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Oral presentations

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Preoperative anemia is associated with increased long-term mortality risk in patients undergoing coronary artery bypass grafting

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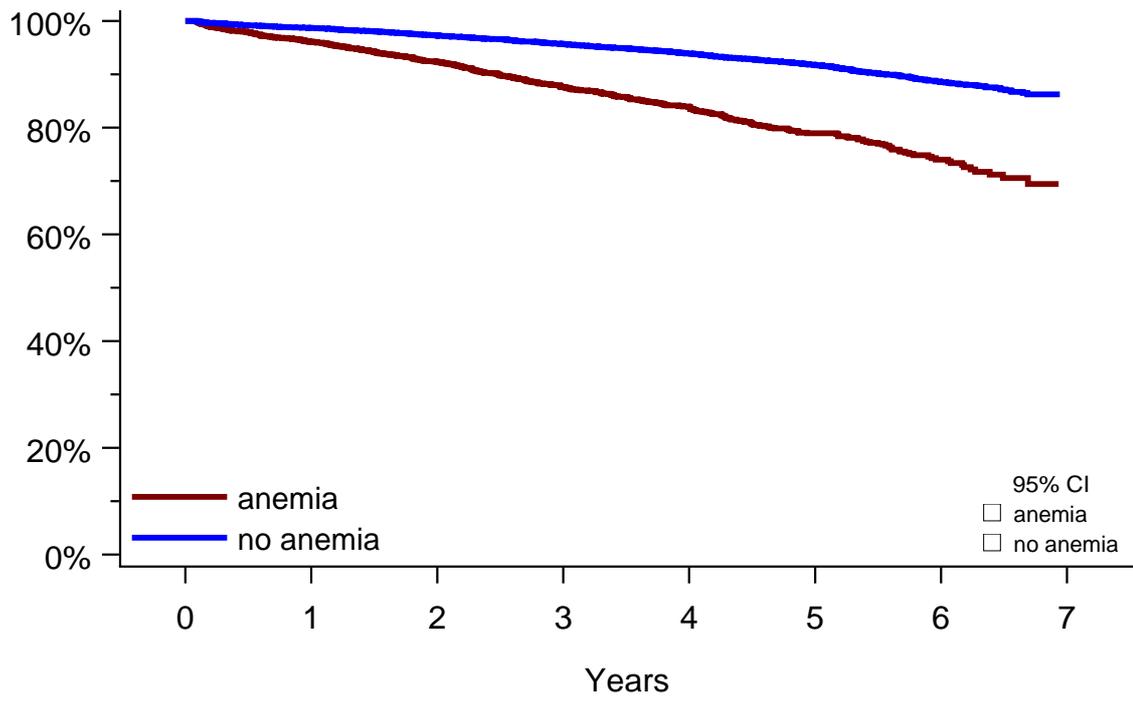
Background: Anemia is associated with inferior early outcome after cardiac surgery. However, the association between preoperative anemia and long-term mortality after coronary artery bypass grafting (CABG) has not previously been investigated.

Methods: In this observational, nationwide cohort study, including patients from the SWEDEHEART registry, all patients who underwent first-time isolated CABG in Sweden 2009-2015 were eligible. Exclusion criteria were a missing preoperative hemoglobin value (n=2,879) or death within the first 30 days after surgery (n=218). The WHO definition of anemia was used (hemoglobin concentration <130 g/L for males, <120 g/L for females). Kaplan-Meier curves and multivariable Cox regression models adjusted for age, sex, renal function, previous bleeding, heart failure, previous stroke, previous myocardial infarction, left ventricular ejection fraction, diabetes, atrial fibrillation, peripheral vascular disease, pulmonary disease, hypertension, and history of cancer, were utilized to compare anemic and non-anemic patients.

Results: Of 16,041 patients included, 3,308 (20.6%) had anemia, 19.5% among males and 25.7% among females. The incidence of all-cause death during follow-up in anemic and non-anemic patients was 4.6 and 1.7 per 100 patient years, respectively. The overall unadjusted hazard ratio (HR) of mortality with 95% confidence interval was 2.73 (2.43-3.07) for preoperative anemia. When adjusted, the HR was 1.53 (1.35-1.73). Furthermore, the sex-specific adjusted HRs for males and females were 1.62 (1.40-1.86) and 1.23 (0.93-1.61), respectively.

Conclusion: Preoperative anemia is independently associated with an increased long-term mortality after CABG, more strongly for males than females. These results suggest closer surveillance postoperatively for patients with preoperative anemia.

Survival probability



	Number at risk							
	0	1	2	3	4	5	6	7
anemia	3308	2719	2175	1628	1151	644	250	0
no anemia	12733	10726	8801	6890	4869	2980	1165	0

Preserved Platelet Function and Numbers after Moderate Cardiopulmonary Bypass Times

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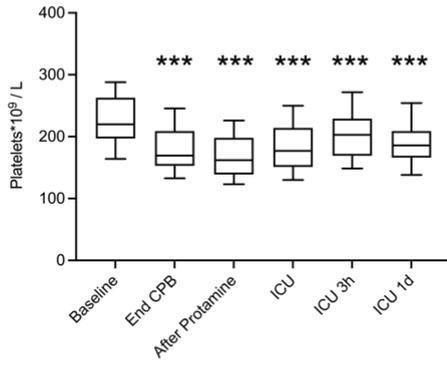
BACKGROUND: Previous older studies have described a decrease in number and function of platelets during cardiopulmonary bypass (CPB). The aim of this study was to quantify changes in numbers and function of platelets during CPB in a present-day cohort.

METHODS: Platelet numbers and function was measured at six time points in 39 patients during and after coronary artery bypass graft (CABG) surgery; at baseline before anaesthesia, at the end of CPB, after protamine administration, at ICU arrival, three hours after ICU arrival and on the morning after surgery. Platelet numbers were expressed as actual concentration and numbers corrected for dilution using hemoglobin as a reference marker. Platelet function was assessed with impedance aggregometry and flow cytometry. Data are presented as mean \pm SD.

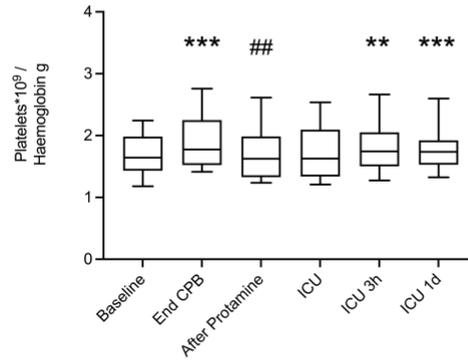
RESULTS: During CPB (85.0 \pm 21 mins), platelet concentration decreased from 227 \pm 48*10⁹/L to 179 \pm 38*10⁹/L (p<0.001). Corrected for dilution, the number of platelets increased from 1.73 \pm 0.42*10⁹/g to 1.91 \pm 0.51*10⁹/g (p<0.001). There was no consistent impairment of platelet function during CPB with neither impedance aggregometry nor flow cytometry. After protamine administration, a decrease in platelet function was measured by impedance aggregometry and for some markers of activation quantified by flow cytometry. Platelet function was restored at arrival or three hours after arrival to the ICU.

CONCLUSIONS: Platelet numbers corrected for dilution did not decrease during moderate CPB times in contrast to previous data. There was no major impairment of platelet function after CPB. Administration of protamine transiently affected platelet function.

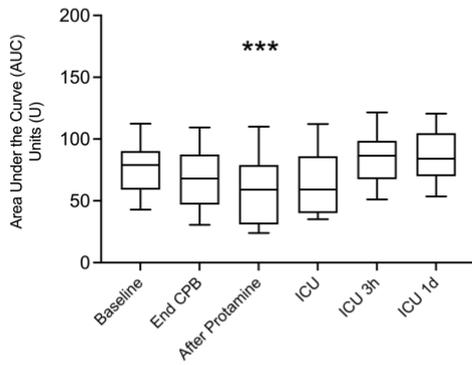
Concentration of platelets without correction for hemodilution



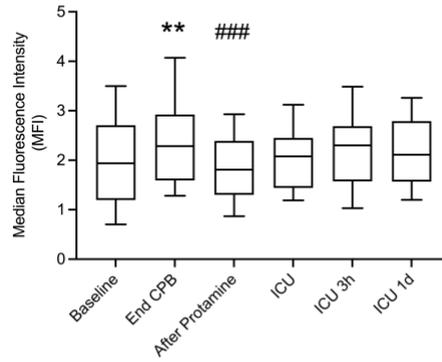
Platelet numbers corrected to hemoglobin concentration



Activation of platelets using adenosine diphosphate (ADP) as agonist measured with impedance aggregometry (Multiplate)



Activation of the fibrinogen receptor using adenosine diphosphate (ADP) as agonist measured by flow cytometry.



The box indicates quartiles with the line as median and whiskers the 10 – 90 percentile range. ** denotes p<0.01 and *** denotes p<0.001 compared with baseline. ### denotes <0.001 when compared with end of CPB using mixed-effects analysis with Šidák's multiple comparisons test.

Patients with a Mitroflow valve - an indication for reoperation?

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Background

This study analyses the performance of bioprosthetic aortic valves by presenting data from solitary SAVR procedures with a Carpentier-Edwards Perimount (CE-P) or Mitroflow bioprosthetic.

Objective

To investigate and compare the long-term rates of survival, re-operation, and clinical outcomes associated to CE-P and Mitroflow to identify valve-associated outcomes without confounding concomitant procedures.

Methods

We conducted a retrospective observational study of all patients undergoing solitary SAVR with CE-P or Mitroflow in Western Denmark between November 1999 to November 2014. Patients were identified from the Western Danish Heart Registry (WDHR). Follow-up until July 2018 was complete for the entire cohort. Survival analysis was compared to the Danish population.

Results

A total of 1150 patients were included in the analysis, 654 and 496 with CE-P and Mitroflow bioprosthesis, respectively (mean age, 71.8 and 75.3 years, respectively). The 1-, 5- and 10-year survival rate was 94%, 81% and 57% and 93%, 72%, and 29%, respectively. Mitroflow was a significant risk of mortality compared with CE-P (HR 1.85, P <0.01). There was no difference in survival in larger valves compared to small valve sizes for each manufacture. Awareness of Mitroflow structural valve deterioration seems to reduce the risk of death for those patients diagnosed, since patients reoperated with another brand had a 63% (95% CI, 0.19-0.69) decreased risk of mortality, when comparing these patients to the remaining Mitroflow population.

Conclusion

Patients still alive with Mitroflow valves should be examined with echocardiographic follow-up to change the course of a compromised prognosis before it is too late.

Incidence of re-treatment after invasively managed primary spontaneous pneumothorax - comparing tube thoracostomy with surgical treatment as primary treatment

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Background and Aims: The purpose of this study is to describe the recurrence rates for primary spontaneous pneumothoraxes managed with primary tube thoracostomy (TT) or surgery and to compare these two management modalities.

Material and Methods: Retrospective register-based study of all patients with primary spontaneous pneumothorax treated either with tube thoracostomy or surgery in Finland between years the years 2005-2018.

Results: The total number of study patients was 1594. At 5 years 53.2% of the TT treated and 33.8% of the surgically treated underwent some kind of re-treatment (either TT or surgery). Surgery was associated with lower risk of recurrence than TT (HR 0,50, $p < 0.001$). Male sex was associated with a lower risk of recurrent treatment (HR 0.75, $p = 0.001$). Higher age decreased the risk of recurrent treatment (HR 0.992, $p < 0.001$). At 5 years 36.0% of the TT treated and 18.8% of the surgical treated had been re-operated at some point. Surgery was associated with lower risk of reoperation than TT (HR 0.42, $p < 0.001$). Male sex was associated with lower risk of recurrent surgery (HR 0.65, $p < 0.001$). Higher age decreased the risk of recurrent surgery (hazard ratio (HR) 0.988, $p < 0.000$).

Conclusions: The reintervention rates after tube thoracostomy and surgery are surprisingly high at long term follow-up. Occurrences of re-treatment and reoperation are significantly higher among primary spontaneous pneumothorax patients treated at index hospitalization with tube thoracostomy than among patients treated with surgery. Female sex was associated with an increased likelihood of repeat treatment.

Statin treatment after surgical aortic valve replacement due to aortic stenosis is associated with better long-term outcome

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Objective

To evaluate the association between the use of statin after isolated surgical aortic valve replacement (SAVR) and major adverse events (MACE, including mortality, myocardial infarction and stroke), in a large population-based, nationwide cohort.

Methods

All 9,553 patients that underwent isolated SAVR due to aortic stenosis between 2006 and 2017 in Sweden and survived six months after discharge were included. Individual patient data from four nationwide registries were merged. Multivariable Cox regression models adjusted for age, sex, comorbidities, valve type and time-updated use of other secondary prevention medications (beta-blockers, RAS-inhibitors, and platelet inhibitors) were used to evaluate the association between time-updated dispense of statins and long-term outcome.

Results

Statins were dispensed to 48.0% patients at baseline and 49.6% at ten years. At baseline, 2.1% were dispensed low dose, 37.0% medium dose and 8.9% high dose statins. Ongoing statin treatment was associated with a reduced risk for MACE [adjusted hazard ratio (aHR) 0.74 (95% confidence interval 0.68 - 0.82)], cardiovascular mortality [aHR, 0.69 (0.59 - 0.82)] and all-cause mortality [aHR, 0.65 (0.58 - 0.73)], all $p < 0.001$. Subgroup interaction analyses demonstrated an association between statin use and a reduced incidence of MACE irrespective of sex, age, history of hyperlipidemia, diabetes, hypertension, prior myocardial infarction, previous stroke, or heart failure.

Conclusion

In this population-based real-life study, ongoing treatment with statins was associated with a markedly reduced long-term incidence of MACE and mortality in patients that have undergone SAVR due to aortic stenosis, suggesting that statin therapy may be beneficial for these patients.

Figure 1. The association between time-updated statin use and outcomes after isolated surgical aortic valve replacement. The model was adjusted for age, sex, comorbidities, valve types and secondary prevention medications (beta-blockers, RAS-inhibitors, and platelet inhibitors).

Long-term stroke/TIA risk after left atrial appendage closure in cardiac surgery patients with atrial fibrillation undergoing lung vein isolation or cryo-maze

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Background

Recent studies show that left atrial appendage (LAA) closure reduces stroke risk in cardiac surgery patients with preoperative atrial fibrillation (AF). We assessed the long-term risk of stroke/transient ischemic attack (TIA) in cardiac surgery patients that underwent concomitant LAA closure in addition to lung vein isolation (LVI) or cryo-maze.

Methods

Patients (n=346, mean age 66.4 years, 26% women) that underwent cardiac surgery with LVI (n=157) or cryo-maze (n=189) at Sahlgrenska University Hospital 2010-2019 were included in a retrospective study. Out of these, 206 patients (59.5%) also underwent LAA closure. The association between LAA closure and long-term risk of stroke/TIA was assessed with a multivariable Cox regression model adjusted for age, sex, previous stroke, type of main AF intervention (LVI or cryo-maze), and CHA₂DS₂-VASC score. Median follow-up was 5.4 years (range 0-10).

Results

LAA closure and non-closure patients did not differ significantly in age, sex or comorbidities at baseline. Overall, there were 28 strokes and 20 TIAs. The incidence of stroke/TIA in the LAA closure and the no closure group was 2,5 and 1.9 events per 100 patient years respectively, (p=0.49). LAA closure was not associated with a reduced risk of stroke in the adjusted multivariable model (adjusted hazard ratio 1.17 (95% CI 0.63-2.16)).

Conclusions

LAA closure was in this retrospective real-life study not associated with a reduction in the incidence of stroke/TIA. Larger real-life studies to assess the value of concomitant LAA closure in patients undergoing LVI and cryo-maze are warranted.

New-onset postoperative atrial fibrillation, early oral anticoagulation, and long-term outcome after aortic valve replacement

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Background

The prognostic implications of POAF in patients undergoing surgical aortic valve replacement (SAVR) are not fully understood. The aim of this study was to explore potential associations between POAF, early initiated oral anticoagulation (OAC) and long-term outcome after SAVR.

Methods

This is a retrospective, population-based study including all 7038 isolated SAVR patients without preoperative atrial fibrillation operated in Sweden 2007-2017. Individual patient data about co-morbidities, medications, and outcome was collected from four nationwide mandatory registries. Early OAC was defined as within 30 days after SAVR. Inverse Probability Treatment of Weighting (IPTW) Cox regression models adjusted for age, sex, comorbidities and type of prosthesis were employed.

Results

POAF was diagnosed in 3131 patients (44.5%), out of whom 2097 (67.0%) received OAC within 30 days after surgery. During a median follow-up time of 4.7 years (range 0-10 years), POAF was associated with a significantly increased risk of death [adjusted hazard ratio (aHR) 1.21 (95% confidence interval 1.06-1.37)], ischemic stroke [aHR 1.32 (1.08-1.59)], any thromboembolism [aHR 1.35 (1.15-1.58)], heart failure hospitalization [aHR 1.46 (1.23-1.72)], and recurrent atrial fibrillation [aHR 6.81 (6.06-7.65)]. No associations between early initiated OAC and death [aHR 0.88 (0.67-1.16)], ischemic stroke [aHR 0.99 (0.72-1.37)], any thromboembolism [aHR 1.00 (0.73-1.38)] or major bleeding [aHR 1.14 (0.87-1.48)] were observed.

Conclusion

POAF after SAVR was associated with an increased risk for long-term mortality and morbidity. Early initiated OAC was not associated with better or worse outcome. Further studies examining the role of early OAC in patients with POAF following SAVR are warranted.

Betablockers are not associated with favorable outcome after surgical aortic valve replacement - a report from the SWEDEHEART registry

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Aim

Previous reports have stated that betablockers appear non-beneficial regarding long-term mortality after surgical aortic valve replacement (SAVR). This study aims to further clarify the association between betablockers and long-term outcome in different patient cohorts, with emphasis on cardioselective betablockers.

Methods

All patients with isolated SAVR due to aortic stenosis in Sweden between 2006 and 2017, and alive six months after surgery were included. Patients were identified in the National Cardiac Surgery Registry and records were merged with data from three other mandatory national registries. Potential associations between dispensed cardioselective betablockers and major adverse cardiovascular events (MACE, including all-cause mortality, myocardial infarction, stroke) was analyzed using Cox proportional hazards models, adjusted for age, sex, comorbidities at baseline, and for time-updated data on medications.

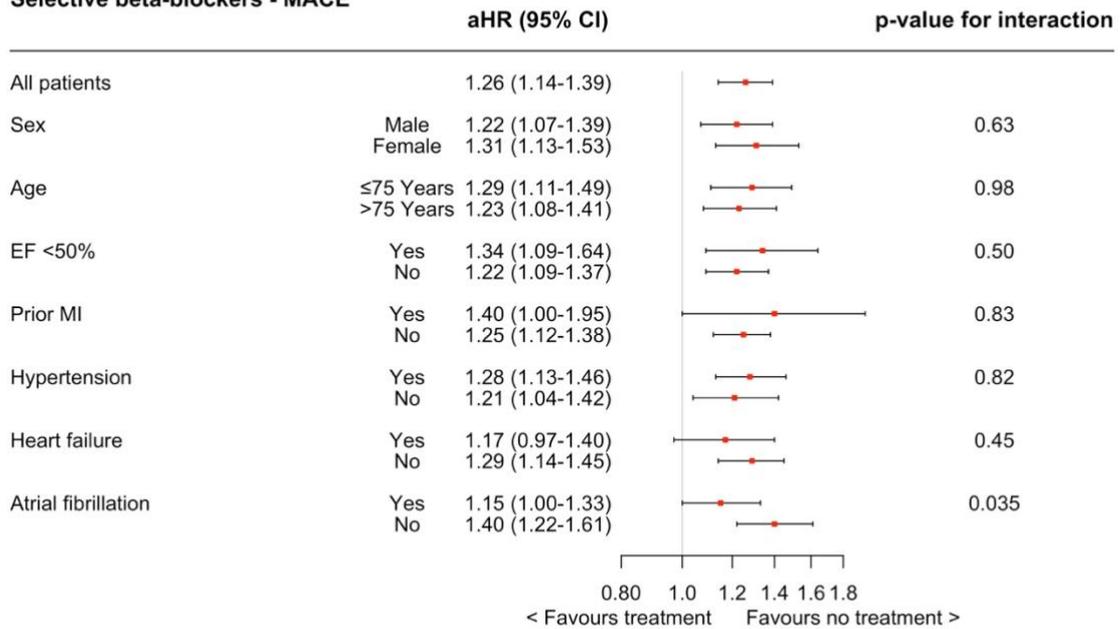
Results

In total, 9410 patients were included (median follow-up 4.4 years [IQR 2.1-7.0]). Cardioselective betablockers were dispensed to 78.3% at baseline, decreasing to 61.0% after 5 years. Ongoing treatment was associated with higher risk of MACE (adjusted hazard ratio 1.26 [95% confidence interval 1.13-1.39]) driven by a higher incidence of stroke and mortality. The association was consistent in subgroups based on age, sex, and other comorbidities with the exception of a significant interaction for patients with atrial fibrillation (see figure).

Conclusion

In this large, real-world study, ongoing treatment with cardioselective betablockers is associated with inferior long-term outcome after SAVR, except for patients with atrial fibrillation. These results suggest caution when continuing betablockers after SAVR, unless there is an imperative indication.

Selective beta-blockers - MACE



Effect of glutamate infusion on NT-proBNP after coronary artery bypass grafting in high-risk patients (GLUTAMICS II): A randomized controlled trial

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Background: Glutamate plays a key role for the recovery of myocardial metabolism after ischemia. The first GLUTAMICS-trial suggested that glutamate mitigated myocardial dysfunction in high-risk patients after CABG, except in patients with diabetes. We investigated whether glutamate infusion can mitigate rises of NT-proBNP in high-risk patients after CABG.

Methods: A prospective, randomized, double-blind study at four academic hospitals. Patients underwent CABG ± valve procedure and had LVEF ≤ 0.30 or EuroSCORE II ≥ 3.0. Intravenous infusion of 0.125M L-glutamic acid or saline at 1.65mL/kg/h was started before releasing the aortic cross-clamp and continued for 150 minutes. The primary endpoint was the difference between preoperative and day-3 postoperative plasma NT-proBNP.

Results: We studied 303 patients (age 74±7 years; females 26%, diabetes 47%), 148 receiving glutamate group and 155 controls. Glutamate was associated with a trend towards a reduced primary endpoint (5390 ± 5396 ng/L vs. 6452 ± 5215 ng/L; p=0.086). One patient died ≤ 30 days in the glutamate group compared to six controls (0.7% vs 3.9%; p=0.12).

A significant interaction between glutamate and diabetes was found (p=0.03). Among patients without diabetes the primary endpoint (4503 ± 4846 ng/L vs. 6824 ± 5671 ng/L; p=0.007), and the incidence of acute kidney injury (11% vs 29%; p=0.005) was reduced in the glutamate group. These associations remained significant after adjusting for differences in baseline data.

Conclusions: Diverging results in patients with and without diabetes agree with previous observations and suggest that the concept of enhancing post-ischemic myocardial recovery with glutamate merits further evaluation.

The PRECISE-DAPT score identifies CABG patients with increased risk for post-discharge major bleeding

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Introduction

Antithrombotic therapy after coronary artery bypass grafting (CABG) reduces the risk for ischemic events but increases the risk of bleeding. Early identification of patients with increased bleeding risk increases the possibility to tailor treatment. We evaluated in CABG patients, an existing bleeding risk score, originally developed for patients on dual antiplatelet therapy (DAPT) after coronary stenting.

Methods

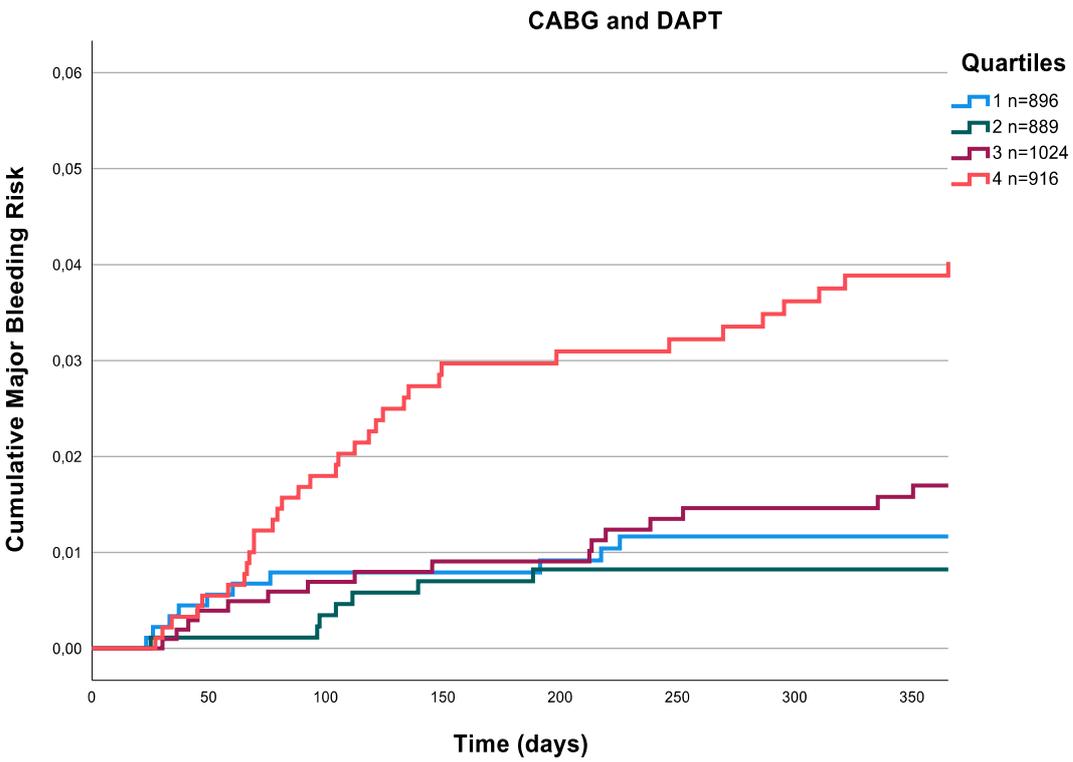
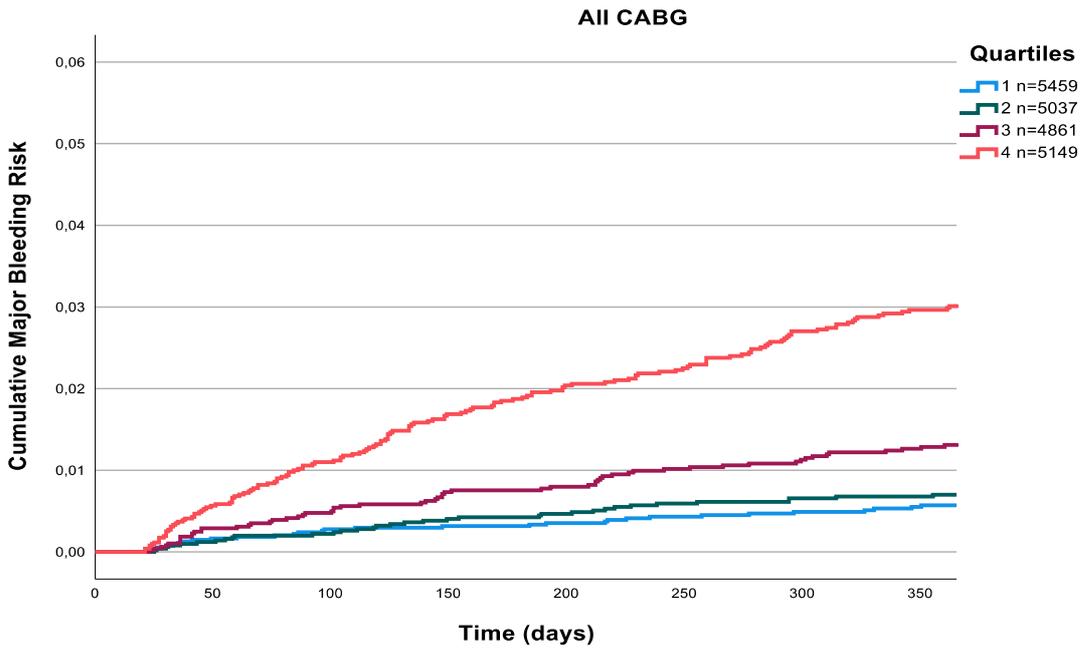
All patients operated with first time, isolated CABG in Sweden 2009-2017 that survived until discharge were included in a population-based retrospective observational study. The PRECISE-DAPT risk score (which is based on age, estimated glomerular filtration rate, preoperative haemoglobin concentration, and previous spontaneous bleeding), was calculated and evaluated in two cohorts, CABG patients on DAPT at discharge (n=3725) and all CABG patients (n=20508). Major bleeding was defined as hospitalisation due to bleeding. The patients were divided in quartiles based on the risk score. A Cox regression model was utilized to compare bleeding risk between the quartiles.

Results

Bleeding events occurred in 275 patients (1.3%) in the whole cohort and in 67 patients (1.8%) in the DAPT group. The incidence of major bleeding was significantly higher in the upper score quartile compared to the three lower quartiles in both DAPT patients [Hazard ratio (HR) 3.50 (95% confidence interval (1.14-10.71) vs lowest quartile, p<0.001, and in all patients [HR 2.43 [1.40-4.21], p<001, see Figure.

Conclusion

The PRECISE-DAPT score is a simple 4-item risk score, which identifies CABG patients with increased risk for major bleeding after discharge.



Cerebral oxygenation and autoregulation during rewarming on cardiopulmonary bypass

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Background

Rewarming on cardiopulmonary bypass (CPB) is associated with increased metabolic demands; however, it remains unclear whether cerebral autoregulation is affected during this phase. This RCT aims to describe the effects of 20% supranormal, compared to normal CPB flow, on monitoring signs of inadequate perfusion, oxygenation and disturbed cerebral autoregulation, during the rewarming phase of CPB.

Method

Thirty two patients scheduled for coronary artery bypass grafting were allocated to a Control group (n=16) receiving a CPB pump flow corresponding to preoperatively measured cardiac output, and an Intervention group (n=16) receiving the corresponding CPB pump flow increased by 20% during rewarming. Cerebral Oximetry Index (COx) was calculated with the aid of Near Infrared Spectroscopy.

Results

Twenty five patients were included in the data. Results show a median COx value of 0.0 (IQR -0.33 - 0.5) (Control) and 0.0 (IQR -0.15 - 0.25) (Intervention) respectively; p=0.85 with individual variations within groups. The median cerebral perfusion pressure (CPP) was 55 (52 - 58) (Control) and 61 (54 - 66) mmHg (Intervention); p= 0.08. No significant difference in rSO₂ values was observed between the groups (58,5% (50 - 61) vs 64% (58 - 68); p=0.06).

Conclusion

The present study showed no difference between increased and normal CPB pump flow with respect to cerebral autoregulation during rewarming. Large variations in cerebral autoregulation were seen at individual level.

Left atrial dysfunction in bicuspid aortic valve patients with severe aortic stenosis is associated with postoperative atrial fibrillation following aortic valve replacement

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The authors have chosen not to publish the abstract.

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The association of body mass index with 30-day mortality and perioperative red blood cell transfusions in open heart surgery

Jenni Räsänen, Sten Ellam, Juha Hartikainen , Auni Juutilainen, Jari Halonen

The authors have chosen not to publish the abstract.

Reoperation or aortic regurgitation progression after reimplantation of the aortic valve (David operation) using the Valsalva graft

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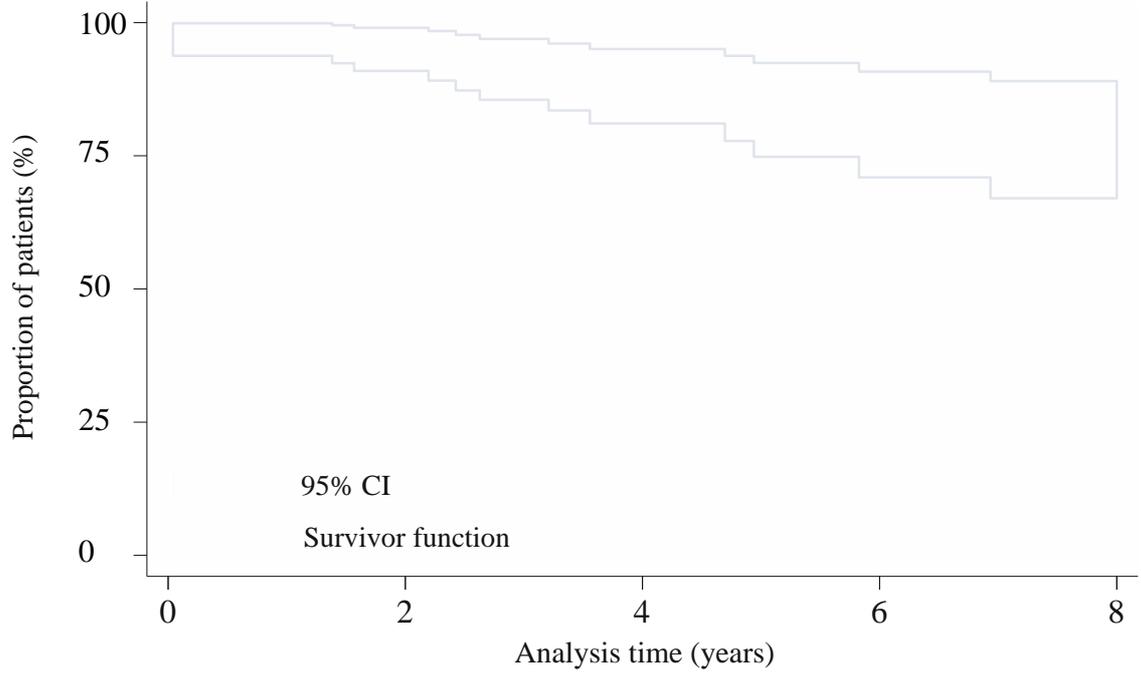
Objective: To assess predictors of a composite endpoint (reoperation for aortic valve (AV) failure or aortic regurgitation grade >2) during up to 11 years follow-up after reimplantation of the aortic valve (RAV) using the Valsalva graft.

Methods: From 2012 to 2021, 112 consecutive patients underwent RAV in a single centre. Multivariable Cox regression analysis was used to identify predictors of the composite endpoint. Kaplan-Meier methods were used for time-to-event analysis.

Results: The mean age was 51 ± 13 years. Nineteen patients (17%) were operated for acute type A aortic dissection, the remainder for aortic root aneurysm. Thirty-day mortality was 1/112 (1%). During follow-up, four patients (3.6%) were reoperated for AV-failure, nine patients (8.1%) developed AR grade > 2. Overall estimated freedom from reoperation or AR grade >2 was 90% (95% CI: 81-95%) at 4 years. Significant lower estimated freedom from the composite endpoint was found for simultaneous aortic valve repair (82% vs 93%, $p=0.05$) and operative residual AR (80% vs 91%, $p=0.006$) at 4 years. In multivariable (Cox) analysis, aortic root diameter and simultaneous aortic valve repair were independent predictors of the composite endpoint

Conclusion: Our study confirms the excellent outcomes with RAV concerning survival, reoperation and freedom from AR grade >2 during up to 11 years follow-up. Aortic root diameter and simultaneous aortic valve repair were identified as predictors for reoperation or AR grade>2.

Estimated freedom from AV-failure reoperation or AR grade > 2



Number at risk 112 83 51 32 17

Long term follow-up after pericardiectomy due to constrictive pericarditis

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Background

Constrictive pericarditis is a rare and severe condition characterized by fibrotic and constrictive changes to the pericardium which leads to restriction of diastolic relaxation. It is difficult to diagnose due to its non-specific heart failure-like symptoms. The only definitive treatment is pericardiectomy. This study aims to present long-term outcomes after surgical pericardiectomy due to constrictive pericarditis.

Methods

This retrospective single-center study included all pericardiectomy procedures (n=22, 17 male, 5 female, mean age 59 SD11.4 years) at Sahlgrenska University Hospital between March 2008 and November 2020. Data was obtained by extracting information from existing electronic medical records. Baseline demographics as well as pre-, peri- and postoperative variables were analyzed. Patients were mainly diagnosed based on symptoms in combination with echocardiography.

Results

Median duration of symptoms before surgery was 12 (IQR 6.3-16.5) months. Fourteen (64%) of the patients had a subtotal pericardiectomy and the remaining 8 (36%) patients had a total pericardiectomy. Other concomitant surgery was performed in 6 patients (27%). CPB was utilized in 13 operations (59%). Heart failure marker NT-pro-BNP was not significantly different after surgery (median preop 698 ng/L vs. 511 ng/L at one year). NYHA-class was improved after the procedure (see figure). One patient died in-hospital and 70% of patients were alive at follow-up (median follow-up 4.6 (IQR 3.2-8.0) years).

Conclusions

Patients experience significant improvement of heart failure-like symptoms after pericardiectomy for constrictive pericarditis. It is associated with favorable short- and long-term outcome, comparable to other published case series.

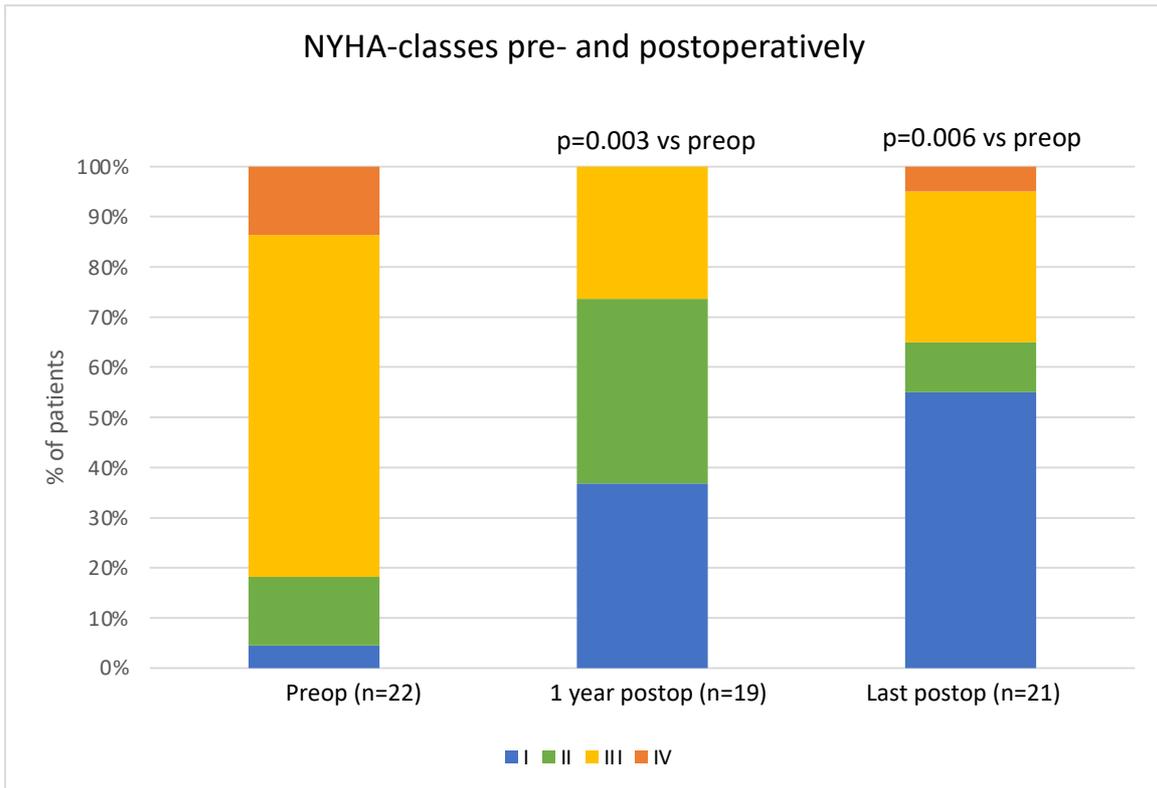


Figure 1. NYHA-class before and after surgery. P-value from Wilcoxon signed ranks test.

Poster presentations

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4559-A-2226

Analysis of infections occurring during postcardiotomy extracorporeal membrane oxygenation support in adults

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Background:

The application of extracorporeal membrane oxygenation (ECMO) in adults has been increasing, but infections occurring during ECMO use are rarely described. The aim of the present study was to evaluate incidence, time course, and causative microorganisms in patients under extracorporeal ECMO support and to identify possible risk factors.

Methods:

We retrospectively analysed the data on nosocomial infections in 336 patients aged 18 years or more undergoing ECMO therapy for more than 48 hours after major cardiac surgery with the use of cardiopulmonary bypass.

Results:

During a total of 1781.25 ECMO days, 216 episodes of infections occurred in 95 patients, including 42 respiratory tract, 40 bloodstream, 10 surgical site, 10 urinary tract, and eight other infections. Pneumonia was most frequently caused by Enterobacteria (26.1%) and Pseudomonas aeruginosa (25.0%), whereas Staphylococci (55.8%) and Klebsiella (19.5%) were the predominant blood isolates.

Beside infections the most frequent complications during ECMO support were open chest treatment (45.9%), re-sternotomy for bleeding complications (35.5%) as well as renal failure requiring renal replacement therapy (39.3%). Infected patients were at higher risk for developing renal failure and ischemic bowel requiring laparotomy. However bleeding complications were less frequent in infected patients. In stepwise logistic regression analysis, longer duration of ECMO use and dialysis were independently associated with a higher risk for infections during ECMO use.

Conclusion:

Respiratory tract infections and bloodstream infection were the most common infections during ECMO use. Duration of ECMO support and the need for renal replacement therapy seemed to be independently associated with infections.

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4585-A-2226

Socioeconomic factors and long-term mortality in patient undergoing surgical aortic valve replacement

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The authors have chosen not to publish the abstract.

A retrospective study on adherence to secondary prevention medications after coronary bypass surgery

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OBJECTIVES: We assessed adherence to statins, beta-blockers and renin-angiotensin system (RAS) inhibitors after coronary artery bypass graft surgery and factors associated with non-adherence.

METHODS: This nationwide retrospective cohort study included all individuals undergoing coronary artery bypass surgery from 22 May 2007 to 20 December 2018, at Landspítali—the National University Hospital (n = 1536). Data on dispensed prescriptions were retrieved from the National Prescription Medicine Registry. Adherence was estimated by the proportion of days covered up to 2 years after hospital discharge, with cut-offs for strict adherence and non-adherence at over 80% and under 50%, respectively. Multivariable logistic regression was used to assess variables associated with non-adherence.

RESULTS: Criteria for strict adherence were met by 39.2%, 36.9% and 30.1% of patients for statins, beta-blockers and RAS inhibitors, respectively. Non-adherence criteria were met for 14.4%, 25.9% and 43.6% of patients for statins, beta-blockers and RAS inhibitors, respectively. High Hospital Frailty Risk Score Class (statins: odds ratio (OR) 2.29, confidence interval (CI) 1.02–4.86; RAS inhibitors: OR 2.06, CI 1.04–4.04), concomitant aortic valve replacement (statins: OR 1.64, CI 1.11–2.38; RAS inhibitors: OR 1.78, CI 1.26–2.52) and a new prescription for a medication class following surgery (statins: OR 2.87, CI 2.06–4.01; beta-blockers: OR 1.70, CI 1.32–2.18; RAS inhibitors: OR 6.95, CI 5.27–9.25) were associated with non-adherence.

CONCLUSIONS: Non-adherence to medical therapy after coronary artery bypass surgery is common. Patients with a higher burden of frailty and patients naive to the medical treatment of coronary artery disease should be a target group for efforts to increase medication adherence.

Outcome after surgery for acute type A aortic dissection is not solely determined by intimal tear resection

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The outcome of acute type A aortic dissection surgery was compared between patients with recorded excised intimal tear and with intimal tear not resected using the NORCAAD registry. After excluding patients with unrecorded tear location (n=243), the final sample consisted of 879 patients with a median follow-up time of 2.6 (inter-quartile range 0.5-5.3) years. The patients with the section of aorta with intimal tear resected and replaced by prosthesis (n=730) were compared to those with intimal tear not resected (n=149). Kaplan-Meier estimates were compared and adjusted restricted mean survival time (RMST) ratios were calculated to compare all-cause mortality and reoperation-free survival. To ensure stability of Kaplan-Meier estimates, maximum follow-up time was limited to six years. The primary tear was located in the ascending aorta in the majority of the patients in tear resected group (83.6%) whereas in the tear not resected group intimal tear was commonly located at aortic root (55.0%) or aortic arch (32.2%). In the tear resected group, the reconstruction encompassed both aortic root and the aortic arch in 7.4% of the patients as compared with 0.7% in the tear not resected patients (p<0.001). Survival analysis showed equal all-cause mortality (adjusted RMST ratio 1.01, 95% confidence interval 0.92-1.12, P=0.799) and reoperation-free survival (adjusted RMST ratio 0.98, 95% confidence interval 0.95-1.02, P=0.436) between the tear resected and tear not resected patients. These findings indicate that the mid-term outcome after surgery for acute type A aortic dissection is not solely determined by intimal tear resection.

Biomarkers indicate structural and functional changes due to fibrosis in severe aortic stenosis

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The authors have chosen not to publish the abstract.

The Incidence of New Persistent Opioid Use Following Cardiac Surgery via Sternotomy

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Introduction: Previous studies from the USA have found that rate of persistent opioid usage after cardiac surgery ranged from 5.5%-12.5%. However, it is still unknown whether the rate of persistent opioid usage following cardiac surgery differs in European cohorts. We aimed to estimate the incidence of new persistent opioid usage in a nationwide cohort.

Methods: The study population included all patients that underwent cardiac surgery via sternotomy from 2005-2018 in Iceland and had not received opioids within 6 months preoperatively. Persistent opioid usage was defined as dispensing at least one opioid prescription in the first 3 months postoperatively and at least one other opioid prescription 3-6 months after surgery. In addition to examining the rate of new persistent opioid usage, we estimated factors associated with new persistent opioid usage using logistic regression.

Results: Overall, 1,227 patients underwent cardiac surgery via sternotomy during the study period. Of those, 925 fulfilled the inclusion criteria and were included in the study. Overall, 45% of patients received an opioid prescription postoperatively. Of those, 10.1% of patients developed persistent opioid usage. The proportion of patients who filled an opioid prescription postoperatively remained constant from 3-24 months after surgery. Chronic obstructive lung disease, preoperative usage of nonsteroidal inflammatory drugs, gabapentinoids, and nitrates were all associated with higher likelihood of new persistent opioid usage.

Conclusions: In this nationwide Icelandic study, the rate of new persistent opioid usage after cardiac surgery via sternotomy was high and similar to previous studies from the USA.

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4599-A-2226

20 years of type B aortic dissections in Finland - population based registry study

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The authors have chosen not to publish the abstract.

In Nordic countries 30-day mortality rate is half that estimated with EuroSCORE II in high-risk adult patients given aprotinin during cardiac surgery

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Background and Aim: European Medicines Agency (EMA)'s approval of aprotinin is restricted to patients at high-risk of major blood loss undergoing isolated coronary artery bypass graft surgery (iCABG). The Study's aim was to report aprotinin's present use and safety endpoints, primarily mortality, in adult patients.

Materials and Methods: Data came from 10 cardiac surgery centres in Sweden, Finland and Norway partaking in the European Nordic aprotinin patient registry (NAPaR) and non-interventional, post-authorisation safety study (PASS) executed at EMA's demand. All patients agreed to participate. Treating physicians decided if aprotinin should be given.

Results and Discussion: From 2016 to 2020, 489 patients (male: 72.8%; >75 years: 9.8%) were treated with aprotinin: 59 (12.1%, on-label) underwent iCABG and 430 (87.9%) another procedure, including a surgery for aortic dissection (n=81, 18.8%) and endocarditis (n=175, 35.8%). 437 patients (89.4%) received the full Hammersmith regimen and 37.2% had a previous heart operation. Dual antiplatelet treatment was present in 14.9% of all patients, in 72.9% of iCABG and in 7.4% of non-iCABG patients. Preoperative renal impairment was present in 50.7% of patients and 51.7% of surgeries were urgent, 17.0% emergent and 4.9% salvage. Mean/median bypass time was 159/148 min (range 25-637 min). Within 24h and 48h after surgery 2.0% [CI95%:1.4%-4.4%] and 5.3% [3.3%-7.3%] of patients were re-explored for bleeding, respectively, and 3 (0.6%) patients had anaphylactic reactions due to aprotinin. Rate of postoperative thrombotic events, day1 rise in creatinine >44 µmol/L and new dialysis for any reason was 2.9% [1.4%-4.4%], 17.0% [13.6%-20.3%] and 7.1% [4.9%-9.4%], respectively. In-hospital mortality and 30-day mortality was 4.9% [2.8%-6.9%] and 6.3% [3.7%-7.8%] in all patients vs. mean EuroSCORE II (estimates 30-day mortality) 11.4% [8.4%-14.0%, p<0.01]. 30-day mortality in patients undergoing surgery for aortic dissection and endocarditis was 6.2% [0.9%-11.4%] and 6.3% [2.7%-9.9%] vs. mean EuroSCORE II 13.4% [6.1%-21.0%, p=0.11] and 14.5% [12.1%-16.8%, p=0.01], respectively.

Conclusions: In patients given aprotinin at high risk of death and

bleeding undergoing cardiac surgery, mainly complex procedures, 30-day mortality was significantly lower, with halved mortality rates vs. estimations by EuroSCORE II. NAPaR data from Nordic countries suggest an excellent safety profile of aprotinin in adult cardiac surgery.

Reoperations after repair for atrioventricular septal defects: >25 years experience at a single center

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Thoracic aorta diameter is associated with intracranial aneurysm size and rupture: A retrospective cohort study

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Background: Risk factors for intracranial aneurysms (IA) or their rupture are established, but IAs association to other arterial aneurysms is yet incompletely understood. Revealing common characteristics of different vascular beds aneurysms is essential when pathologic mechanisms behind aneurysms are studied.

Objective: We investigated how aortic diameter correlates with IA size. Correlation between IA and TA size is hypothesized.

Methods: In this retrospective cohort study our institutions IA patients' records were reviewed and the diameter of the IA (ruptured or largest unruptured) and thoracic aortic were measured from imaging studies.

Patients were categorized by IA size (<7mm and ≥7mm) and by IA status (ruptured and unruptured). Thoracic aortic diameter's association to IA size and status (ruptured or unruptured) was investigated.

Results: 545 patients (mean age 59.7 years, 63.7% were women) IAs were measured. Of them, 398 TA dimensions were measured. Aortic diameter was greater in patients who had IA ≥7mm. Greater aortic diameter increased the risk for IA ≥7mm, OR 1.07 (1.02-1.12, p=0.004). Diameter of ascending aorta ($\beta = 0.132$, SE 0.07, p 0.014) and the diameter of aortic arch ($\beta = 0.175$, SE 0.07) were associated with greater IA size.

Conclusions: Thoracic aortic diameters are greater in patients with larger IAs. Increasing thoracic aortic size is associated with the risk of larger IAs. Common characteristics in pathophysiology are possible.

Autonomic Innervation in Caval Veins' Myocardial Sleeves Related to Cardiovascular Death

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Background

Dysregulation of the cardiac autonomic nervous system may be associated with cardiovascular morbidity and mortality. In this study, we analyzed the distribution of autonomic nerves in myocardial sleeves and surrounding fibro-fatty tissue around caval veins. The nerve density was correlated with available clinical data.

Materials and Methods

In total, 24 autopsied adult hearts were excised together with the superior and inferior vena cava and grouped according to the immediate and underlying causes of death (cardiovascular vs. non-cardiovascular), and heart rhythm history (atrial fibrillation vs. sinus rhythm). The density of autonomic nerves was quantified by measuring the area of immunohistochemical staining for sympathetic (tyrosine hydroxylase, TH) and parasympathetic (choline acetyltransferase, CHAT) nerves and ganglia. Growth-associated protein 43 (GAP43) was used as a neural growth marker.

Results

The mean density of TH-positive nerves in the superior vena cava myocardial sleeves was significantly decreased between groups with documented underlying cardiovascular vs. non-cardiovascular cause of death. Similarly, the nerve density of GAP43-positive nerves in the superior vena cava myocardial sleeves was significantly lower in subjects with documented underlying cardiovascular cause of death. The mean age was significantly higher in subjects with documented underlying cardiovascular vs. non-cardiovascular cause of death. Moreover, there was no association found in nerve densities between subjects with atrial fibrillation vs. sinus rhythm.

Conclusions

Sympathetic denervation in the superior vena cava myocardial sleeves may be associated with aging and/or cardiovascular mortality. No association was found between autonomic nerve densities and atrial fibrillation.

Minimally invasive mitral valve surgery - an alternative to the conventional sternotomy approach

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Objectives

The aim of this study was to compare minimally invasive surgery (MIS) with prior conventional sternotomy (CS) approach for mitral valve (MV) surgery at our institution. The study assessed quality and safety of MIS, possibly contributing to the growing evidence supporting this technique with regard to reduced surgical and postoperative morbidity.

Methods

This single-center retrospective observational study comprised 203 patients, 102 CS patients and 101 MIS patients, who underwent MV surgery with or without concomitant procedures (i.e. tricuspid valve surgery, atrial fibrillation ablation, closure of ASD) between January 2015 and April 2022.

Results

CS patients were older and had a higher preoperative risk profile. Mitral regurgitation was the primary indication for surgery, with MV repair as the predominant procedure. MIS had longer operative time, extracorporeal circulation duration, and cross clamp time, yet a shorter postoperative length of stay at our institution (6 vs. 8 days; $P < 0.001$). There was no significant difference between groups in regard to myocardial injury, intensive care unit stay or postoperative complications. The 30-day mortality was low (1.0% vs 2.0%; $P > 0.999$). Proposed learning curve of MIS was demonstrated by a tendency of shorter intraoperative times with growing experience.

Conclusions

MIS is a feasible alternative to the CS approach for MV surgery at our institution. The patients benefit from a shorter postoperative length of stay, with comparable outcomes in terms of low mortality as well as surgical and postoperative morbidity. We believe that the prolonged intraoperative times will shorten with increased experience of these procedures.

Cardiovascular Mortality and Autonomic Innervation in Myocardial Sleeves Around Pulmonary Veins

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Background

Myocardial sleeves extending to the pulmonary veins (PVs) are richly innervated structures with heterogeneous morphological and electrophysiological characteristics. Quantitative changes in autonomic innervation may be linked with cardiovascular morbidity and mortality. Our study has examined the remodeling of autonomic innervation in myocardial sleeves around human autopsied PVs and atrial-PV ostia by using immunohistochemical and morphometrical methods.

Materials and Methods

PV samples were collected from 37 and atrial-PV ostia samples from 17 human autopsy hearts. Immunohistochemical staining and morphometrical measurements of a total of 215 tissue samples were done by using antibodies against tyrosine hydroxylase, choline acetyltransferase, and growth-associated protein 43. Densities of sympathetic and parasympathetic nerves, and neural growth measurements were correlated with clinical data available from autopsy referrals.

Results

In the PV cohort, subjects with documented immediate cardiovascular cause of death had significantly reduced sympathetic nerve density in fibro-fatty tissue vs. those with documented immediate non-cardiovascular cause of death ($1624.5 \pm 3148.4 \mu\text{m}^2/\text{mm}^2$ vs. $2522.1 \pm 2874.4 \mu\text{m}^2/\text{mm}^2$, $P=0.038$). In the atrial-PV ostia cohort, parasympathetic nerve density in myocardial sleeves was significantly enhanced in subjects with documented underlying cardiovascular cause of death vs. subjects with documented underlying non-cardiovascular cause of death with no parasympathetic nerves identified ($19.5 \pm 45.6 \mu\text{m}^2/\text{mm}^2$ vs. $0 \mu\text{m}^2/\text{mm}^2$, $P=0.034$).

Conclusions

Diverse autonomic nerve density around PVs and atrial-PV ostia might play role in cardiovascular death. There was no association found in autonomic innervation between subjects with and without a history of atrial fibrillation.

Long-term outcome of patients undergoing re-exploration for bleeding following cardiac surgery: a SWEDEHEART study

Alexandra A Heimisdottir, Susanne J Nielsen

Objectives: Excessive bleeding leading to re-exploration is a severe complication of cardiac surgical procedures, associated with early postoperative morbidity and mortality. Less is known about the long-term outcome of these patients. We evaluated the impact of re-exploration after cardiac surgery on peri- and postoperative morbidity and mortality, as well long-term mortality, in a well-defined nationwide population.

Methods: In this retrospective study, 48,060 consecutive patients undergoing coronary artery bypass grafting (CABG) and/or valve surgery from 2006-2015 were analyzed. Multivariable logistic regression was used to identify factors associated with re-exploration, morbidity, and mortality. Cox regression analysis was implemented to explore the association between re-exploration and long-term mortality. Mean follow-up time was 4.6 years (range 0 to 10 years).

Results: Overall, 2,371 patients (4.9%) underwent re-exploration. Factors associated with re-exploration included advanced age, procedures other than isolated CABG, and acute surgery. Re-explored patients had an increased risk of unadjusted mortality at 30, 90 and beyond 90 days (all $p < 0.001$). Significance was maintained after adjustment at 30 days (odds ratio [OR]: 3.94, 95% CI: 3.19-4.85, $p < 0.001$) and 90 days (OR: 3.79, 95% CI: 3.14-4.55, $p < 0.001$), but not with long-term mortality (HR: 1.02, 95% CI: 0.91-1.15, $p = 0.712$). Furthermore, re-exploration was independently associated with other postoperative complications, e.g., prolonged hospital stay, stroke and renal injury.

Conclusions: Patients that are re-explored for bleeding within 24 hours have almost fourfold higher odds of mortality within three months post-procedure. The increased risk of death following re-exploration is not maintained in the long-term.

Tables

Table 1. Comparison of demographic, preoperative and operative characteristics in patients with vs. without re-exploration for bleeding. Values are presented as numbers (percentages) of patients unless stated otherwise.

	Re-exploration (n = 2,371)	No re-exploration (n = 45,689)	p-value
Demographic characteristics			
Female sex	543 (22.9)	11,874 (26.0)	<0.001
Age, median [Q ₁ -Q ₃]	71 [63-77]	69 [62-76]	<0.001
BMI ^a , median [Q ₁ -Q ₃]	25.9 [23.6-28.7]	26.7 [24.3-29.6]	<0.001
Risk factors and preoperative characteristics			
Hypertension	1,319 (55.6)	25,306 (55.4)	0.833
Dyslipidemia	657 (27.7)	13,131 (28.7)	0.290
Diabetes mellitus	520 (21.9)	10,846 (23.7)	0.046
LVEF			<0.001
>50%	1,547 (66.1)	31,723 (70.1)	
30-50%	591 (25.2)	11,102 (24.5)	
<30%	203 (8.7)	2,432 (5.4)	
Recent MI ^a	781 (32.9)	13,852 (30.3)	0.005
Previous PCI	259 (13.4)	5,235 (13.7)	0.705
History of heart failure	564 (23.8)	8,108 (17.7)	<0.001
History of renal failure	130 (5.5)	1,687 (3.7)	<0.001
History of atrial fibrillation	322 (13.6)	5,413 (11.8)	0.012
History of stroke or TIA	263 (11.1)	4,554 (9.9)	0.081
History of cancer	365 (15.4)	6,240 (13.7)	0.290
History of bleeding	474 (20.0)	7,414 (16.2)	<0.001
EuroSCORE I (%), median [Q ₁ -Q ₃]	5.1 (2.4-9.6)	3.5 (2.0-7.0)	<0.001
Preoperative creatinine (μmol/L), median [Q ₁ -Q ₃]	86 [74-102]	83 [72-98]	<0.001
Preoperative hemoglobin (g/L), mean ± SD ^b	135 ± 17	137 ± 15	<0.001
Preoperative use of ASA ^b	456 (19.2)	8,581 (18.8)	0.916
Preoperative use of other platelet inhibitors ^b	150 (6.3)	2,155 (4.7)	<0.001
Operative characteristics			
Type of surgical procedure			
CABG	1,259 (53.1)	29,216 (63.9)	<0.001
Valve surgery	684 (28.8)	12,057 (26.4)	0.009
Combined CABG and valve surgery	428 (18.1)	4,416 (9.7)	<0.001
No. of distal anastomoses, median [Q ₁ -Q ₃] ^c	3 (0-4)	3 (0-4)	0.152
Mammary artery used ^c	1,977 (83.4)	39,893 (87.3)	<0.001
ECC used	2,347 (99.0)	44,849 (98.2)	0.004
Acute operation	183 (7.7)	1,741 (3.8)	<0.001

Abbreviations: BMI, body mass index; LVEF, left ventricular ejection fraction; MI, myocardial infarction; PCI, percutaneous coronary intervention; TIA, transient ischemic attack; ASA, acetylsalicylic acid; CABG, coronary artery bypass surgery; ECC, extracorporeal circulation.

^aMI within the previous 90 days.

^bUsing a subset of the database including years 2013-2015 (n = 13,055) due to the amount of missing data for some variables from previous years.

^cUsing a subset of the database including only those that underwent CABG or combined CABG and valve surgery (n = 35,319).

Table 2. Factors associated with re-exploration for bleeding.^a

	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age(per year)	1.02 (1.00-1.02)	<0.001	1.01 (1.00-1.02)	0.003
Female sex	0.85 (0.77-0.93)	<0.001		
BMI (kg/m ²)				
25-29.9 (reference)	1.00		1.00	
<25	1.31 (1.19-1.44)	<0.001	1.12 (0.98-1.44)	0.072
≥30	0.82 (0.72-0.92)	<0.001	0.88 (0.70-1.10)	0.281
EuroSCORE I (per step)	1.26 (1.22-1.31)	<0.001		
Hypertension	0.96 (0.84-1.11)	0.610		
History of bleeding	1.29 (1.16-1.43)	<0.001	1.16 (0.95-1.42)	0.139
History of anemia	1.40 (1.20-1.63)	<0.001		
Hemoglobin(per g/L)	0.99 (0.98-0.99)	<0.001		
Preoperative use of ASA	1.05 (0.89-1.24)	0.594	1.02 (0.82-1.27)	0.862
Preoperative use of other platelet inhibitors	1.48 (1.24-1.73)	<0.001	1.51 (1.22-1.86)	<0.001
Preoperative S-creatinine (per μmol/L)	1.02 (1.01-1.03)	<0.001	1.02 (1.01-1.03)	<0.001
LVEF				
>50% (reference)	1.00			
30-50%	1.10 (0.99-1.20)	<0.001		
<30%	1.71 (1.47-1.99)	<0.001		
Type of surgical procedure				
CABG (reference)	1.00		1.00	
Valve surgery	1.19 (1.01-1.39)	0.032	1.31 (1.03-1.66)	0.025
Combined CABG and valve surgery	2.27 (1.89-2.70)	<0.001	2.28 (1.81-2.85)	<0.001
ECC used	1.69 (0.95-3.41)	0.103	1.83 (0.91-4.35)	0.124
Acute operation	2.34 (1.82-3.00)	<0.001	2.05 (1.49-2.78)	<0.001

Abbreviations: OR, odds ratio; CI, confidence interval; BMI, body mass index; ASA, acetylsalicylic acid; LVEF, left ventricular ejection fraction; CABG, coronary artery bypass surgery; ECC, extracorporeal circulation.

^aUsing a subset of the database including years 2013-2015 (n = 13,055) due to the amount of missing data for some variables from previous years.

Table 3. Associations between re-exploration for bleeding and perioperative morbidity.

	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)*	p-value
Postoperative length of stay \geq 10 days	1.19 (1.16-1.21)	<0.001	1.81 (1.64-1.99)	<0.001
Perioperative stroke	2.34 (1.81-2.96)	<0.001	2.11 (1.61-2.73)	<0.001
Perioperative AKI	2.34 (2.02-2.71)	<0.001	2.06 (1.76-2.41)	<0.001
Perioperative atrial fibrillation	1.50 (1.31-1.73)	<0.001	1.37 (1.18-1.58)	<0.001
Postoperative need for dialysis	4.24 (3.53-5.08)	<0.001	3.50 (2.83-4.30)	<0.001
Postoperative need for mechanical ventilation	5.00 (4.27-5.83)	<0.001	4.34 (3.46-5.40)	<0.001
Postoperative need for circulatory support	4.24 (3.56-5.03)	<0.001	3.77 (3.06-4.61)	<0.001

Abbreviations: OR, odds ratio; CI, confidence interval; AKI, acute kidney injury.

*After adjustment for age, sex, EuroSCORE, diabetes, preoperative S-creatinine, type of surgical procedure and acuteness of operation.

Figures

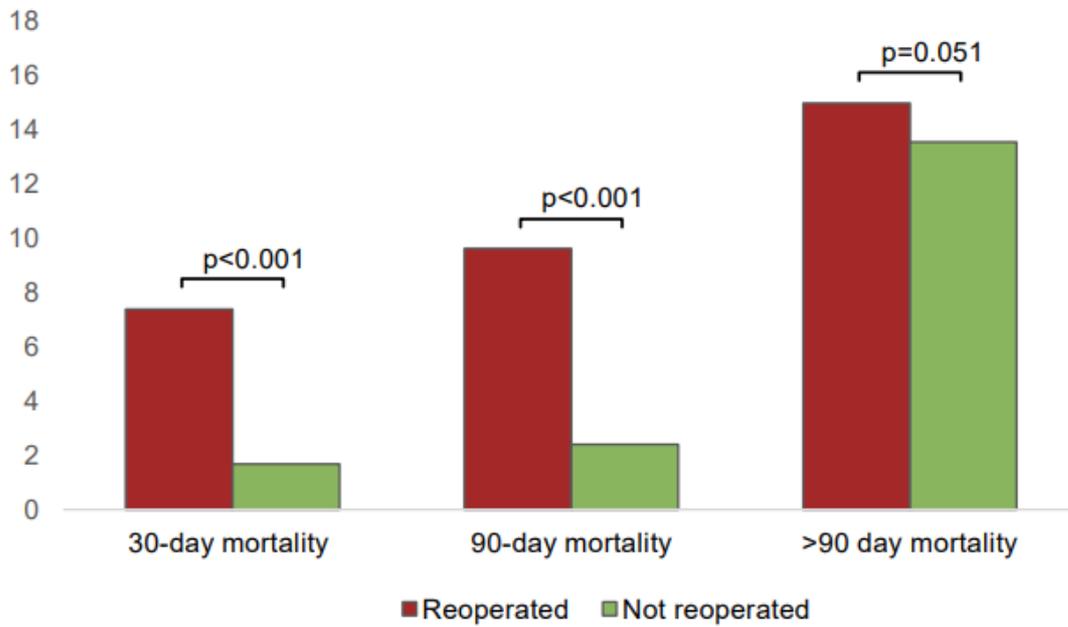


Figure 1. Unadjusted mortality rates at 30-, 90- and beyond 90 days of re-explored vs. non-reexplored patients.

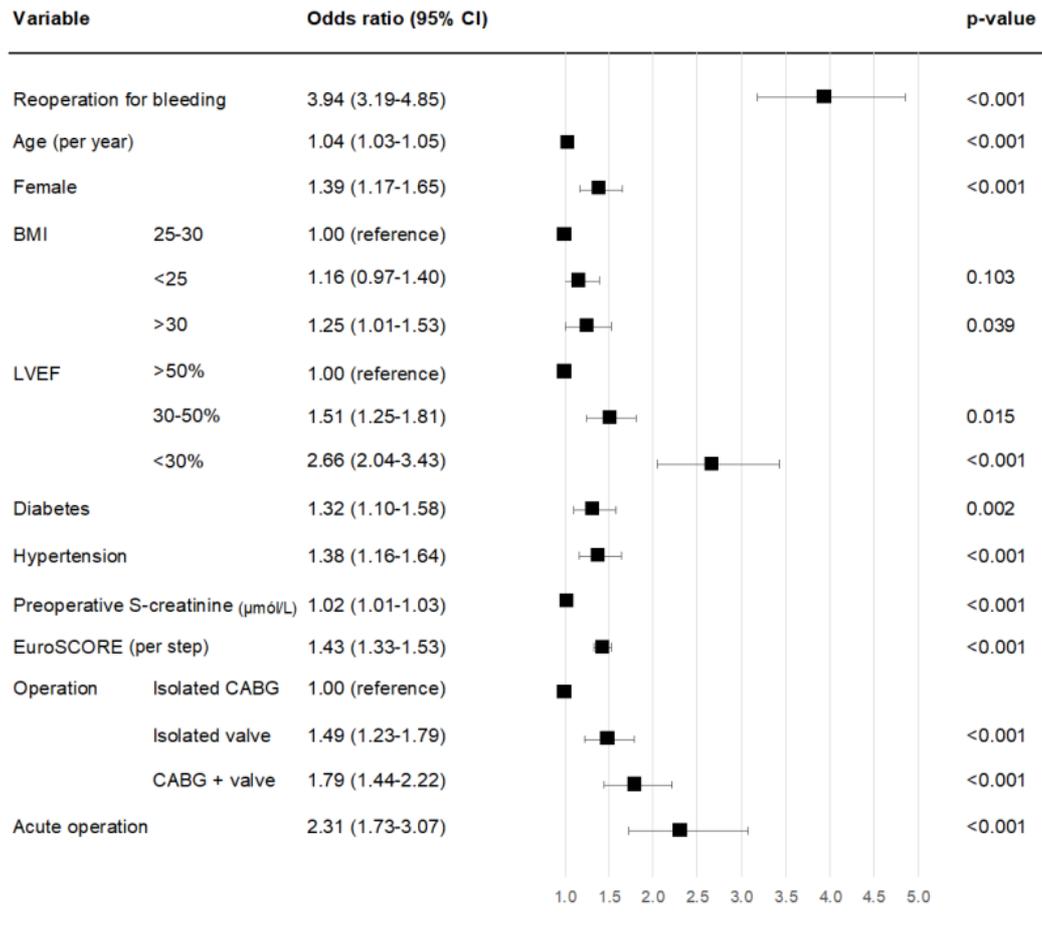


Figure 2. Outcome of the final multivariable logistic regression model for 30-day mortality. Abbreviations: OR, odds ratio; CI, confidence interval; BMI, body mass index; LVEF, left ventricular ejection fraction; CABG, coronary artery bypass surgery.

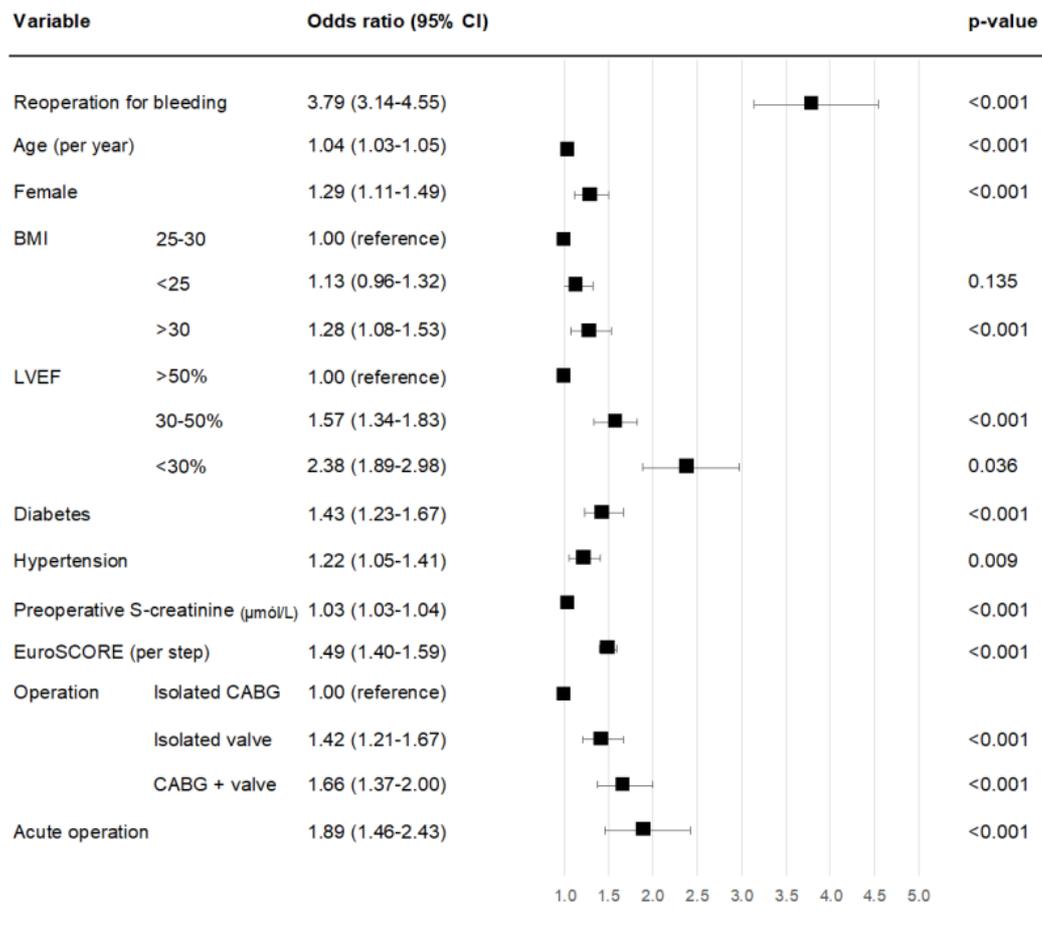


Figure 3. Outcomes of the final multivariable logistic regression model for 90-day mortality. Abbreviations: OR, odds ratio; CI, confidence interval; BMI, body mass index; LVEF, left ventricular ejection fraction; CABG, coronary artery bypass surgery.

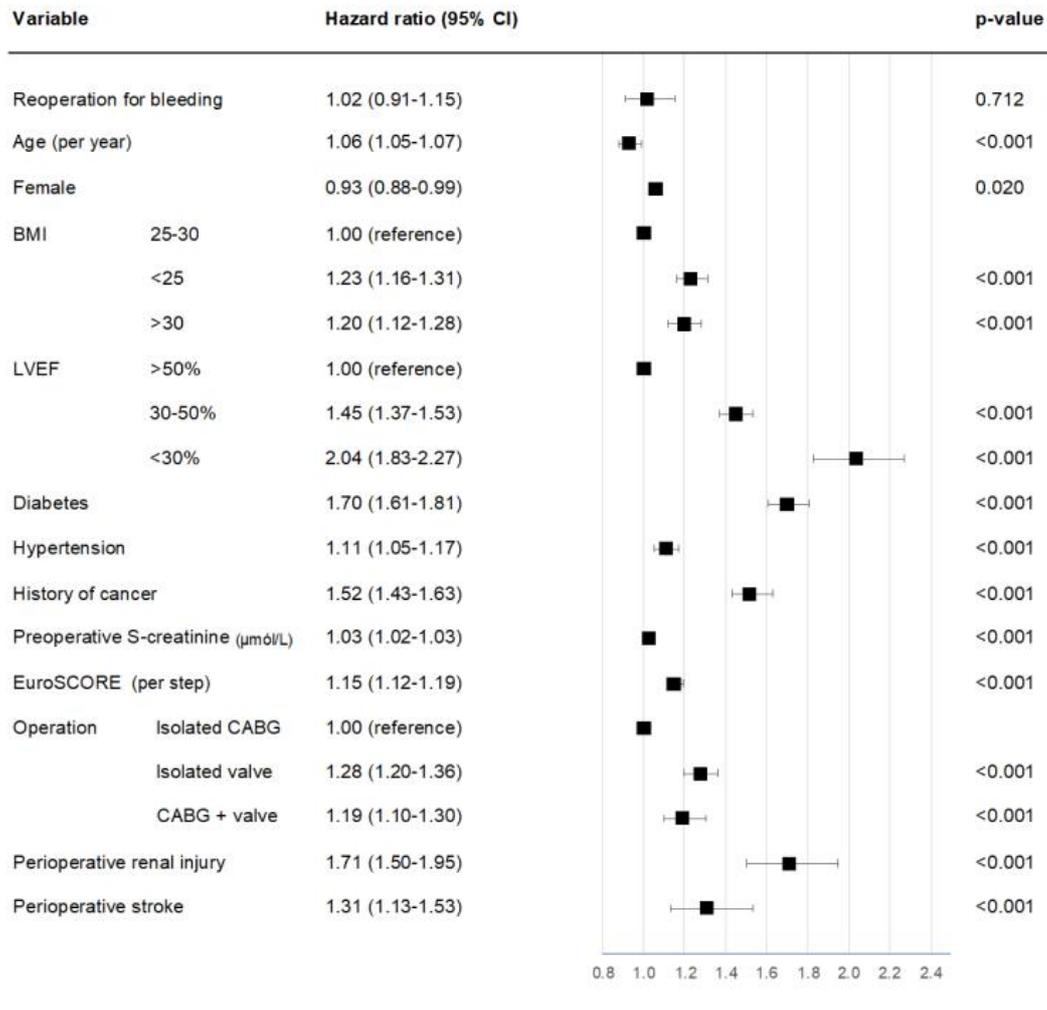


Figure 4. Adjusted analysis for long-term mortality, with mortality before 90 days excluded. Abbreviations: OR, odds ratio; CI, confidence interval; BMI, body mass index; LVEF, left ventricular ejection fraction; CABG, coronary artery bypass surgery.

Outcome of valve repair for degenerative mitral valve disease in a geographically isolated low-volume center

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Objectives: Degenerative mitral valve disease is the most common indication for mitral valve repair in the Western world. The aim of this study was to study the long term outcome of mitral valve repair for degenerative mitral valve regurgitation in Iceland.

Material and methods: A retrospective study of 101 consecutive mitral valve repair patients (average age 57.7 years, 80.2% male) operated in Iceland 2004-2018 for degenerative mitral valve regurgitation. Long term survival and MACCE (Major adverse cardiac and cerebrovascular event) free survival was estimated using the Kaplan-Meier method and compared to age and gender matched reference population. Median follow-up time was 7 years.

Results: On average there were seven (range 1-14) mitral valve repairs performed annually with 99% of the patients receiving ring annuloplasty. A total of 82 (82,2%) underwent resection of the posterior leaflet and 64.4% received Gore-Tex®-chordae. Major early complications occurred in 28.7% of cases, most commonly perioperative myocardial infarction (11.9%) and reoperation for bleeding (8.9%). Mortality within 30 days was 2%, the median duration of intensive care unit stay was one day and the median hospital length of stay was 8 days. One patient needed reoperation later for recurrent mitral regurgitation. Five and ten year MACCE-free survival was 91.1% (95%-CI:85.3-97.2) and 81.0 (95%-CI:71.6-91.6), respectively. Five year survival was 93.5% (95%-CI:88.6-98.7) and 10 year survival 85.3% (95%-CI:76.6-94.9), and was not different from an age and gender matched reference population (p=0.135, log-rank test).

Conclusion: Outcomes of mitral valve repair due to degenerative mitral regurgitation is good in Iceland and results are comparable to larger institutions overseas. Long term prognosis is generally good although early postoperative complications often occur.

The impact of perioperative myocardial infarction on short and long-term outcome following coronary artery bypass grafting

Sunna Run Heidarsdottir, Erla Liu Ting Gunnarsdottir, Sunna Lu Xi Gunnarsdottir, Martin Ingi Sigurdsson, Tomas Gudbjartsson

Background: Perioperative myocardial infarction (PMI) after CABG can contribute to in-hospital morbidity and mortality, however, its clinical significance, especially on long-term outcome, is poorly studied. We therefore studied both short and long-term effects of PMI in CABG-patients.

Methods: A retrospective nationwide-study included consecutive CABG-patients operated in Iceland 2002-2018. Patients admitted with STEMI/NSTEMI or had missing cardiac biomarkers were excluded. PMI was defined as tenfold elevated serum-TnT and/or CK-MB associated with new ECG changes consistent with ischemic aetiology. Short (<30 days) and long-term complications were registered, including a composite endpoint of MI, stroke, PCI, re-CABG and death (MACCE). Survival was estimated with the Kaplan-Meier method and logistic/Cox regression analysis used to determine factors associated with PMI. Mean follow-up was xx months.

Results: Out of 1446 patients 78 (5.4%) were diagnosed with PMI (range: 0-15.5) with significant annual decrease ($p < 0.01$). PMI-patients more often had advanced coronary disease and class IV angina, compared to non-PMI patients, and the mean CK-MB and TnT in the same group being 170 vs. 22.4 mg/L and 3952 vs. 501mg/L, respectively ($p < 0,001$). Rate of short-term complications was threefold for PMI patients (15.4 vs. 5.2%), their 30 day mortality higher (11.5 vs. 0.4%, $p < 0,001$), and 5-year MACCE-free survival significantly inferior (69.2% vs. 84.7%, $p = 0,01$). Five-year survival, however, was not significantly different (84.6 vs. 92.6%, $p = 0.55$) and in logistic regression PMI independently predicted 30 day, but not long-term mortality.

Conclusions: Although PMI is associated with higher rates of short-term complications and inferior 30-day survival, long-term survival is not statistically different from non-PMI patients.

Cardiac transplantation and donation in Icelandic patients - indications and outcome

Atli Steinn Valdgardsson, Thordis Hrafnkelsdottir, Tomas Thor Kristjansson, Hildignnur Fridjonsdottir, Kristinn Sigvaldason, Göran Dellgren, Tomas Gudbjartsson

Introduction: Information on the number, indications and outcome of cardiac transplantations in Icelandic patients is scarce, as is information on the number of hearts donated from Iceland for cardiac transplantation.

Material and methods: A retrospective study on patients receiving heart transplantation from the first procedure in 1988 until March 2019. Clinical information was gathered from Landspítali Transplantation Clinic, patient charts, and information on donated hearts from the Icelandic Donation Registry. Age-standardized incidence of the procedure was calculated, and overall survival (Kaplan-Meier) estimated. Mean follow-up was 10.3 years.

Results: Altogether 24 patients (19 males, median age 38 years, range: 4-65 years) underwent cardiac transplantation; that included one re-transplantation, three simultaneous heart- and lung transplants and two heart- and kidney transplants. The transplantations were performed in Gothenburg (n=20), London (n=3) and Copenhagen (n=2). Most common indications were dilated cardiomyopathy (n=10), congenital heart disease (n=4), and viral myocarditis (n=3). Five patients were bridged with ventricular-assist device preoperatively. Overall survival at 1 and 5 years was 91% and 86%, respectively; median survival being 24.2 years. The incidence of cardiac transplantation was 2.7 heart-TX pmp/year but increased to 4.6 heart-TX pmp/year after 2008 (p=0.01). During the same period 42 hearts were donated from Iceland for transplantation abroad, the first in 2002 and increasing from 0.8 to 3.0 hearts/year during the first and second half of the study-period.

Conclusions: Survival of Icelandic cardiac transplant recipients is good and comparable to larger transplant centers overseas. Number of hearts donated from Iceland have increased and currently Iceland donates twice as many hearts as it receives.

Early detection of driveline infections with the MolecuLight i:X device

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¹ University Hospital Münster

Objectives:

Driveline infection (DLI) is a common complication in patients with left ventricular assist device (LVADs). This complication can seriously undermine quality of life while on LVAD. Diagnose a DLI in the outpatient setting bases on clinical examination and later bacteria isolation. MolecuLight i:X, a handheld fluorescence imaging device capable to visualize bacterial colonization in real time. The present study evaluates the performance of this device for the diagnosis DLI as this device may have the potential advantage to rapidly identify infection and therefore promptly influence therapy.

Methods:

A total of 50 suspicious DLI were included in this study. Additionally to the standard treatment, fluorescence images were captured and swabs were taken at the area of maximal luminosity. Wounds and the pictures were reviewed and classified as positive or negative by a wound specialist and two heart surgeons independently from microbiological results. Real time acquisitions were then coupled with the microbiological results. Sub-analyses of possible influencing factors such as material of the dressing and prior antibiotic treatment were made.

Results:

The MolecuLight showed positive results (red fluorescence) in 16 cases (32%), whereas microbiological examination was positive for microorganisms in 30 cases (60%). The most common bacteria was *Staphylococcus aureus*. The findings resulted in a sensitivity of 25% and a specificity of 55.56%. The positive predictive value was 50% and the negative predictive value was 29.41%. Sub-analyses of the different wound dressings did not show any relevant difference.

Conclusions:

The results of the MolecuLight show a low sensitivity and specificity when being used to detect driveline infections in the outpatient setting. Clinical examination and swabs should remain the gold standard despite microbiological delay. Sensitivity and specificity of the MolecuLight in open wounds after surgical revision of driveline remains to be clarified.

Ascending aortic wall degeneration in patients undergoing bicuspid aortic valve replacement

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Background: Surgery for the ascending aorta during bicuspid aortic valve (BAV) replacement is considered during aortic wall dilatation though the presence of ascending aortic wall degeneration is often unknown.

Methods: We investigated ascending aortic wall degeneration in patients with either bicuspid aortic valve (BAV) or tricuspid aortic valve (TAV). The ascending aortic wall of 67 consecutive patients was processed for histology and immunohistochemistry. The extent of surgery and wall degeneration were investigated. Unadjusted survival was evaluated by Kaplan-Meier analysis. Median follow-up for patients with BAV and TAV was 3.8 years (interquartile range [IQR] 3.5-4.1) and 3.7 years (IQR 3.4-3.9), respectively.

Results: There were 33 patients with BAV and 34 with TAV. Mid-ascending aorta diameter was 54 mm (IQR 50-60). Replacement of the aortic valve, together with an ascending aortic prosthesis, was more frequent in BAV vs TAV patients (24% vs 3%, $P = 0.013$). However, medial fibrosis, elastic fiber thinning, incremental medial degeneration and smooth muscle cell nuclei loss were less prominent in BAV vs TAV patients (0.1 ± 0.4 vs 0.8 ± 1.4 , $P = 0.016$; 0.6 ± 1.4 vs 1.6 ± 2.0 , $P = 0.027$; 1.7 ± 0.7 vs 2.2 ± 0.8 , $P = 0.045$ and 2.3 ± 1.5 vs 3.2 ± 1.3 , $P = 0.026$, respectively).

Conclusions: Histopathology alone may not support the necessity of surgery of the ascending aorta in patients undergoing BAV surgery.

Impact of renal dysfunction on early outcomes of coronary artery bypass grafting surgery

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1 University of Iceland

2 Landspítali

INTRODUCTION: Impaired renal function as seen in chronic kidney disease (CKD) is a known risk factor for coronary artery diseases and has been linked to inferior outcome after myocardial revascularization. Studies on the outcome of coronary bypass grafting (CABG) in CKD-patients are scarce. We aimed to study this subgroup of patients following CABG in a well defined whole-nation cohort, focusing on short term complications and 30 day mortality.

MATERIALS AND METHODS: A retrospective study on 2300 consecutive patients that underwent CABG at Landspítali University Hospital 2001-2020. Patients were divided into four groups according to preoperative estimated glomerular filtration rate (GFR), and the groups compared. GFR 45-59 mL/min/1.73m², GFR 30-44 mL/min/1.73m², GFR <30 mL/min/1.73m² and controls with normal GFR (≥60 mL/min/1.73m²). Clinical information was gathered from medical records and logistic regression used to estimate risk factors of 30-day mortality.

RESULTS: Altogether 429 (18.7%) patients had impaired kidney function; these patients being more than six years older, having more cardiac symptoms and a higher mean EuroSCORE II (5.0 vs. 1.9, p<0.001) compared to controls. Furthermore, their left ventricular ejection fraction was also lower, their median hospital stay extended by two days and major short-term complications more common, as was 30 day mortality (24.4% vs. 1.4%, p<0.001). In multivariate analysis advanced age, ejection fraction <30% and GFR <30 mL/min/1.73m² were independent predictors of higher 30-day mortality (OR=10.4; 95% CI: 3.98-25.46).

CONCLUSIONS: Patients with impaired renal function are older and more often have severe coronary artery disease. Early complications and 30-day mortality were much higher in these patients compared to controls and advanced renal failure and the strongest predictor of 30-day mortality.

Complex aortic root surgery using a valved BioIntegral conduit - 9-year single-center experience

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¹ Dept of Cardiac Surgery, Heart and Lung Center, Helsinki University Hospital

Pathologies affecting the aortic root emerging after a previous heart operation or infection present a great surgical challenge. Especially when endocarditis is involved, biological materials are often regarded as the most optimal for root replacement in complex pathologies. However, the durability of biological materials has been under debate and even chronic infection has been detected.

We report our experience with patients treated for complex aortic root pathologies using BioConduit, a biological conduit by BioIntegral Surgical. In total, 38 patients have undergone aortic root replacement using the BioIntegral conduit between January 2013 and January 2022 at Helsinki University Hospital. Of these, 35 patients (92%) had undergone previous aortic valve replacement; 16 patients (42%) had composite grafts. Infective endocarditis was the indication for surgery in 28 patients (74%); of these, three had previous intravenous drug abuse. In conjunction with the aortic root replacement, 29 patients (76%) required additional procedures, most commonly coronary bypass grafting and pacemaker implantation. During the postoperative hospital stay, one patient suffered an acute myocardial infarction; none had strokes; and four (11%) died.

Our long-term follow-up will end on July 31st, 2022. By that time, the median follow-up will be 43 months (range 6 to 116 months). Using data available through our hospital records, we will report long-term mortality, available echocardiography findings from the last follow-up visit (conduit valve regurgitation, stenosis), need for reoperation, and incidence of conduit infections.

Diagnosis and treatment options for LVAD outflow graft torsion

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¹ University Hospital Münster

Introduction:

Left ventricular assist device (LVAD) therapy for end stage heart failure (HF) has device-specific complications. Outflow-graft (OG) obstruction is an uncommon complication after implantation. OG obstruction can occur due to thrombosis, kinking, or stenosis. We report on three cases of OG obstruction misinterpreted as OG thrombus formation in CT angiography (CTA).

Cases:

A 65-year-old female patient was admitted eight years after LVAD (HeartMate II) implantation with signs of pneumonia and decreased LVAD flow. A CTA revealed a stenosis of the OG interpreted as thrombosis. Indication for surgical pump-exchange was made. Intraoperatively adhesions of the bend-relief with the OG resulting in a torsion were observed. After removing the bend-relief, the torsion resolved and flow recovered.

A 70-year-old female patient complained four years after LVAD implantation (HeartMate III) about a reduction in LVAD flow. The CTA revealed a stenosis of the OG within its bend-relief. After surgically removing the bend-relief, OG stenosis resolved and LVAD flow recovered.

A 59 year-old male patient presented two years after surgery (HeartMate III LVAD) with a reduction of LVAD-flow and signs of heart failure. Functional data of the LVAD suggested OG obstruction. In CTA a thrombus formation after the exit of the bend relief was suggested and patient was scheduled for local lysis. DSA-angiography with invasive measurement of blood pressure showed graft torsion treated successfully by stent implantation.

Conclusion:

OG obstruction caused by graft torsion might be misinterpreted in CTA-scan as graft thrombosis. Often limited operative or interventional therapies are able to solve the problem.

Neurological symptoms resolved with interventional radiology in association with type A dissection surgery

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Objectives: Acute type A aortic dissection (ATAAD) is a life-threatening condition requiring emergent surgical repair. Supra-aortic extension of dissection requires particular consideration to ensure cerebral blood flow intra- and postoperatively. We report two ATAAD patients suffering from neurological symptoms intra- or postoperatively resolved with interventional radiology techniques.

Materials and methods: A 57-year-old female had aphasia and right-sided hemiplegia before collapse. Computed tomography angiography (CTA) showed dissection of the carotid artery and proximal embolic event of the middle cerebral artery (MCA) on the left. Aortic dissection from the aortic root to the aortic arch was detected. A 57-year-old male experienced sudden left-sided vision impairment followed by clumsiness of the right hand. Dissection of both common carotid arteries was detected by CTA, and extended aortic CTA confirmed ATAAD.

Results: The female patient was treated with mechanical thrombectomy followed by supracoronary replacement of the ascending aorta at the same operation. CTA confirmed perfusion of the MCA area. She was able to move all the extremities, but experienced dysphagia postoperatively. The male patient received supracoronary replacement of the ascending aorta under arrest. Postoperative aphasia and right-hand weakness were detected and resolved with left carotid artery stenting. CTA showed complete perfusion of the head vessels. Postoperatively, he resolved all neurological symptoms in clinical examination. Follow-up CTA at three months will be organized after discharge for both patients.

Conclusions: ATAAD patients with cerebral malperfusion should be evaluated thoroughly since patients benefit from active co-operation of different specialists in challenging and time-sensitive clinical scenarios.

Indications and outcomes of TAVI (transcatheter aortic valve implantation) in Iceland

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Martin Ingi Sigurðsson¹, Tómas Guðbjartsson¹, Ingibjörg Guðmundsdóttir¹

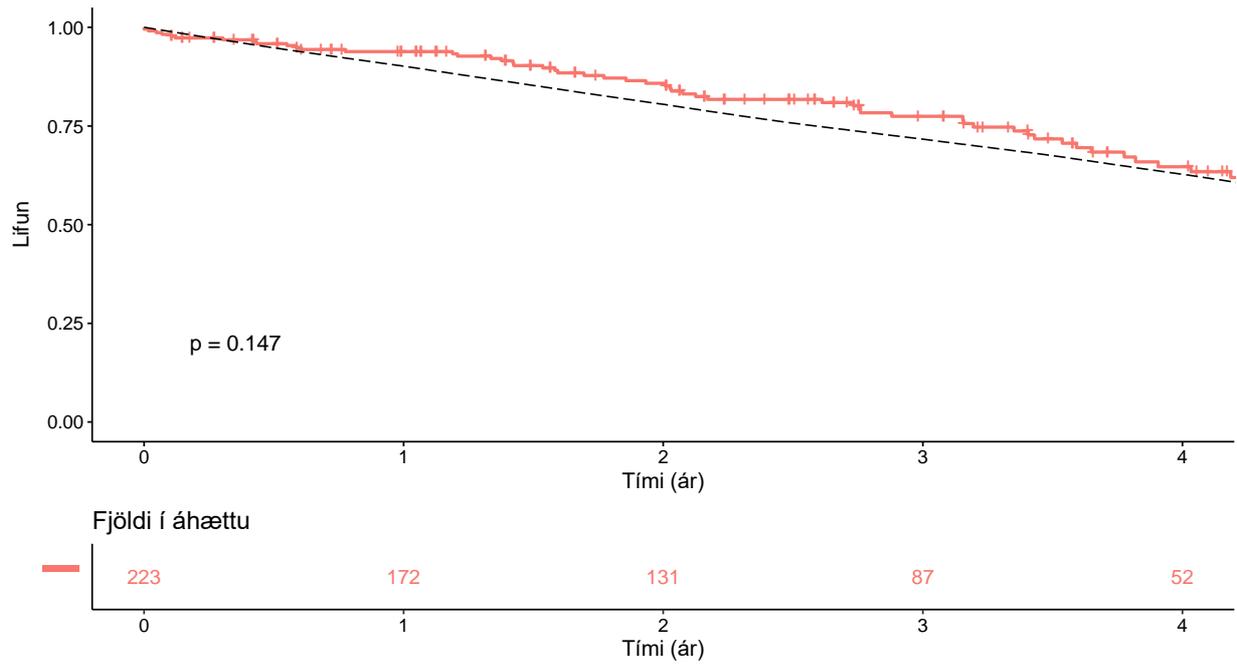
¹ Landspítali

Introduction Surgical aortic valve replacement (SAVR) has been the standard of treatment for aortic stenosis but transcatheter aortic valve implantation (TAVI) is increasingly used as treatment in Iceland and elsewhere. Our objective was to assess the outcome of TAVI in Iceland, focusing on indications, complications and survival.

Material and methods: This retrospective study included all TAVI-procedures performed in Iceland between 1st of January 2012 and 7th of May 2021. Patient characteristics, outcome and complications were registered, and overall survival compared to an age and sex matched Icelandic reference-population. The mean follow-up was 2.7 years.

Results: Altogether 223 TAVI procedures (mean age 82±6 years, 41.5% females), were performed, all with a self-expandable valve. Most patients (81.7%) had symptoms of severe heart failure (NYHA-class III-IV) and median EuroSCORE-II was 4.8 (range: 0.9-32). Echocardiography pre-TAVI showed a mean aortic-valve area of 0.67 cm² and max aortic-valve gradient of 78 mmHg. One out of four patients (24.6%) needed permanent pacemaker implantation following TAVI. Other complications were mostly vascular-related (11.1%) but cardiac tamponade and stroke was detected in 3.1 and 4.9% of cases, respectively and severe paravalvular aortic valve regurgitation in 0.4% cases. Thirty-day mortality was 1.8% (n=4) with one-year survival of 93.8% (95% CI: 90.6-97.1), but long-term survival of TAVI-patients was similar to the matched reference population (p=0.15).

Conclusions: The outcome of TAVI-procedures in Iceland is good, especially regarding 30-day mortality and long-term survival that was comparable to a reference population, but incidence of major complications was also low.



Non-infectious sternal dehiscence after coronary artery bypass surgery

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Introduction: Non-infectious sternal dehiscence (NISD) is a known complication following coronary artery bypass grafting (CABG), with previous studies estimating an incidence of 0.4%-1% of surgeries. We aimed to study the incidence of NISD together with short- and long-term outcome in a whole-nation cohort of patients.

Materials and methods: A retrospective study on consecutive CABG-patients diagnosed with NISD at Landspítali from 2001 to 2020. Patients diagnosed with infectious mediastinitis (n=20) were excluded. NISD-patients were compared to non-NISD patients regarding patient demographics, cardiovascular risk factors, intra- and postoperative data and estimated overall survival. The median follow-up was 9.5 years.

Results: Twenty out of 2300 patients (0.87 %) developed NISD and the incidence did not change over the study period (p=0.983). The median time of diagnosis was 12 days postoperatively (range, 4-240). All patients were re-operated using a Robicsek-rewiring technique, with two cases requiring a titanium-plate for fixation. Patients with NISD were older, had a higher BMI and EuroSCORE II, lower LVEF, and more often had a history of COPD, MI and diabetes compared to those without NISD. Length of stay was extended by 15 days for NISD-patients, but short and long-term survival was not statistically different in the groups.

Conclusions: The incidence of NISD was low (0.87% of surgeries) and in line with previous studies. Although length of hospital-stay was extended, both short- and long-term survival of NISD-patients was not significantly different from non-NISD patients.

Aortic valve tissue analysis after aortic valve surgery

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Background. Surgery enables complete aortic valve tissue resection and analysis. Purposeful patient care after aortic valve surgery includes follow-up of the patient. We investigated tissue analysis of the resected aortic valve and the early postoperative outcome of patients undergoing either hemisternotomy or full sternotomy for surgery of the aortic valve.

Material and Methods. A total of 136 resected aortic valves out of 161 consecutive patients undergoing surgery for the aortic valve with or without ascending aorta were investigated for histopathology. The extent of inflammation and wall degeneration were investigated. Unadjusted survival was evaluated by Kaplan-Meier analysis. Median follow-up was 2.7 years (interquartile range 1.5-3.9).

Results. Mean patient age was 68.7 years. There were 49 hemisternotomy and 112 full sternotomy cases. All 38 (24%) emergent cases included full sternotomy. There were two mediastinitis and one sternal instability after full sternotomy, and one hemisternal dehiscence after hemisternotomy. During follow-up, 13 patients died (log rank, $P=0.296$). Though endocarditis was diagnosed in only six patients preoperatively, severe aortic valve inflammation was observed in 32 patients of whom 12 patients had acute, subacute or chronic endocarditis.

Conclusions. Aortic valve tissue analysis reveals severe inflammation that may aid decision-making for postoperative surveillance and medication.

Decreasing incidence of primary spontaneous pneumothorax surgeries in Iceland

Thordis Magnadottir, Leon Arnar Heitmann, Tinna Harper Arnardóttir, Tomas Kritjansson, Martin Silverborn, Martin Ingi Sigurdsson, Tomas Gudbjartsson

BACKGROUND: Primary spontaneous pneumothorax (PSP) is a common disease where surgery is indicated for persistent air leak or recurrent pneumothorax. We studied the outcomes of PSP-surgery over a 28 year period in a whole nation.

MATERIALS AND METHODS: A retrospective study on 386 patients (median age 24 years, 78% males) that underwent 430 PSP surgeries at Landspítali University Hospital 1991-2018. Annual incidence of the procedure was calculated and previous medical history, indication and type of surgery, complications and length of hospital stay were registered. Patients in four 7 year periods were compared, recurrent pneumothoraces requiring reoperation (median follow-up 16 years) registered and predictors of reoperation identified with logistic regression.

RESULTS: Annually 14.5 PSP surgeries (median, range 9-27) were performed; the incidence decreasing by 2.9% per year on average. Every other patient smoked and 77% of surgeries were performed with video assisted thoracoscopic surgery (VATS). The most common early complications (<30 days from surgery) were persistent airleak (17%), pneumonia (2%) and empyema (0,5%). No patient died within 30 days from surgery. Reoperation for recurrent pneumothorax was performed on 27 patients; 24 following VATS (7%), median time from the primary surgery being 16 months. Logistic regression showed that younger patients were more likely to require reoperation for recurrent pneumothorax.

CONCLUSIONS: Surgical treatment for PSP is safe and major early complications rare. The rate of recurrent pneumothorax requiring surgery was 6%, which is similar to other studies. For unknown reasons the incidence of PSP surgery declined, but future research has to answer if it is linked to decreased smoking in the Icelandic population.

*Information regarding weight was missing for 23 patients**Information regarding height of 57 patients was missing

gender related early-term outcomes after surgical aortic valve replacement with inspiris resilia valve

Giorgia Cibirin¹, Augusto D'Onofrio¹, Valentina Lombardi¹, Emma Bergonzoni¹, Irene Cao¹, Enrico Giuseppe Italiano¹, Gino Gerosal

¹ University of Padova

Objective: Aim of this retrospective study was to evaluate early-term outcomes of aortic valve replacement (AVR) with Inspiris Resilia Bioprostheses (IRB) in females versus men.

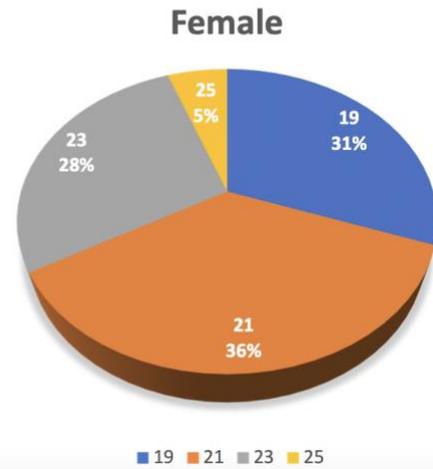
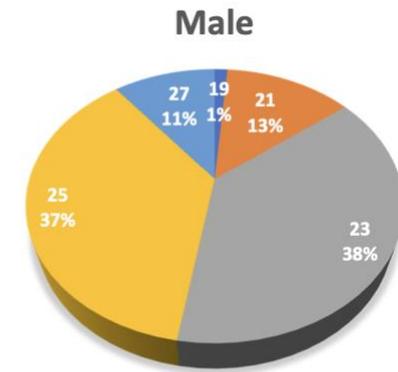
Methods: We analyzed data of all patients who underwent AVR with IRB at our institution. Preoperative variables were defined according to EuroSCORE criteria and postoperative complications according to VARC-2 definitions. Descriptive statistics were performed. The distribution of continuous and categorical variables was compared using Wilcoxon and Pearson Chi-squared tests, respectively.

Results: Data of 112 consecutive patients undergoing IRB implantation were analyzed. Of these, 76 (68%) were male and 36 (32%) were female. Females have a major incidence of diabetes and higher EuroScoreII mortality than males (1.85 vs. 1.39, p=ns). Males have a major incidence of aortic regurgitation requiring intervention (53% vs 28%, p=0.023). Surgical times in isolated AVR, both CPB and ACC, are shorter in females compared with males. Post-operative clinical outcomes are similar in both groups. There is an increased incidence in developing acute kidney injury in female group (19% vs. 16%, p=0.003). Since females received smaller valves (19/21 vs 23/25) than males, the latter had lower trans-aortic gradients.

Conclusions: According to our data early-term outcomes after AVR with Inspiris valve are good and don't seem to be significantly influence by patient's gender.

Intra-operative Variables	Female (N=36)	Male (N=76)	P-value
Cardiopulmonary bypass time is isolated SAVR (CPB) (min)	109 [90-193]	121 [73-155]	
Aortic Cross Clamp time in isolated SAVR (ACC) (min)	86 [66-135]	94 [66-130]	
Isolated AVR	24 (66.7%)	40 (53.6%)	0.23
ICU hours	23.5 [16-115]	24 [14-75]	
Post-op Hospitalization days	9.5 [7-14]	11 [6-27]	

Postoperative Outcomes	Female(N=36)	Male (N=76)	P-value
VARC all cause mortality	2 (6%)	3 (4%)	0.916
VARC CV mortality	2 (6%)	2 (3%)	0.815
PM Implantation	0 (0%)	3 (4%)	0.961
AKI	7 (19%)	12 (16%)	0.003
Peak Gradient (mmHg)	21 [12-34]	19 [10-37]	
Mean Gradient (mmHg)	11 [6-19]	10 [6-19]	
PPM moderate or severe	1 (3%)	4 (5%)	



Prolonged Intensive Care Unit Stay after Open Heart Surgery - Incidence and Risk Factors

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Introduction: Number of ICU beds is limited in most hospitals and therefore prolonged ICU stay can result in elective cardiac surgeries being postponed. To maximize the usage of ICU beds we estimated the incidence and predictors of prolonged ICU-stay after the two common heart procedures.

Materials and methods: A retrospective nationwide study on patients that underwent CABG and/or AVR between 2001-2020 in Iceland. Clinical information was gathered from hospital charts and survival data obtained from a centralized National Death Registry (100% follow up). Patients who stayed ≥ 2 nights in ICU postoperatively were compared to those who stayed one night. Predictors for prolonged ICU stay were calculated with logistic regression and long-term survival estimated (Kaplan-Meier).

Results: Out of 2952 patients 23.6% had prolonged ICU stay, of which 65.9% underwent CABG, 9.8% AVR and 24.3% CABG+AVR. Patients with prolonged ICU-stay were significantly older, more often females, had more advanced cardiovascular disease and more often COPD, their EuroSCORE-II was higher, and LVED lower compared to controls ($p < 0.01$). Factors independently associated with prolonged ICU stay included advanced age, female sex, heart failure, atrial fibrillation/flutter, reduced LVEF and high EuroSCORE-II.

Conclusions: One out of four patients needed prolonged ICU stay. Their 30 day mortality and complications rates were higher and long-term survival inferior. Elderly females with cardiovascular comorbidities and high EuroSCORE-II are likely to need prolonged ICU-stay. Hopefully our findings will shed light on patients that need prolonged ICU stay - and be of help to maximize the usage of ICU beds