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**Abstract Book**

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# **SATS ORAL PRESENTATIONS**

## **01 - 022**

## The Effects of Atrial Natriuretic Peptide on Renal Function During Cardiopulmonary Bypass – A Randomized Blinded Study in a Pig Model

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**BACKGROUND:** Acute kidney injury is a well-known complication after cardiopulmonary bypass (CPB). In the present animal study, we evaluated the effects of atrial natriuretic peptide (ANP) on renal function, perfusion, oxygenation and tubular injury during CPB.

**METHODS:** Twenty pigs (mean 56kg) were blindly randomized to infusion of ANP (50ng/kg/min) or placebo (0.9 % saline solution) before, during and after CPB. A renal artery flow probe measured renal blood flow (RBF) and laser Doppler flowmetry measured cortical and medullary perfusion. The renal oxygen consumption (RVO<sub>2</sub>) and oxygenation was measured by a renal vein catheter. Glomerular filtration rate (GFR) was measured by infusion clearance of <sup>51</sup>Cr-EDTA. Laser Doppler Flowmetry (LDF) probes were applied to the kidney to assess cortical and medullary blood flow separately. Data were obtained before, during and after CPB.

**RESULTS:** GFR was higher ( $p < 0.001$ ) while RBF or renal oxygen delivery was not affected by ANP during CPB. RVO<sub>2</sub> did not differ between groups during CPB, while renal oxygen extraction was higher in the ANP group ( $p = 0.03$ ). Sodium excretion was 7-fold higher in the ANP group during CPB. The release of the tubular injury marker (NAG) did not differ between groups. The medullary blood flow dropped while on CPB, an effect that was inhibited by ANP.

**CONCLUSIONS:** Despite impaired renal oxygenation, ANP did not cause tubular injury, suggesting a renoprotective effect of ANP during CPB. The CPB-induced effect on the medullary blood flow is a new and unexpected finding. This points to a possible new understanding of the pathophysiological mechanism for post-CPB renal injury.

### Reference 1:

O'Neal, J. B., A. D. Shaw, et al. (2016). "Acute kidney injury following cardiac surgery: current understanding and future directions." *Crit Care* 20(1): 187.

### Reference 2:

Sward, K., F. Valsjö, et al. (2004). "Recombinant human atrial natriuretic peptide in ischemic acute renal failure: a randomized placebo-controlled trial." *Crit Care Med* 32(6): 1310-1315.

## Infective Endocarditis in Right Ventricular Outflow Tract Conduits: A Register-based Comparison of Melody Transcatheter Valves, Contegra Conduits and Homografts

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### Objectives

The objective of this study was to investigate the incidence of infective endocarditis (IE) in homografts, Contegra grafts and Melody valves implanted as right ventricular outflow tract conduits at a Danish tertiary centre.

### Methods

Cases of IE in patients with a homograft, Contegra graft or Melody valve were evaluated with regards to conduit involvement and scored according to the modified Duke criteria. Incidence rates for IE and survival free of IE were calculated separately for all three conduits and for Melody subgroups depending on which conduit served as landing zone.

### Results

432 conduits were implanted in 300 patients. Annual incidence rates of IE were 0.23 % for homografts, 0.92 % for Contegra grafts (HR 2.24, 95 % confidence interval (CI) [0.68; 7.40],  $p = 0.19$ ) and 2.60 % for Melody valves (HR 6.74, 95 % CI [2.22; 20.42],  $p = 0.001$ ). Subgroup analysis revealed annual incidence rates of 1.74 % for Melody valves in homografts and 7.13 % for Melody valves in Contegra conduits (HR 3.44, 95 % CI [0.76; 15.50],  $p = 0.11$ ). Median time between surgery and onset of symptoms related to IE was 2.25 years (interquartile range (IQR) 0.32-6.92) for homografts, 3.70 years (IQR 0.87-4.02) for Contegra conduits, 0.98 years (IQR 0.54-1.91) for Melody valves.

### Conclusion

Infective endocarditis was significantly more frequent and survival free of IE significantly shorter for Melody valves compared to homografts, whereas no significant difference was found between Melody valves and Contegra grafts, Contegra grafts and homografts or Melody subgroups. Larger studies are needed to confirm these findings.

### Reference 1:

Van Dijck I, Budts W, Cools B, et al. Infective endocarditis of a transcatheter pulmonary valve in comparison with surgical implants. *Heart*. 2014;1-6. doi:10.1136/heartjnl-2014-306761.

### Reference 2:

Uebing A, Rigby ML. The problem of infective endocarditis after transcatheter pulmonary valve implantation. 2015;0(0):1-4

## 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 and aortic valve infective endocarditis (MVE and AVE, respectively) are usually grouped together as left-sided native valve endocarditis (LNVE), while the differences between AVE and MVE have not yet been properly investigated. We aimed to compare MVE and AVE regarding patient characteristics, microbiology, and determinants of survival.

### Methods

We conducted a retrospective study using the National Swedish Endocarditis Registry, which contains nationwide patient data from 2007-2017. Cases were patients with either AVE or MVE.

### Results

We included 649 cases with MVE and 744 with AVE. *Staphylococcus aureus* (*S. aureus*) was more often the causative pathogen in MVE (41% vs. 31%,  $p < 0.001$ ), whereas enterococci more often in AVE (14% vs. 7.4%,  $p < 0.001$ ). Abscesses were more frequently found in AVE (8.5% vs. 3.5%,  $p < 0.001$ ), and brain embolisms more frequently in MVE (21% vs. 13%,  $p < 0.001$ ). Surgery was performed more often (35% vs 27%,  $p < 0.001$ ), and sooner after diagnosis (6.5 days vs. 9 days,  $p = 0.012$ ) in AVE than in MVE. Several risk predictors differed between the two groups.

### Conclusions

The microbiology appears to differ between AVE and MVE, which might be explained by the physiological differences between the two valves. The causative pathogen likely plays a lesser role than pressure conditions around the valves in tissue invasiveness. *S. aureus* AVE should therefore not necessarily be seen as an indication for surgery. Between-group differences regarding the presence of abscesses, brain embolisms, and time delay of diagnosis, indicate that it is important to differentiate AVE from MVE in the treatment of LNVE.

## Small Atrial Septal Defects: A nationwide study

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### Background

In a recent Danish nationwide register-based study from our group, adults with small, unrepaired atrial septal defects (ASD) have been found with increased risk of pneumonia, atrial fibrillation and stroke. Moreover, they revealed higher mortality than the background population. We wish to characterize adults with small, unrepaired ASD.

### Methods

In a nationwide descriptive study, all Danish patients, aged 18 to 65, diagnosed between 1953 and 2011 with an unrepaired ASD and still alive were invited for transthoracic echocardiography. Furthermore, all received the National Health Profile (NHP) questionnaire, aiming at comparing patients with the general population. The entire patient group were also characterized using the unique Danish registries.

### Results

A total of 153 patients (mean age: 32yr) were included. An open defect was verified in 20% (n=30) of the patients, of which, half needed intervention. Most due to dilated right heart chambers (n=10). Since time of diagnosis, 182 patients had died. The most common cause of death was heart failure.

From the NHP, more patients are found with chronic diseases than the general population (38.2% vs. 26.9%;  $p=0.005$ ), particularly lung disease (3.6% vs. 0.9%;  $p=0.008$ ). Also, 25.5% of the patients often felt stressed or nervous as compared with 16.3% of the general population ( $p=0.004$ ). Moreover, patients revealed a higher degree of anxiety and self-assessed their physical function significantly poorer.

### Conclusion

Small, unrepaired ASD patients need to continue routine follow-ups, since patients have increased risk of premature death and almost 10% needed intervention due to progression in haemodynamic significance.

## 30-day mortality in Frail patients undergoing Cardiac Surgery

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### Background

In general, patients referred to cardiac surgery are aging. Therefore, frailty assessment has become interesting as potential predictor for mortality after cardiac surgery.

### Material and methods

In a prospective observational study we have compared the surgical outcome in frail versus non-frail patients. Patients aged > 65 years and undergoing non-acute cardiac surgery were included. Frailty was assessed with the comprehensive assessment of frailty (CAF) score. CAF evaluate the patients physical condition through performing less physical tests, consisting of strength, balance and walking speed.

### Results

A total of 604 patients were included. The mean age was  $72.9 \pm 4.8$ , and 79 % (477) were men. Twenty-five per cent were deemed frail. Frail patients had a higher 30-day mortality ( 5% vs. 1%,  $p=0.006$ ) and more likely received a combined procedure (23% vs. 13%,  $p=0.003$ ). ). Furthermore, frail patients had twice as many re-operations, five times more gastrointestinal complications, three times as many who developed renal failure, twice as many who was in need of dialysis, developed delirium and needed prolonged ventilation. Patients who died within 30 days had a significant higher CAF score than those who survived ( $p=0.021$ ).

### Conclusion

Frailty is associated with increased risk of 30-day mortality, postoperative complications and CAF score may be a significant instrument for patient selection in cardiac surgery.

### Reference 1:

Sündermann S, Dademasch A, Praetorius J, Kempfert J, Dewey T, Falk V, et al. Comprehensive assessment of frailty for elderly high-risk patients undergoing cardiac surgery. *Eur J Cardiothorac Surg.* 2011;39:33–7

### Reference 2:

Sündermann S, Dademasch A, Rastan A, Praetorius J, Rodriguez H, Walther T, et al. One-year follow-up of patients undergoing elective cardiac surgery assessed with the Comprehensive Assessment of Frailty test and its simplified form. *Interact Cardiovasc Thorac Surg.* 2011;13:119–123



## Modified surgery using a rapid deployment aortic valve

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### **Background**

Rapid deployment aortic valve replacement (RAVR) may facilitate cardiac surgery in patients with aortic valve stenosis. We adopted a surgical strategy using primarily RAVR operated through hemisternotomy. Traditional biological or mechanical aortic valve replacement (AVR) via hemisternotomy was performed whenever the aortic valve was asymmetrical, during annulus enlargement and during a bioBentall operation. Sternotomy was utilized whenever a concomitant cardiac procedure was necessary.

### **Material and Methods**

We report our initial experience on 41 consecutive patients treated with a RAVR operated either via hemisternotomy (n=17) or sternotomy (n=14), and AVR via hemisternotomy (n=10). Concomitant surgery included tricuspid valve annuloplasty, coronary artery bypass grafting and septal myectomy.

### **Results**

Altogether, 39 patients recovered. Two patients with RAVR and one with AVR had a paravalvular leak perioperatively. One patient with RAVR and tricuspid valve surgery underwent hemostasis. Two patients with AVR and intended hemisternotomy underwent sternotomy and concomitant coronary bypass grafting. Two patients (one with RAVR and one with AVR) received a pacemaker. Two patients died at hospital; an emergent comorbid patient with end-stage chronic obstructive pulmonary disease doomed initially inoperable underwent RAVR and hemisternotomy died after suffering from mediastinitis. Another patient with RAVR via hemisternotomy underwent hemostasis through sternotomy, but died unexpectedly due to cardiac failure. One patient with RAVR and coronary bypass grafting through sternotomy experienced sternal dehiscence.

### **Conclusions**

A tailored surgical approach using RAVR aids surgery in patients with aortic valve stenosis. Follow-up of patients with RAVR and AVR is mandatory.

### **Reference 1:**

Borger MA et al. Haemodynamic benefits of rapid deployment aortic valve replacement via a minimally invasive approach: 1-year results of a prospective multicentre randomized controlled trial. *Eur J Cardiothorac Surg.* 2016;50:713-20

## Preoperative dual antiplatelet therapy increases bleeding but not mortality in acute aortic dissection type A repair – a NORCAAD report

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### Background

Acute aortic dissection type A is a life-threatening condition, warranting immediate surgery. Presentation with sudden chest pain infers a risk of misdiagnosis, especially as acute coronary syndrome with subsequent potent antiplatelet treatment. We investigated the impact of dual antiplatelet therapy (DAPT) on bleeding and mortality in the Nordic Consortium for Acute Type A Aortic Dissection (NORCAAD) registry.

### Materials and methods

NORCAAD is a retrospective multicenter registry where 135 of 1159 patients (11.6%) had DAPT with ASA+clopidogrel (n=122) or ASA+ticagrelor (n=13) before surgery. We conducted a propensity score matching (PSM), yielding 361 controls and analyzed with logistic regression. Endpoints were major bleeding and 30-day mortality.

### Results

Before PSM, DAPT patients had 48.9% major bleeding, compared to 37.7% in non-DAPT patients ( $p=0.017$ ). DAPT patients received more transfusions of red blood cells, (median 8U (range 0-87) vs. 6U (0-169),  $p<0.0001$ ) and platelets (median 4 (0-22) vs. 2U (0-42),  $p<0.0001$ ). Crude 30-day mortality was 19.3% vs. 17%, respectively. After PSM, major bleeding remained significantly different between groups, 48.9% vs. 34.6% (OR 1.81, 95%CI 1.21-2.70,  $p=0.004$ ), however, OR for mortality after PSM was not significant (OR 0.97, 95%CI: 0.59-1.61  $p=0.92$ ). Major bleeding per se was associated with increased mortality (OR 2.05, 95%CI 1.31-3.21,  $p=0.0017$ ).

### Conclusions

DAPT prior to acute aortic dissection repair was associated with increased bleeding and transfusions, but not with mortality. Our results indicate that acute surgery in aortic dissection is warranted regardless of DAPT or not before surgery. Major bleeding in itself was associated with a significant increase in 30-day mortality.

## Long-term Results after Mechanical Composite Graft Replacement of the Aortic Root

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### Background

Aortic root replacement with a mechanical composite graft is standard treatment in patients with acute Type A dissection and elective procedures such as aortic root dilation. The aim of this study was to evaluate the long-term results of this procedure in a single high volume surgical center

### Methods

This was a retrospective, observational cohort study. All mechanical composite graft implantations performed at Rigshospitalet, Copenhagen, Denmark from February 1998 until February 2017 were included. Patients under 18 years were excluded.

### Results

255 patients were identified. Mean age was 51.5 years (range 19-79 years), 82.8% were males. The most common indications were root dilation (53.7%) and type A dissection (37.2%). Nineteen percent of our patients had previously undergone cardiac surgery. Non-elective surgery accounted for 44.3%. 30-day mortality was 27.8% for type A dissection, 2.2% for root dilation and 9.1% in remaining patients. Independent risk factors for early mortality in multivariate logistic regression were age >61 years (OR:3.76; CI95%[1.448-9.751]; P = .007;) and type A dissection (OR:5.63; CI 95%[1.490-21.284]; P = .011). Overall 5-year survival was 74.8% (60.0% for type A-dissection, 84.84% for root dilation and 88.9% for remaining indications). The excess mortality in patients with aortic dissection was confirmed to the early postoperative period whereas survival from day 30 was similar in groups, Figure.

### Conclusions

Patients undergoing elective mechanical composite graft implantations had low 30-day mortality whereas 30-day mortality in emergent cases was considerably higher, but beyond 30 days outcome was similar in groups with 75% of 30 days survivors being alive after 10 years.

## Acute Kidney Injury Following Surgery for Acute Type A Aortic Dissection: Incidence, Risk Factors and Survival

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**Background:** The aim of this study was to examine the incidence and risk factors of acute kidney injury (AKI) following surgery for acute type A aortic dissection (ATAAD). Furthermore, mid-term survival of patients who developed AKI was studied, using the NORCAAD registry.

**Materials and Methods:** A total of 1159 patients underwent ATAAD surgery at eight Nordic centers from 2005-2014. Patients were excluded if they died intraoperatively, had missing baseline or postoperative serum-creatinine measurements or required dialysis before surgery. AKI was defined according to the RIFLE-criteria. Multivariable logistic regression was used to identify risk factors for AKI and survival was evaluated with the Kaplan-Meier method.

**Results:** AKI was detected in 367/941 patients (39.0%). In multivariable analysis, age (per 10 years, OR=1.2, 95%-CI=1.1-1.4), male gender (OR=1.4, 95%-CI=1.0-2.0), a history of hypertension (OR=1.5, 95%-CI=1.1-2.0), DeBakey Type-I dissection (OR=1.7, 95%-CI=1.2-2.5), cardiac arrest before surgery (OR=2.1, 95%-CI=1.1-4.0) and prolonged cardiopulmonary bypass-time (per 10 minutes, OR=1.05, 95%-CI=1.03-1.08) were the main risk factors of AKI. Postoperatively, AKI patients were more likely to have other severe complications (53.0% vs. 33.4%,  $p<0.0001$ ) and their 30-day mortality rate was twofold compared to non-AKI patients (16.0% vs. 7.6%,  $p<0.0001$ ). One-year survival of patients who developed AKI and those who did not was 77.8% and 90.4%, respectively ( $p<0.0001$ ).

**Conclusion:** AKI is a common complication following surgery for ATAAD. Male gender, age, hypertension, extended dissection and longer cardiopulmonary bypass-times were independent risk factors of AKI. Patients who develop AKI have much poorer outcomes including higher rates of other serious complications as well as inferior short- and mid-term survival.

## Outcome after type A aortic dissection repair with preoperative cardiac arrest

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### Background

Ascending type A aortic dissection (ATAAD) patients who experience cardiac arrest before surgery are considered to have very poor prognosis but there is scarce data in the literature. We used a large, contemporary database to evaluate the characteristics and outcome of ATAAD patients with cardiac arrest.

### Methods

We evaluated 1159 surgically treated ATAAD patients from the Nordic Consortium for Acute Type A Aortic Dissection (NORCAAD) registry (1) between 2005 and 2014. Patients with and without cardiac arrest were compared and variables univariately associated with mortality in the cardiac arrest group were identified. Kaplan-Meier curve was used to estimate survival. Median follow-up time was 2.7 years (range 0-10).

### Results

Thirty-day mortality was 45.5% and 16.5% (HR 3.34, CI 2.10-5.30,  $p < 0.001$ ) in the arrest and no arrest group, respectively. In the nine patients with ongoing cardiopulmonary resuscitation before surgery, four survived. In total, 50.0% (22/44) arrest patients survived. Preoperatively, the arrest group had significantly more frequent hypotensive shock (54.5% vs 22.1%), cardiac malperfusion (27.3% vs 7.5%), pericardial tamponade (60.5% vs. 15.8%) and higher lactate concentration ( $5.5 \pm 4.0$  vs  $1.5 \pm 2.2$  mmol/l). Non-survivors in the arrest group had more often DeBakey type I dissection (89.5% vs 50.0%), cardiac tamponade (81.0% vs 40.9%), cardiac malperfusion (40.9% vs 13.6%) and higher lactate concentration ( $6.9 \pm 4.3$  vs  $4.0 \pm 2.7$  mmol/l) (all  $p < 0.05$ ).

### Conclusions

Early mortality and complication rate after ATAAD surgery in patients with preoperative cardiac arrest is high but mid-term outcome in patients surviving the initial period is excellent. Preoperative cardiac arrest should not be considered an absolute contraindication for surgical treatments.

### Reference 1:

Geirsson A, Ahlsson A, Franco-Cereceda A, et al. The Nordic Consortium for Acute type A Aortic Dissection (NORCAAD): objectives and design\*. Scand Cardiovasc J. 2016;50(5-6):334-340. doi:10.1080/14017431.2016.1235284.

## Dextran-based prime vs. crystalloid and mannitol-based prime in adult cardiac surgery: A prospective randomized study

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### Background

The optimal priming fluid for the cardiopulmonary bypass (CPB) circuit is still debated. We compared a new hyperoncotic priming solution containing dextran 40 and an electrolyte composition that mimics extracellular fluid with a standard crystalloid-based prime.

### Methods

Eighty cardiac surgery patients were included in a double-blind randomized single-centre study. The patients were randomized to either a dextran-based prime (PrimeECC®; XVIVO Perfusion, Gothenburg, Sweden) or a crystalloid prime containing Ringer acetate and mannitol. The primary endpoint was colloid oncotic pressure (COP) in serum during CPB. Secondary endpoints included fluid balance, bleeding and transfusion requirements, pulmonary function, haemolysis, systemic inflammation, and markers of renal, hepatic, myocardial, and cerebral injury. Blood samples were collected before, during, and after CPB.

### Results

COP was significantly better maintained during and 10 min after CPB in the dextran group (18.8±2.9 vs. 16.4±2.9 mmHg on CPB and 19.2±2.7 vs. 16.8±2.9 mmHg after CPB;  $p < 0.001$  for both). Patients in the dextran group required less intravenous fluid during CPB (1090±499 vs. 1437±543 ml;  $p = 0.003$ ) and net fluid balance was less positive 12h after surgery (+1,430±741 vs. +2,201±1,011 ml;  $p = 0.014$ ). Haemolysis index was significantly lower in the dextran group 2h after CPB (18.7±11.4 vs. 42.9±35.5;  $p = 0.001$ ). There were no significant differences in bleeding, transfusion requirements, organ function, systemic inflammation, or cerebral and myocardial injury markers between the groups at any time point.

### Conclusions

Our results suggest that a hyperoncotic dextran-based priming solution is safe, preserves intraoperative COP, and reduces volume overload and haemolysis compared to crystalloid prime. (ClinicalTrials.gov identifier NCT02767154).

## Reduced pulmonary function in young adults with closed ventricular septal defects – the VENTI trial

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### Background

Ventricular septal defects (VSD), both small unrepaired and surgically closed during the first years of life, are considered to have great prognoses. Nevertheless, there is an increasing awareness of not only late cardiac dysfunction, but also pulmonary abnormalities later in life. The aim of this study was to describe pulmonary function in young adult patients born with a VSD.

### Methods

Young adults born with a VSD and healthy, age- and gender-matched controls were included. Participants underwent extended pulmonary function tests: static and dynamic spirometry, impulse oscillometry, multiple breath washout, and diffusion capacity for carbon monoxide.

### Results

Thirty VSD-operated patients, 30 patients with unrepaired, small VSDs, and 30 healthy control subjects were included. VSD-operated displayed impaired dynamic pulmonary function compared with healthy controls with lower forced expiratory volume in one second ( $99 \pm 13$  vs.  $111 \pm 13\%$  pred.), lower forced vital capacity ( $106 \pm 12$  vs.  $118 \pm 13\%$  pred.), and reduced peak expiratory flow ( $95 \pm 18$  vs.  $118 \pm 19\%$  pred.),  $p < 0.05$ . Furthermore, increased airway resistance in the conducting airways was observed in operated VSDs compared with controls ( $125 \pm 40$  vs.  $105 \pm 28\%$  pred.), as well as decreased diffusion capacity for carbon monoxide ( $85 \pm 10$  vs.  $92 \pm 12\%$  pred.) and alveolar volume ( $92 \pm 10$  vs.  $101 \pm 11\%$  pred.),  $p < 0.05$ . Patients with small, unrepaired VSDs were comparable with healthy controls.

### Conclusion

Adults with surgically closed VSDs demonstrate impaired pulmonary function compared with healthy controls. Unrepaired VSDs and controls had comparable pulmonary function, suggesting that the surgical procedure plays a role in late ventilatory dysfunction in VSD operated patients. Consequently, continuous follow-up of these patients is recommended.

## Snake graft or separate vein grafts to the right and left coronary artery territories in coronary artery bypass grafting?

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2. University of Turku

3. Statistiska konsultgruppen

### Background

To compare short- and mid-term outcome after CABG utilizing two different revascularization strategies.

### Methods

All 6895 CABG patients operated in Sweden 2009-2015 with LIMA to LAD and either a single sequential saphenous vein graft connecting left and right coronary territories to aorta (snake graft, n=2122), or separate vein grafts (n=4773) were included. Data was obtained from SWEDEHEART and the Swedish Patient Registry. All-cause mortality, myocardial infarction (MI), re-angiography, and new revascularization, adjusted for age, gender, co-morbidity, and Euroscore II, were compared employing logistic regression for 30-day and Cox-regression for mid-term outcome. Median follow-up was 42 months.

### Results

At 30 days the Snake group had a higher incidence of re-angiography (adjusted odds-ratio [OR] 1.51 [95% confidence interval (CI) 1.07-2.14], P=0.019 and a trend towards higher mortality (OR 1.47 [0.97-2.22], P=0.067). The composite endpoint of death, MI, re-angiography and revascularization was significantly more common in the Snake group (OR 1.31 [1.03-1.68], P=0.030). At the end of follow up, there was no significant difference between the groups in mortality (adjusted hazard ratio [HR] 0.95 [0.79-1.14], P=0.56), MI (HR 1.11 [0.88-1.41], P=0.39), revascularization (HR 1.19 [0.94-1.50], P=0.15), while re-angiography remained more common in the Snake group (HR 1.25 [1.05-1.48], P=0.013). The composite endpoint did not differ significantly (HR 1.08 [0.95-1.22], P=0.24).

### Conclusions

Snake grafting was associated with a higher rate of early post-operative complications, possibly reflecting a more demanding surgical technique, while mid-term outcome was comparable. One strategy cannot be recommended over the other.



## Lung donation after circulatory death. An experimental model to investigate reconditioning of donor lungs with ex vivo lung perfusion after exposure to warm ischemia

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### Background

The limiting factor in lung transplantation is lack of acceptable donor lungs. Lungs from Donation after Circulatory Death (DCD) donors is an underused source because they suffer from warm ischemia after circulatory arrest. The aim of this project is to investigate, through a DCD pig model, if it is possible to recondition lungs exposed to 1 or 2 hours of warm ischemia with EVLP.

### Material and methods

Danish domestic pigs (N=17) were put down by ventricular fibrillation and left untouched for 0, 1 or 2 hours of warm ischemia. Lungs were harvested and evaluated with EVLP (Vivoline LS1) primed with perfusion buffer (Steen solution and autologous red blood cells). Lungs were evaluated at FiO<sub>2</sub> 100% and 21% after 83±38 minutes of EVLP. Endpoints were physiological parameters (PaO<sub>2</sub>, compliance and pulmonary vascular resistance (PVR)), Δweight, TNF-alfa and myeloperoxidase activity (MPO) in bronchial lavage fluid, tissue homogenates and perfusion buffer. A histopathologic assessment score was performed.

### Results

Lungs exposed to 2 hours of warm ischemia did not meet the criteria: PaO<sub>2</sub>>13.9 kPa that is required for donation opposite the lungs subjected to 0 and 1 hours of warm ischemia (p<0.001). We found no significant difference in compliance and PVR between the groups. Levels of TNF-alfa increased during EVLP. This was only significant in the 1 h group (p<0.05).

### Conclusions

Results show that opposite lungs subjected to 0 or 1 hours of warm ischemia, lungs subjected to 2 hours of warm ischemia did not meet the criteria for transplantation based on EVLP evaluation.

## Safety of direct true lumen cannulation after venous exsanguination – A study with a surviving porcine model

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### Background

Type A aortic dissection requires immediate surgery. The pericardial tamponade and malperfusion threaten the circulation. During the emergent settings, ensuring true lumen perfusion and avoiding malperfusion is crucial. Direct true lumen cannulation (DTLC) after venous exsanguination avoids these problems but leads to transient global ischemia. We studied the safety of this method with a surviving porcine model.

### Methods

Twelve pigs were randomized into two groups: The intervention group (n=6) and the control group (n=6). The intervention group underwent simulated DTLC by exsanguination and circulatory arrest for 5 minutes at 35°C before cardiopulmonary bypass (CPB). Both groups underwent cooling with CPB to 25°C followed by a 25-minute arrest period and warming to 36°C. Frequent blood sampling was used to measure the levels of neuron specific enolase (NSE). Near-infrared-spectroscopy (NIRS) was used to determine brain oxygenation. Neurological recovery was evaluated with a quantitative scoring system during a 7-day follow-up and the brain was harvested for histopathological analysis after euthanization.

### Results

All pigs recovered to their normal neurological behaviour. Neurobehavioural total score of the second postoperative day reached borderline statistical significance favouring the intervention group (P=0.06). Histopathological analysis showed no differences between the groups. NIRS values and NSE levels slightly favoured the control group during the cooling period but the difference was not clinically significant.

### Conclusions

A 5-minute period of normothermic global ischemia before CPB, that enables DTLC, does not impair neurologic outcome following hypothermic circulatory arrest in a surviving porcine model. In fact, it may function as a precondition to the nervous system.

## Copenhagen Arterial Revascularization Randomized Patency and Outcome (CARRPO) trial: 5-year results

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### Background

We report clinical and angiographic outcomes 5 years after coronary surgery using total arterial revascularization.

### Methods

We randomized 331 patients with multi-vessel or left main-stem disease to arterial grafts (ITAs + radial artery) versus conventional grafts (left ITA + saphenous vein). All were invited for angiography and followed-up through national health registries. The primary angiographic outcome was the patency index: number of patent grafts divided by number of constructed grafts. Patent grafts were less than 90% stenosed.

### Results

Both groups received a median of 3 grafts. Angiography was carried out in 76% of patients. Mean patency index ( $\pm$ SD) was  $89 \pm 22\%$  in the arterial group and  $89 \pm 19\%$  in the conventional group. All grafts were patent in 74% of the arterial patients and in 71% of the conventional patients. Outcomes were comparable regarding survival (log rank  $p=0.93$ ) and cardiac event-free survival (log rank  $p=0.83$ ). Mean patency indices ( $\pm$ SD) for individual graft types: LITA  $93 \pm 26\%$ . RITA  $83 \pm 38\%$ . Radial artery  $89 \pm 27\%$ . Saphenous vein  $85 \pm 28\%$ . LITA was superior to vein grafts ( $p=0.01$ ) and RITA ( $p=0.05$ ). RITA, radial artery and saphenous vein were comparable ( $p>0.05$ ). For grafts to target vessels with stenoses above 70% mean patency indices were: LITA  $97 \pm 16\%$ . RITA  $87 \pm 34\%$ . Radial artery  $94 \pm 23\%$ . Saphenous vein  $84 \pm 32\%$ . There was improved patency for all arterial graft types, while saphenous vein graft patency was unaffected.

### Conclusions

Total arterial and conventional revascularization showed comparable outcomes. Arterial graft patency is improved when target vessels with high-grade stenoses are grafted.

## Single center registry from the Nordic-Baltic-British Left Main Revascularization Study (Noble). An advantage for surgical revascularization?

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### Background

We compared mortality for non-randomized patients with left main stenosis treated with CABG or PCI during our recruitment period for the Noble trial.

### Methods and results

429 patients were treated outside the randomized protocol for left main stenosis during the Noble recruitment period (CABG, n=225 and PCI, n=204). Treatment was a heart team decision based on coronary pathology, perceived risk factors and patient preference. Age of the patients were 74±10 (PCI) and 68±10 (CABG, p<0.0001). Comorbidities were more prevalent in the PCI group; eGFR (ml/min/1.73m<sup>2</sup>) 72±31 vs 90±29, p<0.0001, EF<35 28% vs 12%, p<0.001, prior MI 37% vs 20%, p<0.001, acute coronary syndromes 70% vs 52%, p<0.001, peripheral vascular disease 25% vs 13%, p=0.001, prior CABG 27% vs 0.4%, p=0.001. Average Syntax score; 30±10 (CABG) vs 26±11 (PCI), p=0.015. The mean observation period was 229 weeks for CABG patients and 150 weeks for PCI patients (difference due to unequal mortality). All-cause mortality was 37% (PCI) and 9% (CABG), p<0.000. Hazard ratio for mortality favored CABG in the overall population (HR 0.18, 95% CI 0.11-0.29, p<0.001). A Cox proportional hazard model for all-cause mortality found PCI to be an independent predictor of mortality (OR 3.1 (95% CI, 1.1 – 8.8)). In addition, a diagnosis of cancer, previous MI, pulmonary disease and peripheral vascular disease were independent predictors for all-cause mortality.

### Conclusion

In comparable risk groups, CABG was superior to PCI for all-cause mortality. Analyses to clarify the influence of revascularization technique on specific cardiovascular mortality are warranted.

## Aprotinin and lung passage of 8-isoprostane after coronary artery bypass grafting

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### Background

The lungs participate in the modulation of the circulating inflammatory factors induced by coronary artery bypass grafting (CABG). We investigated whether aprotinin- which has been suggested to interact with inflammation- influences lung passage of key inflammatory factors after coronary artery bypass grafting (CABG).

### Material and methods

A total of 40 patients undergoing CABG were randomized into four groups according to aprotinin dose: 1) high dose, 2) early low dose, 3) late low dose, 4) without aprotinin. Pulmonary (PA) and radial artery (RA) blood samples were collected for the evaluation of calculated lung passage (PA/RA) of the pro-inflammatory factors interleukin (IL) 6 and IL8, 8-isoprostane, myeloperoxidase and the anti-inflammatory IL10 immediately after induction of anesthesia (T1), 1 min after releasing aortic cross clamp (T2), 15 min after releasing aortic cross clamp (T3), 1 hour after releasing aortic cross clamp (T4), and 20 hours after releasing aortic cross clamp (T5).

### Results

PA/RA 8-isoprostane increased in patients with high aprotinin dose as compared with lower doses (1.1 range 0.97 vs 0.9 range 1.39,  $p = 0.001$ ). The main effect comparing high aprotinin dose with lower doses was significant ( $F(1, 38) = 7.338$ ,  $p = 0.01$ , partial eta squared = 0.16) further supporting difference in the effectiveness of high aprotinin dose for PA/RA 8-isoprostane.

### Conclusions

According to the PA/RA equation, the impact of aprotinin on 8-isoprostane after CABG is dose-dependent. Aprotinin may aid the lung passage of circulating factors towards a beneficial anti-inflammatory milieu.

### Reference 1:

Yun TJ, Rho JR. Aprotinin attenuates the elevation of pulmonary vascular resistance after cardiopulmonary bypass. *J Korean Med Sci.* 2006;21:25-9

### Reference 2:

Toikkanen V, Rinne T, Nieminen R, Moilanen E, Laurikka J, Porkkala H, Tarkka M, Mennander AA. Aprotinin Impacts 8-Isoprostane after Coronary Artery Bypass Grafting. *Scand J Surg.* 2018 in press

## Postoperative Thromboprophylaxis in Coronary Artery Bypass Surgery Patients. A Prospective Randomized Trial Using Hemostatic Analysis of Acetylsalicylic Acid Alone or in Combination with either Enoxaparin or Unfractionated Heparin.

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### Background

Heparin's effects on the hemostasis in patients after cardiac surgery with heart lung machine is poorly described in the literature. Observational evidence suggests no effect of post-operative administration of heparin or analogues, and thus more knowledge in this field is warranted

### Methods

A prospective, randomized trial with 3 treatment groups with 20 patients each. Patients were randomized pre-operatively to: daily dose of 75 mg acetylsalicylic acid (ASA) [group 1]; daily dose of 75 mg ASA daily and 40 mg low molecular weight heparin (LMWH) [group 2]; and daily dose of 75 mg ASA daily and 7 IU/kg/h continuous infusion of unfractionated heparin (UFH) [group 3]. Each day, a blood sample was obtained pre-administration and 4-6 hours post-administration. All blood samples were analyzed by TEG®- and Multiplate®-analysis.

### Results

Only few time points were significantly different in the Multiplate tests. Only the ASPI-test revealed a significant difference (pre- vs. post-administration tests). We saw no significant fixed effects for choice of treatment for the Multiplate parameters. TEG analyses showed significant differences for the R-value, angle, and lysis at post-operative day 2, but no significant difference when reviewing pre- vs. post-administration tests.

### Conclusions

We only found a slight indication of effect of the unfractionated heparins in the early post-operative period. We found no clear effect of low molecular weight heparin. A possible explanation could be residual effects from the surgery and cardiopulmonary bypass. This study was limited by its low power, but we consider a bigger trial with focus on clinical endpoints a relevant next step.

## Use of serotonin reuptake inhibitors is not associated with increased bleeding after coronary artery bypass graft surgery

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### Background

Selective serotonin reuptake inhibitors (SSRIs) and serotonin noradrenaline reuptake inhibitors (SNRIs) are frequently used as first-line antidepressants. Studies suggest that SSRI/SNRI use can increase bleeding following surgery, including open heart surgery. The objective of this study was to analyse their effects on bleeding after coronary artery bypass grafting (CABG).

### Methods

Out of 1,237 patients that underwent CABG in 2007-2016, 97 (7.8%) used SSRIs/SNRIs preoperatively and were compared to a reference group (n = 1,140) not taking these drugs. Bleeding was assessed using 24-hour chest-tube output, number of RBC units transfused and reoperation for bleeding. Thirty-day mortality and complications were compared, but also long-term mortality and major adverse cardiac and cerebrovascular event (MACCE) free survival (Kaplan-Meier). Median follow-up was 5.5 years.

### Results

The groups were comparable with respect to demographic, preoperative and operative variables, with the exception of BMI being significantly higher in the SSRI/SNRI group (30.2 vs. 28.3 kg/m<sup>2</sup>, p < 0.001). There were no significant differences between groups in 24-hour chest-tube output (815 (SSRI/SNRI) vs. 877 ml (reference), p = 0.26), number of RBC units transfused (2.2 vs. 2.2, p = 0.99) or the rate of reoperation for bleeding (4.1% vs. 6.0%, p = 0.61). The incidences of complications, 30-day mortality rate, and 5-year MACCE-free survival were also similar.

### Conclusions

Preoperative use of SSRIs/SNRIs did not increase bleeding after CABG, with short-term complication and 30-day mortality rates comparable to controls. Thus, temporary cessation of SSRI/SNRI treatment prior to CABG, in order to decrease the risk of bleeding, is inadvisable.

## Long-term outcome of CABG patients with reduced left ventricular ejection fraction

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### Background

Surgical revascularisation is an established indication for patients with advanced coronary artery disease and reduced left ventricular ejection fraction (LVEF). Long-term outcomes for these patients is not well defined. We studied the long-term outcomes of patients with ischemic cardiomyopathy who underwent surgical revascularization in a well defined nationwide cohort.

### Materials and methods

A retrospective study on 2004 patients that underwent isolated coronary artery bypass grafting (CABG) in Iceland between 2000-2016. Patients were categorized into two groups based on their preoperative LVEF; LVEF  $\leq 35\%$  (n=145, median EF 30%) and LVEF  $> 35\%$  (n=1859, median EF 60%). Demographics and MACCE (major adverse cardiac and cerebrovascular event), were compared between groups along with cardiac specific and overall survival (Kaplan-Meier). Mean follow up was 7.6 years.

### Results

Demographics were similar in both groups regarding age, gender, and most cardiovascular risk factors. However, patients with LVEF  $\leq 35\%$  more often had diabetes, renal insufficiency, chronic obstructive pulmonary disease and a previous history of myocardial infarction. Thirty-day mortality was five-times higher (7.6% vs. 1.5%,  $p < 0.001$ ) in the LVEF  $\leq 35\%$ -group compared to controls. MACCE-free survival was 83% and 62% at 1 and 5 years for LVEF  $\leq 35\%$ -group compared to 94% and 82% for the control group. Overall survival was 87% and 69% at 1 and 5 years for LVEF  $\leq 35\%$ -group compared to 98% and 91% for controls.

### Conclusion

A good long-term outcome after CABG can be expected for patients with reduced LVEF, however their survival is still significantly inferior to patients with normal ventricular function.



# **SATS POSTER PRESENTATIONS**

## **P1 - P29**

## Simultaneous surgical treatment of postinfarction ventricular septal rupture, right ventricular and left ventricular aneurysms: case report

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### Background

A 76-year-old man was admitted to the clinic June 1, 2016. The diagnosis on admission: ischemic heart disease; recurrent myocardial infarction (May 2016); postinfarction ventricular septal rupture (VSR); left ventricular apical aneurysm; posterior right ventricular aneurysm; moderate mitral regurgitation; congestive heart failure (NYHA IV). EuroScore rate was 58.96%. Echocardiography revealed VSR 1.5 cm lower the mitral valve annulus; the size of the VSR was 3.5×2 cm. Left ventricular ejection fraction was <45%. Pulmonary arterial pressure was 82 mm Hg. The coronary angiography revealed a severe three-vessel disease.

### Methods

The patient survived right ventricular thrombectomy, postinfarction VSR repair using the synthetic patch, repair of the right ventricular aneurysm with synthetic patch, repair of a left ventricular aneurysm (the Stoney technique) and three-vessel coronary artery bypass grafting.

### Results

The postoperative period was complicated by acute heart failure required intra-aortic balloon pump therapy for two days after the surgery. The patient was extubated on the 2nd day after the surgery. ICU stay was 5 days. Total hospital stay was 25 days. One-year follow-up revealed no clinical signs of heart failure or angina on physical exertion.

### Conclusion

The most important factor affecting the results of the surgery is the adequate closure of postinfarction VSR. Different techniques could be used to close the VSR. The choice is usually determined by the location of the defect, VSR size and time needed to prepare patient for the surgery. Surgical approach to a VSR through the aneurysm seems to be the most optimal technique.

## Outcomes after surgically treated ascending aortic dissection - a nationwide study

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### Background

Ascending aortic dissection or rupture are associated with high mortality despite rapid surgical intervention. We aim to analyze short and mid-term survival, and need for reoperation after surgically treated for ascending aortic dissection.

### Materials and Methods

Between 2004 and 2013, all ascending aortic dissection patients (n=567) in Finland who underwent their first ascending aortic surgery were identified from the Finnish National Institute for Health and Welfare Register. Mortality data were gained from the National Statistics. The extent of surgery (supracoronary interposition 41.6% vs. root replacement 38.5% vs. arch involvement 19.9%) were compared as groups. Univariate and multivariate regression analysis were performed to predict risk factors for mortality and reoperations.

### Results

The median follow-up time was 3.2 years (range 0-9). The 30-day mortality was 22.2 % and survival at 1 and 3 years were 73.5% and 70.0% in overall, and 94.6% and 89.8% for 30-day survivors, respectfully. The extent of surgery was not a significant factor for a later reoperation ( $p=0.12$ ) but arch involvement significantly increased mortality at five years ( $p<0.02$ , HR 1.58). The cumulative incidence of reoperations was 2.6% (n=15). Freedom from reoperation in hospital survivors was 96.7% at five years and there were no differences in survival between reoperated and non-reoperated ( $p=0.869$ ).

### Conclusions

Mid-term survival after ascending aortic dissection surgery were great for 30-day survivors. The extent of primary surgery had no significant impact on later reoperation rates. The reoperation rate was low and survival was good even after reoperation.

## Mediastinitis after Coronary Artery Bypass Grafting. Twenty Years Survival Experience.

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### Background

Mediastinitis is a severe complication after coronary artery bypass grafting (CABG). The aim of the study was to present its effect on 20 years survival. The end point was total mortality.

### Method

The study design was a retrospective cohort study. Median follow up time was 14.6 years, range, 1 day to 29.0 years, containing exposed mediastinitis patients, n = 107 and non exposed random controls, n = 444. The crude effect of mediastinitis was estimated using rate ratio (RR) and its 95% confidence limits (CL). Survival analysis and the log rank test were considered.

### Results

At the end of the study in the mediastinitis group 13 patients (12.1%) were alive, and in the control group 125 (28.1%). The mediastinitis group contained 95 mortality events with a follow up of 1107 patient years, giving an incidence of 8.58 events per 100 patient years. In the control group there were 320 events with a follow up time of 6464 patient years or an incidence of 4.9 events per 100 patient years, RR = 1.73, 95% CL 1.36-2.18, and p-value = 0.00001. Patients with mediastinitis had 1.7 higher risk of death than controls. The cumulative probability survival at 20 years of follow up was 11.06%, standard error (SE) 3.37% for patients with mediastinitis, and for controls 36.02%, SE 2.32%. The log rank test was highly significant, p = 0.00001.

### Conclusion

For patients with mediastinitis there is a significant excess risk of mortality compared to controls up to 20 years after operation.

### Reference 1:

Risnes I, Abdelnoor M, Almdahl SM, Svennevig JL. Mediastinitis after Artery Bypass Grafting. Risk Factors and Long-term Survival. Ann Thorac Surg 2010;89:1502-10.

## A Single Center Experience with Biological Aortic Valve Prostheses

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### **Background**

Aortic valv replacement is the standard treatment of severe aortic stenosis. There have been reports of decreased durability of the Sorin Mitroflow pericardial prosthesis.

### **Method**

A retrospective analysis of 666 consecutive patients implanted with a pericardial aortic valve prosthesis at Sahlgrenska University Hospital was performed during 2009 – 2012. This study included all 225 patients that received a Mitroflow prosthesis and 441 patients that received an Edwards Perimount prosthesis. Outcome, in terms of mortality and freedom of re-operation due to structural valve deterioration (SVD) was compared between the two types of prosthesis. Both unadjusted and propensity score matched comparisons were made. The postoperative prosthetic function was further evaluated in the Mitroflow group by assessing all documented follow-up echocardiograms.

### **Results**

After propensity score matching, there was not a significant difference ( $p=0.232$ ) in survival between the two groups. 21/225 patients in the Mitroflow group were accepted for re-intervention due to SVD compared to 2/441 patients in the Perimount group. The risk for intervention in the Mitroflow group was significantly higher using both unadjusted (HR: 25.4 [5.8 – 110.6],  $p < 0.01$ ) and propensity score matched analysis (HR: 26.1 [5.8 – 116.2],  $p < 0.01$ ). The reviewed echocardiograms identified additional nine patients with severe SVD, not subjected to re-intervention.

### **Conclusion**

Patients receiving the Mitroflow aortic valve prosthesis were more prone to SVD necessitating re-intervention, compared to patients receiving the Edwards Perimount prosthesis. In total, the study identified 30/225 patients with SVD in the Mitroflow cohort.

## Effects of Gender on Early Outcome following Repair of Acute Type A Aortic Dissection: Results from The Nordic Consortium for Acute Type A Aortic Dissection (NORCAAD)

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**Background:** Female gender is known to increase perioperative mortality in cardiac surgery. Studies reporting effects of gender on outcome following surgical repair for Acute Type A Aortic Dissection (ATAAD) have shown diverging results. This study aimed to compare preoperative characteristics, operative management and postoperative outcome between the genders in a large and well defined cohort of patients operated for ATAAD.

**Materials and methods:** The Nordic Consortium for Acute Type A Aortic Dissection (NORCAAD) study included patients with surgical repair of ATAAD at eight Nordic centers between January 2005 and December 2014. Independent predictors of 30-day mortality were identified using a multivariable logistic regression.

**Results:** Females represented 373 (32%) out of 1154 patients and were significantly older ( $65 \pm 11$  vs.  $60 \pm 12$  yrs.,  $p < 0.001$ ), had lower BMI ( $25.8 \pm 5.4$  vs.  $27.2 \pm 4.3$  kg/m<sup>2</sup>,  $p < 0.001$ ) and had more often a history of hypertension (59% vs. 48%,  $p = 0.001$ ) and chronic obstructive pulmonary disease (8% vs. 4%,  $p = 0.033$ ) as compared to males. Hypothermic cardiac arrest time ( $28 \pm 16$  vs.  $31 \pm 19$  min.,  $p = 0.026$ ) and operation time ( $345 \pm 133$  vs.  $374 \pm 135$  min.,  $p < 0.001$ ) were shorter among females. There was no difference between the genders in unadjusted intraoperative death (9.1% vs. 6.7 %,  $p = 0.17$ ) or 30-day mortality (17.7% vs. 17.4%,  $p = 0.99$ ). In a multivariable analysis including pre- and perioperative factors influencing mortality, no difference was found between females and males in 30-day mortality (OR 0.92, 95% CI 0.62-1.38,  $p = 0.69$ ).

**Conclusions:** Female patients were older and had more co-morbidities, but this study found no association between gender and early mortality after surgery for ATAAD.

## Reoperation for bleeding in a elective cardiac surgical population - Does it affect survival?

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### Background

Earlier studies have shown that re-operation for bleeding after cardiac surgery is associated with increased mortality and morbidity in both acute and elective patients. The aim of the study was to assess the effect of re-operation for bleeding on short- and long-term survival and the causes of re-operation on an exclusively elective population.

### Methods

This was a single-center, retrospective study conducted at the Department of Cardiothoracic Surgery at Copenhagen University Hospital. Rigshospitalet, Denmark. We included all elective patients undergoing first-time coronary bypass, valve surgery or combinations hereof between January 1998 and February 2014. Data was obtained from the electronic patient records on demographics, cardiological risk profile, blood transfusion and surgical record.

### Results

A total of 12652 patients were included in the analysis of whom 688 (5.2%) patients underwent re-operation for bleeding. Patients were divided into two groups; non re-operated (NRO) and re-operated (RO). Baseline characteristics were comparable. Median survival was lower in the RO group (142 vs 160 months ( $p = 0.001$ )). Morbidity and 30 day mortality was significantly higher in the RO group. Cox-regression analysis showed a significantly increased age-adjusted risk of death in the RO group (HR 1.21 (1.07-1.37).  $p = 0.003$ ). In 81.4% of the patients the site of bleeding was found during the re-operation.

### Conclusion

We found both short and long-term survival to be lower in the RO group. A surgical cause for re-operation was found in the majority of cases. The study shows the importance of meticulous hemostasis during cardiac surgery.

## Deep Sternal Wound Infections after Median Sternotomies in Iceland: Incidence, Treatment and Mortality. Preliminary Results.

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### Background

Deep sternal wound infections (DSWI) as a complication of a median sternotomy can result in increased morbidity and mortality of patients undergoing open cardiac surgery. We studied the trends in incidence and outcome of DSWI a well-defined population over a 17-year period.

### Materials and Methods

A retrospective study, including all adult patients treated for DSWI following a median sternotomy for cardiac disease in Iceland 2000-2017. Information was gathered from medical records and cases of DSWI confirmed based on the Center of Disease Control and Prevention (CDC) criteria from 2018. Mean follow-up was 75 months (January 2018).

### Results

A total of 55 patients (mean age 69 years) were included in the study, 41 men (75%) and 14 women. The DSWI rate was 1.7% out of 3771 open heart surgery patients and did not change significantly during the study-period; or from 1.8% during 2000-2010. Most patients had undergone CABG (85%), 65% of them isolated CABG and 4% isolated AVR. DSWI was diagnosed within 30 days in 46 patients (84%) and was treated with negative-pressure wound therapy (NPWT) in 33 patients (60%), or all patients after 2005. The most common pathogens were coagulase-negative staphylococci (49%) and *Staphylococcus Aureus* (36%). 30-day post-op mortality was 0% but 7 patients (12,7%) fell within the 1-year mortality rate.

### Conclusions

The rate of DSWI after open heart surgeries in Iceland has not changed significantly over the course of 17 years. All patients diagnosed after 2005 were treated with NPWT and it has therefore been considered as a first-line treatment for DSWI.



## **Anomalous left coronary artery from the pulmonary artery and right coronary artery aneurysm, in an adult – a case report.**

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**Introduction** Anomalous left coronary artery connection to pulmonary trunk (ALCAPA) is rare. In the natural history of the disease the left ventricular ischemia is fatal in infancy. With rich inter-arterial collateralisation, a restrictive angulation between the left main coronary artery and pulmonary trunk, and a dominant right coronary circulation, a minority of patients survive into adulthood. We present an atypical adult case that underwent restoration of a two coronary system and excision of aneurysm. Case report A 61-year-old female, with a background history of diabetes, hypertension and smoking, presented with dyspnoea (NYHA class IV), episodes of tachy-brady syndrome and raised troponin levels. Coronary angiography revealed ALCAPA, a large dominant right coronary artery (RCA) and proximal aneurysm measuring 6mm by 12mm. CT coronary angiogram, confirmed these findings (Figure 1). Surgical correction was performed via median sternotomy and standard cardiopulmonary bypass. The right coronary aneurysm was dissected and excised and reconstructed with a saphenous vein patch. A pulmonary arteriotomy was performed and the anomalous left main ostium was identified. It was ligated with a double layer of continuous 5-0 prolene sutures. An aorto-coronary bypass graft to left anterior descending was performed using a reversed saphenous vein graft. The postoperative course was uneventful.

**Discussion** ALCAPA can present in adults and can have variable presentation; from LV dysfunction, angina, refractory arrhythmia or even sudden cardiac death. Although it is a congenital coronary anomaly, with advances in CT coronary angiograms, it is being more frequently diagnosed in the adult population.

## Prevalence of aneurysms or dilatations of the thoracic aorta in patients with intracranial aneurysms

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2. University of Turku

### Background

The prevalence of intracranial aneurysms is higher in patients with abdominal and thoracic aortic aneurysms, however the prevalence of thoracic aortic aneurysms is unclear in patients with intracranial aneurysms.

### Methods

Retrospective review of 1778 consecutive patients with ruptured or unruptured intracranial aneurysms (IA) diagnosed at a university hospital between 2006 and 2016. 519 patients with available imaging studies of the thoracic aorta (CT, CT-angiography, MRA and MRI, catheter angiography) were identified and dimensions of the thoracic aorta were measured and compared to normative values.

### Results

There were 491 patients with saccular and 28 patients with fusiform IA. In patients with saccular IA, the prevalence of thoracic aortic dilatations and aneurysms were 17.1 % and 6.1 % and in patients with fusiform IA the prevalences were 29 % and 18 % respectively. The aortic arch was the most common location for dilatation (64.2 %) in patients with saccular IA and the ascending aorta in patients with fusiform IA. Age (OR 1.04,  $p = 0.001$ ), rheumatoid disease (OR 3.09,  $p = 0.008$ ) and alcohol abuse (OR 2.51,  $p = 0.007$ ) were significant risk factors for aortic dilatation in multivariate analysis.

### Conclusion

The prevalence of aortic dilatations and aneurysms is considerably higher in patients with intracranial aneurysms compared to the general population, suggesting a similar shared background for pathogenesis for both types of aneurysms. Also Our findings further suggest that , patients with intracranial aneurysms and having rheumatoid disease and/or a history of alcohol abuse should be considered for screening of thoracic aortic dilatations and aneurysms.

## Biocompatibility of second and third generation LVAD therapy – A retrospective study

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### Background

New technologies have resulted in smaller and better functioning left ventricular assist devices (LVADs). Newer models are assumed to have an improved biocompatibility profile and thus have a lower incidence of hemolysis and pump thrombosis. The following retrospective study looks at routine blood tests after LVAD implantation and attempts to compare the biocompatibility profiles of two models, second and third generation (Heartmate IIÓ (HM2) and Heartmate 3Ó (HM3)).

### Methods

All 40 patients receiving LVAD as bridge to heart transplantation between 2012-2017 were included, in total 21 patients that received a HM2 and 19 patients that received a HM3. The populations were of similar age and sex distribution, Euroscore II was 10.5% (2.9-18) versus 12.8% (2-21.3). We retrospectively reviewed routine postoperative blood tests, at 1 week, 1 month and 3 months, and yields were 58%, 75% and 56%, respectively. Lactate dehydrogenase (LD), D-Dimer, haptoglobin, fibrinogen and CRP were reviewed in an attempt to assess hemolysis and inflammation. Values were tested using either T-Testing or Wilcoxon rank sum.

### Results

A significant difference was found for haptoglobin at all points in time and for LD at one and three months, on average 0,65 versus 1,94 (g/L) and 6,07 versus 4,89 (microkat/L) respectively. There was no difference in 30 day mortality between groups (19% (7.1-40.6) versus 15.8% (4.7-38.4) respectively for the HM2 versus HM3).

### Conclusion

The significant difference in haptoglobin and LD differences together point to a lower level of hemolysis and improved biocompatibility in third generation LVADs as compared to second generation.

## Operative treatment of infectious mitral valve endocarditis at Haukeland University Hospital, 1997-2016

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### Background

To evaluate outcomes and for operative treatment of infectious mitral valve endocarditis at Haukeland University Hospital in a 20 year period.

### Materials and methods

Retrospective study of patients operated for infectious mitral valve endocarditis 1997-2016.

### Results

68 patients, 56±17 years (29% female) were operated for infectious mitral valve endocarditis, 11 in 1997-2006 and 57 in 2007-2016. 13% had prosthetic valve endocarditis and 21% were intravenous drug users. Most common pathogens were *S. aureus* (n=22; 32%) and *Viridans streptococci* (n=21; 31%). 74% had vegetations (15±8 mm) and 53% had embolization, strongly associated with *S. aureus*. 57% received bio-prosthesis, 22% mechanical prosthesis and 21% mitral valve repair. 28% had double valve surgery (mitral + aortic) and 16% were redo-procedures. 30-day mortality was 16%, higher with surgery <14 days (p=0.03), in women (p<0.01) and in double valve endocarditis (p<0.01). Cumulative survival was 75%, 57 % and 47% after 1, 5, and 10 years. Age, bacteriology, PVE, IVDU, embolization, redo-surgery and prosthesis type was neither associated with increased early mortality (30 and 90 days) nor late mortality up to 5 years.

### Conclusions

Surgery for mitral valve endocarditis increased dramatically during 1997-2016 and about 2/3 was caused by *S. aureus* and *Viridans streptococci*. Increased early mortality was associated with urgent operations, female gender and double valve endocarditis.

## Effect of warm versus cold ischaemia in protection against pulmonary graft thrombosis in lung donation after cardiac death

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### Background

To overcome organ shortage, the use of lung donation after cardiac death is increasing and the tolerable warm ischemic period has been discussed extensively. It has previously been suggested that lung donation after cardiac death may be used for transplantation if intrapleural cooling and heparinization is rapidly. A recent study found that warm rather than cold ischaemia protected the pulmonary graft from thrombosis in unheparinized pigs.

### Materials and methods

A prospective clinical animal with 16 pigs that were divided in 4 groups exposed to 1 hour of ischaemia at 38 °C, 30-32 °C, 25 °C, or 17-18 °C. Arterial and venous samples were drawn pre-fibrillation; post-fibrillation; and from the aorta, pulmonary artery, and pulmonary vein at 1 hour of ischaemia. Measurements included antitrombin, prostacyclin, von Willebrand factor, and syndecan-1. The lungs were harvested en bloc. Pulmonary arterial branches were studied macroscopically for thrombotic material.

### Results

We found no significant difference ( $P=0.118$ ) in thrombus size, however the coldest group was numerically different. Comparing the 2 warmest groups vs. the 2 coldest groups there was a trend towards larger thrombi ( $P=0.096$ ) in the coldest groups. We found no significant differences between groups when looking at von Willebrand factor, antithrombin, and prostacyclin. We had no ELISA-test signal for thrombomodulin and syndecan-1.

### Conclusions

We found hints that warm ischemia is more protective against pulmonary graft thrombosis than warm ischaemia in unheparinised pigs. Unfortunately, our coagulation marker analyses did not elucidate this further. These markers might not be sufficient in finding underlying mechanisms in lung graft hemostasis.

## Rapid progression from Aortitis to Aortic Dissection in Giant cell Arteritis (GCA)

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### **Introduction**

Giant cell arteritis is the most common systemic vasculitis of adults over the age of 50. It affects large and medium sized vessels and expresses partiality for the thoracic aorta and great vessels. Subclinical or clinical aortitis is common and progression to acute aortic syndromes occur in 1-6% of cases. Unfortunately, predictive factors for such sequelae in GCA have not been identified. We describe a rare case of a 75 year old lady who underwent rapid progression from aortitis to a Stanford type A dissection, in the setting of being recently diagnosed with GCA.

### **Case**

A 75 year old lady with a background history with dyslipidaemia and diabetes presented with severe chest pain. CT aortogram revealed thickening of the ascending aorta and arch walls. Infective causes were ruled out and rheumatology diagnosed her with histology negative, PET positive large vessel vasculitis. High dose steroid and methotrexate was initiated. One month later, she presented with recurrence of pain. Repeat imaging revealed a dissecting aneurysm limited to the ascending aorta with a false lumen measuring 34x 19mm. The patient underwent emergent surgery via median sternotomy and central cannulation. Intraoperative findings revealed an engorged and bruised aorta. As the diseased aorta was opened, it revealed a large contained hematoma contained within the peri-aortic tissues extending from sinotubular junction to proximal arch.

### **Conclusion**

Patients with GCA are at risk of fatal thoracic aortic complications. Physicians should be alert and this progression is unpredictable. Close monitoring with serial imaging is important. Early surgical intervention may be life-saving.

## Simultaneous thoroscopic segmentectomy and left atrial posterior wall isolation in patient with early-stage lung cancer and atrial fibrillation

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### Background

cardiac rhythm disorders are common in many patients with cancer. The management of synchronous permanent atrial fibrillation (AFib) and pulmonary lesions remains a serious surgical dilemma due to the lack of clinical data and surgical guidelines. This case report aims to show our experience and results of simultaneous thoroscopic segmentectomy and left atrial posterior wall isolation in patient with early-stage lung cancer and atrial fibrillation.

### Methods

We treated a 65-yo female diagnosed with long-standing (>25 years) persistent AFib. Preoperative chest computed tomography (CT) revealed a mass in the superior segment (S6) of the inferior lobe of the right lung. We performed a segmental resection of right S6 through a thoroscopic minimally sized incision. The tumor had dark red appearance and was completely included in the S6. After that we performed totally thoroscopic left atrial posterior wall isolation (with use of Gemini-S device, Medtronic) and left atrial appendage resection. Sinus rhythm was restored 24 hours later after amiodarone infusion and electrical cardioversion. Pathologic examination of the lung lesion showed a well differentiated lung adenocarcinoma.

### Results

patient recovered and was discharged on the sixth postoperative day. After 30 days patient was in sinus rhythm. Chest CT showed good expansion of the residual right lower lobe with no consolidation.

### Conclusion

thoroscopic segmentectomy combined with left atrial posterior wall isolation is an effective minimally invasive treatment for concurrent lung cancer and atrial fibrillation.

## Five-year results for Aortic Valvular Bypass

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### BACKGROUND

Aortic valve bypass (AVB) is performed through a left sided thoracotomy, to treat aortic valve stenosis. A valved conduit connects the left ventricle (LV) to the descending aorta and bypasses the aortic stenosis. This study aims to follow up a small series of AVB patients.

### METHOD

This is a prospective, observational, single-surgeon series study. Data were collected from medical records, echocardiography and MRI.

### RESULTS

Twelve patients were operated between April 2011 and September 2012. Mean age 73.5 years (range 65-90), 10 patients were males. Four patients had undergone previous sternotomy, six had a heavily calcified aorta and six patients had a very small aortic annulus or LV-outflow tract. Median aortic valve area was 0.7 cm<sup>2</sup>, mean aortic valve gradient 47.0 mmHg (SD 19.7), mean LV-outflow tract 1.8 cm (SD 0.2), mean LV ejection fraction was 54.2% (range 35-60). Median Euroscore was 6.5 (range 1.5-19). Perioperative and 30-day mortality was 0%. Overall 5-year survival was 67%. Out-of-hospital complications: One ventricular septal defect, 1 LV aneurysm and 1 stroke. Conduit patency in surviving patients was 100%. The four deceased patients had normal routine examinations before death, however non-cardiac and non-valve-related causes of death could not be confirmed.

### CONCLUSIONS

Five-year over all survival after AVB in our single surgeon series was 67 %, there was 100% conduit patency. AVB is a safe and effective treatment for aortic stenosis and may be an option for few patients not suitable for neither sternotomy nor transcatheter aortic valve implantation.



## Acute Chest Pain caused by Bilateral Coronary Ostial Stenosis from pseudointimal membranes in a full root Freestyle valve: a case report

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### Background

Coronary ostial stenosis is a rare but well-known complication to aortic root replacement. The occurrence of this complication in patients with the (Medtronic) Freestyle bioprosthesis (MFB) is poorly described. We report a case of late bilateral coronary ostial stenosis due to endoluminal membranes within an MFB, resulting in acute coronary syndrome (ACS).

### Case

In 2013 a 41-year-old patient received an MFB as a full aortic root implantation due to prosthetic endocarditis. Preoperative coronary angiography was normal. The patient that previously had been without symptoms of coronary ischemia, presented with severe chest pain and ACS in 2017. Coronary angiography and ECG-gated 4D contrast-enhanced cardiac CT showed bilateral coronary ostial stenosis. The patient was treated with CABG successfully. Per-operative inspection revealed visible pseudo-intimal membranes covering the coronary ostia. Histological examination showed fibrointimal thickening with areas of inflamed granulation tissue.

### Conclusions

Bilateral coronary ostial stenosis is a severe, potentially life-threatening condition, and a possible complication to the implantation of the MFB as a full root. It may occur late and as a separate process from coronary plaques. Awareness of this complication is important in patients with chest pain and reimplanted coronaries, also in absence of other risk factors for coronary artery disease. A possible etiology to the ostial stenosis presented in this case, which is not explained by plaques or surgical technicalities, could be an immunologic reaction towards the MFB.

## Obstructive hypertrophic cardiomyopathy relieved by resection of abnormal papillary muscle

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### Background

Surgery for obstructive hypertrophic cardiomyopathy (HCM) is classically a myectomy of the ventricular septum. When the ventricular septum is under 18 mm the surgical strategy is more challenging. Different advanced techniques for addressing the mitral valve and its subvalvular apparatus has been reported. However, in rare instances a single abnormal papillary muscle may be responsible for systolic anterior mitral motion (SAM) and outflow obstruction.

### Methods

We report a case of obstructive HCM in a severely symptomatic 54-year-old man with a thin basal septum. After repeated echocardiographic studies an abnormally running papillary muscle was found responsible for traction of the mitral valve towards the septum. The patient was operated through median sternotomy using bicaval cannulation and normothermic cardiopulmonary bypass.

### Results

Resection of the abnormal papillary muscle with a limited septal myectomy relieved SAM of the mitral valve and severe outflow obstruction. The patient had marked improvement in symptoms.

### Conclusions

This case underlines the importance of meticulous and thorough echocardiography in patients with obstructive HCM, especially when the septum is thin or almost normal. Also, systematic inspection of the mitral valve and the subvalvular apparatus intraoperatively by means of bicaval cannulation may be needed when there is chordal or papillary muscle abnormalities

## Scimitar syndrome and co-existent coronary artery disease is an unusual blend of congenital and acquired cardiac disease

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### **Introduction**

Scimitar syndrome and co-existent coronary artery disease is a blend of congenital and acquired cardiac disease. Scimitar syndrome is characterised by anomalous pulmonary venous drainage of the right lung to the IVC. Co-existing abnormalities include ASD and lung hypoplasia. Due to the paucity of scimitar syndrome, much less the combination of both pathologies, there are no guidelines. We report a case of a 71 year-old man who underwent revascularization and conservative treatment of scimitar syndrome.

### **Case report**

A 71 yr old male smoker with a history of hypertension, dyslipidaemia, presented with an exacerbation of COPD. His hospital stay was complicated with raised cardiac enzymes. Coronary angiography revealed flow-limiting lesions to the LAD, OM and PDA. After being referred for re-vascularisation, it was noted the chest radiograph revealed a curvilinear density traced along the right heart border. Previous CT chest studies revealed the presence of total anomalous drainage of the right pulmonary vein into the IVC with mild lung hypoplasia. To assess for associated cardiac abnormalities, a Cardiac MRI was preformed. The MRI confirmed the right upper and lower pulmonary vein formed one common vein, which enters a dilated IVC (43x36) close to the junction of the IVC and RA. A multi-disciplinary discussion came to the conclusion that his structural abnormalities are longstanding and not contributing to his symptoms. Thus, only coronary re-vascularisation was undertaken.

### **Conclusion**

The two main indications for surgical intervention are large left-to-right shunt, and recurrent pulmonary infection. In patients with minor symptoms with small left-to-right shunt, conservative management is recommended.

## Biomechanical in vitro assessment of the porcine aortic root

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### Background

The biomechanical properties change in patients with aortic root aneurism. In order to understand these changes, knowledge of the biomechanical function of the native aortic root is needed. Therefore, the aim of this study was to investigate the biomechanical properties of different segment of healthy native aortic roots.

### Methods

Hearts from 80kg pigs were obtained from a slaughterhouse. Circumferential aortic wall specimens were cut out at the annular, sinus and sinotubular junction (STJ) level. Each of these specimens were further divided into three segments in relation to the right-coronary, left-coronary and non-coronary commissures. The biomechanical characterization was performed by a Bose ElectroForce 3200 apparatus in a circumferential direction and with a standardized sample width. Uniaxial tensile tests were performed in order to determine the stress-strain relationship and maximum strength.

### Results

For the sinus level, the maximum stress was significantly larger for the non-coronary compared to the right-coronary commissure ( $3.37 \pm 1.6$  MPa and  $1.70 \pm 0.8$  MPa, respectively). Likewise, the maximum stiffness and elastic modulus was significantly larger for the non-coronary compared to the right-coronary commissure. For the aortic annulus and STJ there were no significant differences, but the same pattern was recognized for the STJ (maximum stress was  $2.75 \pm 0.7$  MPa for the non-coronary and  $2.16 \pm 0.6$  MPa for the right-coronary commissures). No specific change or pattern was seen for the annulus.

### Conclusion

These preliminary data suggest that the biomechanical strength and characteristics are significantly different along the circumferential part at the aortic sinus level. Although not significant, these inhomogeneities were also found at the STJ level.

## Pump-assisted beating-heart coronary artery bypass grafting in patients with diffuse coronary artery disease and severe left main stem stenosis

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### Background

The pump-assisted beating heart technique has been successfully used in high-risk patients. However, the use of this technique in stable patients with a diffuse coronary artery disease (CAD) and severe left main stem (LMS) stenosis is not well thoroughly evaluated. This study aimed to evaluate the impacts of conventional coronary artery bypass grafting (CABG), pump-assisted beating-heart CABG and off-pump CABG for surgical revascularization on early and mid-term clinical outcomes in stable patients with a diffuse CAD and severe LMS stenosis.

### Methods

237 consecutive patients with a diffuse CAD and severe LMS stenosis (SYNTAX Score >40) who underwent non-emergency, primary CABG from January 2014 to December 2017 were included in this study and divided into 3 groups: a conventional CABG group (cardiopulmonary bypass, aortic cross-clamping and cardioplegic arrest, n = 135), an OFF group (off-pump CABG, n = 45) and an ONBEAT group (pump-assisted beating-heart CABG, n = 57). The early and mid-term clinical outcomes were investigated and compared.

### Results

The post-operative drainage amount, length of hospital stay and length of post-operative intensive care unit stay were significantly ( $P < 0.001$ ) lower in the off-pump CABG group than in the conventional and pump-assisted beating-heart groups. No significant difference was found regarding 30-day mortality and morbidity rates including stroke, pneumonia, arrhythmia, intestinal complication and low cardiac output syndrome. There were no statistical differences in the freedom from cardiac events and mid-term survival.

### Conclusion

The pump-assisted beating-heart technique doesn't provide superior short-term and mid-term results for stable patients with a diffuse CAD and severe LMS stenosis.

### Reference 1:

Samuels L, Samuels M (2017) Pump-Assisted Beating-Heart Coronary Artery Bypass Grafting: The Pursuit of Perfection. J Clin Exp Cardiol 8: 540.  
doi:10.4172/2155-9880.1000540

## First experiences with aortic root remodeling in a single center

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### Background

Aortic root remodeling is a valve-sparing surgical technique, which is an alternative to valve- and root replacement for aortic insufficiency (AI) and/or root dilatation in selected patients. This study evaluates the short-term results in our initial patient cohort with respect to clinical safety and postoperative valve characteristics.

### Method

A prospective, observational cohort study was conducted on all aortic root remodeling patients from the introduction of the procedure at Rigshospitalet, Copenhagen, in September 2015 until June 2018. There were no exclusion criteria. Patient data were found in medical records and the local surgical registry.

### Results

56 patients were included. 71% were male, mean age was 50.5 ( $\pm 16.9$ ) years. 77% had tricuspid valves. Mean preoperative creatinine was 82.8 ( $\pm 16.2$ )  $\mu\text{mol/l}$ . Mean Euroscore II was 3.4 ( $\pm 2.1$ ). 58% of patients were NYHA  $\geq 2$ . Nine percent of patients had previously had open-heart surgery. Preoperative mean LVEF was 53.8% ( $\pm 8.6$ ) and LVEF at discharge was 51.6% ( $\pm 9.5$ ) ( $p = \text{NS}$ ). Median preoperative AI was moderate-severe, which changed to none-mild at both perioperative- and discharge echocardiography ( $p < 0.0001$ , rank-sum test). On post-remodeling echocardiography, mean cusp effective-height was 11.5 ( $\pm 2.3$ ) mm and mean coaptation-height was 7.3 ( $\pm 1.4$ ) mm. 30-day mortality was 2% ( $N = 1$ ). There were two late deaths at postoperative day 71 and 426 in the follow-up of 76.4 patient years.

### Conclusion

Aortic root remodeling is a promising procedure for treating aortic insufficiency and -root dilatation, being safe with an acceptable short-term mortality. Postoperative leaflet characteristics abide by established guidelines, thus suggesting desirable valve longevity.

## The Freestyle as a Full Aortic Root - Indications and Intermediate-term Outcomes

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### Objective

The Porcine Freestyle Stentless bioprosthesis® (Medtronic Inc., Minneapolis, MN, USA) can be used as a full aortic root replacement. The present study aims to describe indications for use and intermediate-term patient outcomes in a single institution.

### Methods

In a retrospective cohort study all procedures with a full root Freestyle implantation at Rigshospitalet Copenhagen, Denmark, 1999-2016 were reviewed. Data were stratified according to indication for aortic root replacement.

### Results

In total 451 Freestyles were implanted in 437 patients. Mean age was 64.7 (SD 11.5) years, 68.0% were male. Mean preoperative LVEF was 48.9 (SD 10.8) %; 35.7% were in NYHA ≥ II. Mean serum-creatinin was 106.9 (SD 96.4) µmol/l. 9.3% had coronary artery disease with significant stenoses. 37.7% had previous cardiac surgery. Indications for surgery were (number of patients, (%)) and actual 5-year survival): type A dissection 72 (16.0%), 69%; endocarditis (prosthetic and/or root abscess) 160 (35.5%), 47%; root dilatation 120 (26.6%), 77%; small aortic root 36 (7.8%), 77%; miscellaneous (primarily redo-aortic root replacement), 63 (14.0%), 82%. Kaplan Meier survival analysis stratified for indications show curves separating with log-rank  $p=0.0004$ . Follow-up was 0-14.6 years, mean 3.0 (SD 2.8) years. Overall 30-day and 5-year survival were 87.2% and 65%, respectively.

### Conclusions

The overall 5-year survival after full aortic root implantation of the Freestyle bioprosthesis was 65% with significant variation reflecting the indication for use. The most common indication was endocarditis. Future studies evaluating durability of the Freestyle bioprosthesis must take the relevant indications into consideration.

## Long term outcome and clinical evaluation of patients operated for Hypertrophic Obstructive Cardiomyopathy using exercise echocardiography

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### Background

If left untreated, hypertrophic obstructive cardiomyopathy (HOCM) can cause sudden death or progressive heart failure. Septal myectomy is an effective treatment that reduces symptoms and prolongs survival. The aim of this study was to investigate outcome after septal myectomy and to evaluate long-term hemodynamics with exercise echocardiography.

### Methods

A retrospective study of 47 consecutive patients from January 1998 to August 2017 operated with septal myectomy for HOCM at Skane University Hospital in Lund. Clinical data and echocardiography measurements were reviewed. All 39 patients that were alive and living in Sweden were invited to participate in exercise echocardiography to evaluate exercise capacity and hemodynamics. Twenty patients accepted and carried out exercise echocardiography.

### Results

Overall survival was 98% at one year and five-year survival was 94% following surgery. Resting LVOT (Left Ventricle Outflow Tract) gradient was reduced after septal myectomy from the mean  $66.2 \pm 39.3$  mmHg to the median 14.4 (9.5–24.3) mmHg ( $p < 0.001$ ). Septum thickness was reduced from  $21.7 \pm 5.0$  mm preoperatively to  $16.1 \pm 2.9$  mm postoperatively ( $p < 0.001$ ). Patients that underwent the long-term follow up with exercise echocardiography had a median LVOT gradient of 7.9 mmHg at rest, which then increased to 12.6 mmHg during exercise ( $p = 0.001$ ). None of the patients had dynamic LVOT obstruction during exercise echocardiography.

### Conclusion

Long-term survival following septal myectomy is good. At long-term follow up, LVOT gradients were low and remained low during physical exercise. The results show that, at long-term follow-up, excellent survival and hemodynamics can be achieved in a center that carries out a low number of septal myectomies per year.



## Surgery is underused in elderly patients with infective endocarditis: a nationwide registry study

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### Background

Infective endocarditis (IE) is associated with higher mortality in elderly patients but the role of surgery in this group is not fully understood. The aim of this study was to assess short-term and long-term outcomes of elderly patients with IE and to determine the influence of surgery on mortality in the elderly.

### Methods

A nationwide retrospective study using the Swedish Registry on Infective Endocarditis on 2260 episodes divided into 80 years (n=524). Follow-up on survival was performed using the Swedish National Population Registry. Long-term survival was estimated with the Kaplan-Meier method. Propensity score matched analysis was used to assess the effect of surgery on survival in patients >75 years.

### Results

The proportion of patients who underwent surgery decreased with increasing age from 47% in patients aged 80 years. In-hospital mortality was 3 times higher in the >80-years-group compared to the <65-years-group (23% and 7%, respectively) and almost 2 times that of patients aged 65-79 years (13%). In the matched groups, in-hospital mortality in operated patients was 19% compared to 25% in non-operated patients (p=0.36). One-year survival was 49.9% (95% CI 49.8-50.0%) in operated patients compared to 70.4% (95% CI 70.3-70.5%) in non-operated ones.

### Conclusion

In this large series of patients with IE, the proportion of elderly patients with IE who are operated is very low compared with younger patients. In matched elderly patients, 1-year mortality was higher in non-operated patients, suggesting that surgery is underused in elderly patients.

## Socioeconomic status and mortality risk among 110,742 men and women in Sweden after coronary artery bypass grafting

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### Background

Socioeconomic status (SES) is associated with outcome after cardiac surgery. However, it is not known if the association differs between men and women after CABG.

### Methods

The SWEDEHEART registry was used to identify 110,742 patients (23,636 women), who underwent CABG in Sweden 1992-2015. SES (marital status, income, education) and co-morbidity were collected from national registries. Multivariable Cox regression models were used to estimate mortality risk.

### Results

Never being married, compared to being married, was associated with a higher risk in women than in men (Hazard Ratio 1.32 (95% CI 1.20-1.44) vs 1.17 (1.13-1.22),  $p=0.030$ ). The lowest income quintile compared to the highest, was associated with a more marked risk in men (HR 1.44 (CI 1.38-1.51 vs 1.25 (1.14-1.38) ( $p=0.004$ )). In contrast, the significant difference between highest/lowest education and mortality did not differ significantly between men and women (HR 1.15, 95% CI 1.11-1.19 vs HR 1.25, 95% CI 1.16-1.35),  $p=0.75$ . Women aged 60 with the least favorable SES (unmarried, lowest income quintile, <10 years education) had 18% mortality at 10 years after surgery compared to 11% in women with most favorable SES, and had 4.8 years shorter median life expectancy. Corresponding figures for 60 year old men was 21 vs 12 % mortality risk at 10 years and 5.0 years shorter life expectancy.

### Conclusion

The strong association between low SES and increased mortality risk after CABG differs between men and women. These results emphasize the importance of effective secondary prevention strategies for CABG patients with low socioeconomic status.

# **SCANSECT ABSTTRACTS**

## **T1 - T3**

## Immersive high-fidelity simulation in perfusion education: Student perspective

**Neal, Jennifer<sup>1</sup>**

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### **Background**

Medical simulation has emerged as a powerful tool to provide a realistic and safe way for learners to acquire new skills prior to clinical encounters. In this model, the learning curve is overcome in the simulation environment, not on real patients. Perfusion programs have largely embraced simulation into their curriculum. The purpose of this paper is to describe from a students' perspective one programs use of immersive high-fidelity simulation to develop, measure and assure a pre-clinical skill set prior to clinical rotations.

### **Methods**

In this model, immersive simulation is applied in the first 2.5 semesters. Initially, simulation is used to deconstruct cardiopulmonary bypass into its fundamental skills (technical and non-technical), to teach and practice the specific elements that exist within the skills. Knitting these fundamental CPB skills together leads to applied "full mission" simulated CPB with added details aligned with cardiac pathologies. Finally, using simulation, students are fully trained in crisis management with practice and assessment of high risk events such as oxygenators change-out, pump failure, air embolism, and emergent re-initiation of CPB.

### **Discussion**

Recording these simulation sessions adds value of reviewing and self-critique. Using comprehensive rubrics, faculty lead competencies are performed mid-way and the end of the semesters to assure students are performing within appropriate ranges.

### **Conclusion**

Completion of the immersive simulation phase of training is the gateway to the traditional clinical rotation. This pre-clinical preparation and skill acquisition compliments and augments the traditional model and is beneficial to the student, the clinical instructor and to the patient.

### **Reference 1:**

Jenny Neal, Edward Darling, Jeff Riley, Bruce Searles, SUNY Upstate Medical University, Syracuse, NY

## Does a crystalloid prime solution ensure the oxygen demand during isolated limb perfusion (ILP)? - A randomized controlled study

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### Background

Isolated limb perfusion (ILP) is a treatment option for localized metastatic disease. The principle idea is to surgically isolate a region of the body and connect the circulation of this region to an extracorporeal circulation. A high concentration of a chemotherapeutic agent is then delivered to the region where the tumour is localized, while systemic toxicity is avoided. The use of packed red blood cells in the primingsolution is the norm during ILP. The aim of this study was to investigate the possibility to replace an erythrocyte based primesolution with a crystalloid based primesolution while still ensuring the oxygen demand during ILP.

### Methods

In a single center, randomized controlled, non-blinded, non-inferiority clinical trial, 21 patients (median age 74 years, range  $\pm 50$ , 62% men) scheduled for ILP were included and randomized 1:1 to either an erythrocytebased primesolution (control group) or a crystalloidbased primesolution (intervention group).

### Results

There was a significant difference in lactate level (mmol/L) between the intervention group and the control group ( $1.6 \pm 0.4$  vs  $3.6 \pm 0.7$ ,  $p=0.001$ ). No significant differences in oxygen extraction (%) was found ( $17 \pm 10$  vs  $9 \pm 4$ ,  $p=0.07$ ), oxygen delivery (mL/min) ( $798 \pm 473$  vs  $1046 \pm 395$ ,  $p=0.25$ ), oxygen consumption (mL/min) ( $109 \pm 37$  vs  $125 \pm 25$ ,  $p=0.31$ ), regional central venous saturation (%) ( $83 \pm 10$  vs  $91 \pm 4$ ,  $p=0.07$ ) or INVOS (%) ( $76 \pm 14$  vs  $81 \pm 11$ ,  $p=0.42$ ) between the intervention group and the control group.

### Conclusion

The main finding of this study showed no significant difference in ensuring the oxygen demand in the treated extremity during ILP without adding packed red blood cells in the primesolution.

## Novel fluid using oxygen microbubbles

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### **Background**

Microbubbles have been used in a variety of fields and have unique properties, such as shrinking collapse, long lifetime, efficient gas solubility, a negatively charged surface, and the ability to produce free radicals. In the medical fields, microbubbles have not been used in common. In this study, we demonstrated that microbubbles could achieve oxygen supersaturation in fluids and improve hypoxic conditions in the blood.

### **Methods**

Sodium chloride solution and swine venous blood were applied to the following experiments. Blood sampling was approved by the Ethics Review Committee of Okayama University of Science. Generation of microbubbles Fine microbubbles of oxygen gas were generated in the liquid (150 mL) using a micro-nanobubble aerator with hydrodynamic function for 15 min, with which oxygen gas was supplied in a flow volume of 1 L/min. Evaluation of dissolved oxygen in blood samples Dissolved oxygen partial pressure (Po<sub>2</sub>) in the blood mixed with oxygen microbubble normal saline solution (NSS) samples were measured by a blood gas analyzer.

### **Results**

Microbubbles could achieve oxygen supersaturation in fluids (Po<sub>2</sub>=1003.2 ± 25.5mmHg). The Po<sub>2</sub> values were 64.6 ± 1.4 mmHg in control blood, 72.4 ± 1.5 mmHg in blood diluted 10% with NSS, and 81.9 ± 3.3 mmHg in blood diluted 10% with Oxygen microbubble NSS (P < 0.05).

### **Conclusions**

Oxygen microbubble NSS was effective for improving hypoxic conditions in the blood. Thus, the use of oxygen microbubble fluids is a potentially effective novel method for hypoxic blood oxygenation.

# **SATNU ABSTRACTS**

## **N1 - N7**

## Illness perception after heart valve surgery - differences among men and women

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**Background:** Fewer women than men undergo heart valve surgery in Denmark every year, but compared to men, women are older, have more comorbidity, higher 30-day mortality and a higher risk of complications. After surgery, the risk of poor outcomes increases with a negative perception of the illness and therefore the objective of this study was to investigate possible differences in illness perception among men and women undergoing heart valve surgery.

**Materials and methods:** Data on illness perception were collected with the Brief Illness Perception Questionnaire (B-IPQ) in three surgical heart centers in Denmark during one year (2013-2014). Multiple linear regression models adjusted for potential confounders were used to investigate the association between gender and each item level of B-IPQ, presented as the regression coefficient ( $\beta$ ) and 95% confidence intervals.

**Results:** Of the 1,100 patients included in the study 349 (32.2 %) answered the B-IPQ, 246 (70 %) were men. Compared to men, women reported significantly poorer outcomes in the following items in the B-IPQ; Consequence ( $\beta$ = 0.99 CI 0.22; 1.75), timeline ( $\beta$ =0.72, CI 0.02; 1.43) identity ( $\beta$ = 1.02, CI 0.33; 1.71), concern ( $\beta$ = 1.19, CI 0.39; 1.99), understanding ( $\beta$ = -0.90, CI -1.59; -0.22) and emotional representation ( $\beta$ =1.43, CI 0.64; 2.22).

**Conclusions:** Illness perception after heart valve surgery is different among men and women, with women having poorer outcomes. This knowledge should be incorporated in future interventions to improve patient's illness perception and thereby also their treatment outcome.

**Reference 1:** Berg SK, Svanholm J, Lauberg A, Borregaard B, Herning M, Mygind A, et al. Patient-reported outcomes at hospital discharge from Heart Centres, a national cross-sectional survey with a register-based follow-up: the DenHeart study protocol. *BMJ open*. 2014;4(5).

**Reference 2:** Broadbent E, Petrie KJ, Main J, Weinman J. The brief illness perception questionnaire. *J Psychosom Res*. 2006;60(6):631-7



## Experiences of multidisciplinary telemonitored cardiac rehabilitation: Analysis of patient narratives

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### Background

Telemonitored cardiac rehabilitation is gaining currency to increase rates in patient participation and to support recovery following heart disease. However, more insight is needed into its use and results among patients in cardiac rehabilitation. Therefore, the aim of this study was to explore patients' understanding of and experiences with multidisciplinary telemonitored cardiac rehabilitation as well as their perceived gain from attending the programme.

### Methods

A phenomenological-hermeneutic study was conducted among seven patients after completing a 12-week telemonitored cardiac rehabilitation programme. The interviews were analysed as narratives using the interpretation theory by the French philosopher Paul Ricoeur.

### Results

Patients valued that telemonitored cardiac rehabilitation enabled not being restricted to the hospital setting. The flexibility of a telemonitored programme was experienced as positive, because it could fit into everyday life. The patients showed, however, greater acknowledgement and adherence towards rehabilitation interventions, if they were already a part of everyday life. Rehabilitation interventions not in line with the patients' self-image and previous preferences in life posed an extra challenge to succeed.

### Conclusions

Self-image and previous life preferences were important aspects of the patients' understanding of and experiences with telemonitored cardiac rehabilitation influencing their possible achievements of the programme. To further optimise the programme, it would be positive to increase focus on the individual patient's self-image and to balance the rehabilitation interventions during the programme.

## Temperature management in patients undergoing thoracic surgery

**Nielsen, Kristine Rydahl<sup>1</sup> ; Pedersen, Carsten Michel<sup>1</sup>**

*1. Copenhagen University Hospital*

### Background

Patients undergoing thoracic surgery are in high risk of perioperative hypothermia which are associated with perioperative complications<sup>(1)</sup>.

Aim

- To implement intraoperative temperature management, SpotOn, to prevent a drop of core temperature to a maximum of 0,5°C.
- To ensure the intraoperative hypothermia rate (< 36°C) is < 10%.

### Method

A prospective observational single center study on the effectiveness of FAW for adult patients undergoing thoracic surgery. Evaluation of the existing FAW blanket – identifying the rate of hypothermia (< 36°C). Based on the rate of hypothermia different warming blankets' functionality and effect were tested. Results 41 patients were included in a period of 6 month, average OR time was 150 min. The baseline measurement showed that the hypothermia rate (< 36°C) was 49% in all patients undergoing thoracic surgery. The hypothermia rate for patients undergoing thoracotomy was 55% (6/11) versus 46% (14/30) for patients undergoing VATS. Overall 32% of the patients had a core temperature drop of > 0,5°C. Based on the result different warming blankets' functionality and effect were tested. No difference in keeping the FAW on when draping the patient were found. The overall hypothermia rate was reduced to 42% (10/24) by changing the FAW blanked to a Full-Body Multi Access blanket.

### Conclusion

The hypothermia rate is still greater than 10%. It is a continuing process to prevent the inadvertent perioperative hypothermia and we need to look into alternative methods inspired by recommendations from the Danish National Guideline.

### Reference 1:

(1) Knaepel, Abigail. "Inadvertent perioperative hypothermia: a literature review." Journal of perioperative practice 22.3 (2012): 86-90.

## The occurrence of pressure damage in the oral cavity caused by endotracheal tubes

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### Background

The current clinical practice at our clinic is to reposition the endotracheal tubes (ETT) every 72 hours if no risk factors are present. Evidence-based guidelines on how often an ETT should be repositioned from one corner of the mouth to the other is lacking. The aim of this observational study was to investigate the occurrence of pressure damage caused by ETT when the tube is repositioned from one corner of the mouth to the other every third day.

### Methods

For the assessment of oral condition and the eventual damage caused by ETT, a modified version of the Oral Assessment Guide (OAG) was used. The oral condition was assessed once per day in all adult patients who were orally intubated with a tube for over 24 hours. Thirty-eight patients were included in the study.

### Results

Most patients (n=33, 86.8 %) had no pressure damage. Five patients (13.2%) had pressure damage on the oral mucosa and lip caused by endotracheal tubes. The group with damage to the oral mucosa was treated with noradrenaline, had bleeding problems and clotting disorders and had significantly more intubated and study days. The assessment of the oral mucosa according to the OAG reflected the worsening oral condition in the group with pressure damage<sup>(1)</sup>.

### Conclusions

Endotracheal tubes may need to be repositioned more often than every third day to avoid pressure damage in patients with a high risk of complications, and individually tailored care may need to be implemented.

### Reference 1:

(1) Wickberg, M., Falk, AC. (2017). The occurrence of pressure damage in the oral cavity caused by endotracheal tubes. *Nordic Journal of Nursing Research*, 37 (1), 2-6. doi: 10.1177/2057158516656109.

## What is going on in the operating theatre - How to prepare the patient?

**Molge, Kristina<sup>1</sup>**

### *1. Rigshospitalet*

**Background:** The information, which the patients currently receive preoperatively is sparse and does not include the operating theatre. Studies conclude that patients undergoing cardiac surgery need information preoperatively about anesthesia, the surgical procedure and information about the stay at the operating theatre <sup>(1, 2)</sup>. Lack of information may increase the level of preoperative and postoperative anxiety.

**Aim:** To investigate how to organize preoperative information regarding patients undergoing cardiac surgery to prepare the patient and to decrease preoperative anxiety.

**Method:** Systematic search of literature in CINAHL and PubMed for abstracts in Danish, Swedish, Norwegian or English from western countries, between 2006 – 2016 including patients > 19 years. A total of eight studies were included.

#### **Results:**

- Preoperative information should be organized as a combination of several interventions; in writing, orally and visually using pictures and video.
- The information should commence at an early stage preoperatively.
- The information should be multidisciplinary.
- The patient should decide what kind of information he requires and when to receive it.
- Introduction to the reception and stay in the operating theatre enhances the patients experience of being prepared.
- Information seems to reduce preoperative anxiety and decrease postoperative complications.

**Conclusion:** To meet the patient's needs, preoperative information should be multidisciplinary, available in writing, visually and orally at a time of the patient's choice. The information should include introduction to the patients stay in the operating theatre. We recommend that future studies investigate the relation between information and pre-and postoperative anxiety.

#### **Reference 1:**

Feuchtinger J et al. "Anxiety and fear in patients with short waiting times before coronary artery bypass surgery – a qualitative study". Journal of clinical Nursing 23, 1900-1907. Germany 2013.

#### **Reference 2:**

O'Brien L et al. "Pre-surgery education for elective cardiac surgery patients: A survey from the patient's perspective". Australian Occupational Therapy Journal 60, 404-409. Melbourne, Australia 2013.

## Using mobile application to prepare patients for surgery of pectus excavatum

**Andersen, Pernille Brasch <sup>1</sup> ; Roelsgaard, Birthe <sup>1</sup>**

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### **Background**

The increased use of health information technologies enables new ways to communicate, while ensuring that patients feel safe, well informed and involved in their own treatment. The objective of the project is primarily to enhance the quality of information and preparation of the patient before surgery for pectus excavatum through a new method of communication. Secondary we aim to benefit the patient and healthcare professionals by saving resources by a patient-centered application.

### **Methods**

The mobile application can be accessed weeks before surgery and provides all necessary information on pain, pain relief, exercises, fasting, post surgical restrictions etc. in videos or text. The application also allows for dialog between patient and nursing-staff through text messages to account for pre- and postoperative questions. The project has been evaluated by questionnaires and interviews with patients and nursing-staff.

### **Results/conclusion**

The results will be presented at the conference. We expect to find improved recovery of patients undergoing surgery for pectus excavatum based on enhanced quality of information, preparation and empowerment of patients, as well as advantages of reduced workload of the nursing staff.

## Parents are a matter of the heart

**Hohlmann Laursen, Sille**<sup>1</sup>

*1. Cardiothoracic, Rigshospitalet*

### **Background**

Annually approximately 500 children are anesthetised for elective heart surgery. Often parents and children are witnessed anxious and there is presently not any systematic approach for reducing preoperative anxiety.

### **Aims**

To investigate which nonpharmacological interventions are effective in reducing anxiety in both parents and children (age 0-15 years) in the period up to induction of anesthesia in connection with elective heart surgery.

### **Method**

Through a systematic search of literature randomized controlled studies (RCT) have been found in the databases PubMed, Cochrane, Embase and Web of Science. The search has been conducted across wide groups of patients. Nine RCT studies have been selected and examined using Cochranes Risk of Bias tool 2.0. The findings have been discussed and connected to clinical issues supplemented with qualitative studies as well as systematic reviews. Results Effects of interventions were found within 3 categories: Multicomponent program, the use of clowns in the induction face, web-based interventions and a children's book. The effect of anxiety reduction in the studies was measured by use of reliable and valid instruments M-YPAS, ICC, APAIS, and STAI.

### **Conclusion**

The use of a multicomponent and a web-based program can help in reducing anxiety in both parents and children. The meeting with clowns, watching an information video or reading a children's book has shown to have an anxiety reducing effect on either parents or children. The studies support collaboration between the involved departments to accomplish the reduction of anxiety creating a link to the ward to enhance the hospitalization of the family.

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