1.11]; 2010, 1.08 [1.03,1.13]; 2011, 1.18 [1.13,1.23]; and 2012, 1.34 [1.29,1.40]; P<0.0001 for 2007 and 2009–2012 vs 2006.

Conclusions:
These results suggest a shift in the clinical profile and HF aetiology of newly diagnosed patients with HF over time. The increasing comorbidity burden might explain the increasing mortality over time in patients with newly onset HF, and indicates the need for intense evaluation and care of these patients.
Echocardiographic estimation of left ventricular filling pressure in heart transplant recipients

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Background
Noninvasive evaluation of left ventricular (LV) filling pressure is challenging and several echocardiographic parameters are routinely used in clinical practice. Following heart transplantation (HTx) invasive evaluation are conducted through right heart catheterization the first year. The purpose of this study was to evaluate if any echocardiographic parameter showed correlation to invasive measurements and thereby could be used for estimation of left ventricular filling pressure after HTx.

Methods
Fifty-four clinically stable HTX patients (male n=44) were prospectively examined with echocardiography 1 year after transplantation. Diastolic function were assessed using routine parameters (i.e mitral E-wave and A-wave, E/A-ratio, lateral é and E/é- ratio) according to guidelines. LV filling pressure and mean left atrial pressure were estimated invasively with a Swan Ganz Catheter using the pulmonary capillary wedge pressure (PCWP). Echocardiography was performed and analyzed using Philips iE33 and Philips Xcelera software. Pearson correlation coefficients were used to evaluate echocardiography against invasive measurements.

Results
The magnitude of E-wave showed a moderate correlation to invasively measured PCWP (R= 0.44, p<0.001), E/A-ratio correlated weakly to PCWP (R= 0.31, p<0.05), whereas A-wave velocity, lateral é and E/é-ratio showed no correlation to PCWP (n.s.).

Conclusion
Early LV filling, represented by mitral E-wave, showed superior correlation to invasive PCWP. The weak correlation observed between E/A-ratio and PCWP is probably driven by the magnitude of E-wave velocity. The fact that mitral A-wave did not correlate to invasive measures of filling pressure is likely a result of the surgical procedure and could indicate that the normal atrial contribution to LV filling is disturbed. HTx-patients are previously described to have reduced LV longitudinal function which might explain why é velocity fail to reflect invasively measured filling pressure. Based on our findings we recommend that mitral E-wave velocity should be the preferred parameter when evaluating diastolic function in HTx-patients.