A-1

Creatine kinase-MB release after coronary artery bypass grafting: Validation of a new biomarker classification

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Background

Diagnosing perioperative myocardial infarction (PMI) is a challenge in cardiac surgery. The European Association of Cardio-Thoracic Surgery (EACTS) recently published a new classification of biomarker release after cardiac surgery. The aim of this study was to validate the recommendations regarding creatine kinase-MB (CK-MB) release in a large nationwide cohort of patients undergoing isolated CABG.

Methods

We conducted an observational study including all patients with documented postoperative peak CK-MB that underwent isolated CABG in Sweden 2009-2020 (n=17 849). Patient data were collected from the SWEDEHEART-registry. The patients were divided into four groups according to the EACTS definition: 1. No biomarker elevation (<5 × the upper reference limit (URL)). 2. Biomarker elevation (5-10×URL); 3. Myocardial injury (10-20×URL); 4. Myocardial infarction (>20×URL). A typical URL for CK-MB is 5 µg/L. Thirty-day and long-term mortality were compared between the groups with Log-rank test.

Results

Based on CK-MB 10.9% had biomarker elevation, 4.8% had myocardial injury and 3.0% had PMI. Thirty-day mortality was 0.8 % in patients with no biomarker elevation, 1.6% in patients with biomarker elevation, 2.7% in patients with myocardial injury and 8.9% in patients with myocardial infarction (p<0.001), Fig 1A. Long-term survival was inferior in patients with PMI (p<0.001) but the curves did not diverge further beyond the first 30 days after surgery, Fig 1B.

Conclusion

The results of this large registry-based study demonstrates that the new classification of CK-MB release identifies groups of patients with different 30-day mortality risk, which supports the clinical usefulness of the classification.

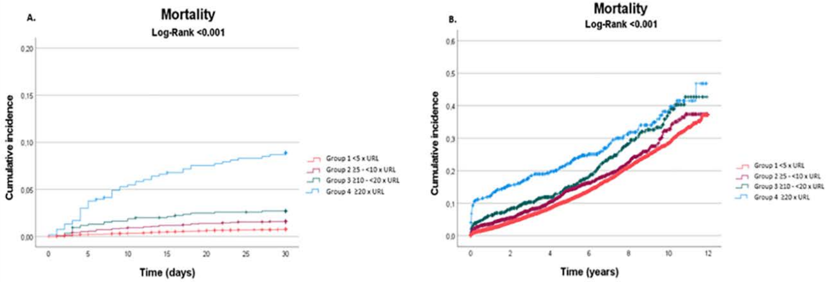


Figure 1. Mortality by CK-MB group according to the consensus recommendations. Group 1 defined as no biomarker elevation (<5xURL), group 2 defined as biomarker elevation (≥5 to <10xURL), group 3 defined as myocardial injury (≥10 to <20xURL) and group 4 defined as perioperative myocardial infarction (≥20xURL). **A.** Thirty-day mortality. **B.** Mortality over time.

A-2

The Effect of Bicuspid Versus Tricuspid Aortic Valve Morphology on the Fate of The Ascending Aorta

Malin Granbom Koski, Michael Dismorr

Background: Bicuspid aortic valves are known to be associated with ascending aortic pathology. However, the effect of aortic valve morphology on long-term outcomes in the aorta is unknown.

Materials and methods: Prospective, observational, cohort-study including patients who are part of the Advanced Study of Aortic Pathology (ASAP) study. The primary outcome was aortic diameter growth, and the secondary outcomes were all-cause mortality and adverse aortic events.

Results: Of 570 patients in the original ASAP cohort, 204 underwent echocardiographic follow-up for ascending aortic diameter, and 566 was followed for adverse aortic events. Mean growth rate was 4mm ($p<0.001$) during 10-year follow-up. There was no difference in growth rate between patients with BAV and TAV ($p=0.68$). After multivariable adjustment, there was no difference in all-cause mortality (HR 0.87, 95%CI 0.65–1.18), but BAV was associated with a decreased risk of adverse aortic events (HR 0.39, 95%CI 0.19–0.82). Concomitant ascending aortic surgery was associated with an increased risk of adverse aortic events in patients with TAV (HR 5.6, 95%CI 2.2–14.1), but had a protective effect in patients with BAV (HR 0.08, 95%CI 0.01–0.48).

Conclusion: There was no difference in aortic growth between patients with TAV and BAV. TAV was associated with an increased risk of adverse aortic events compared to BAV patients. The use of concomitant ascending aortic surgery was associated with an increased risk of adverse aortic events in TAV patients but had a protective effect in BAV patients.

Figure 1

Weighting adjusted Kaplan-Meier estimated survival according to bicuspid and tricuspid native aortic valve morphology. BAV = bicuspid aortic valve, TAV = tricuspid aortic valve, HR = hazard ratio, CI = confidence interval.

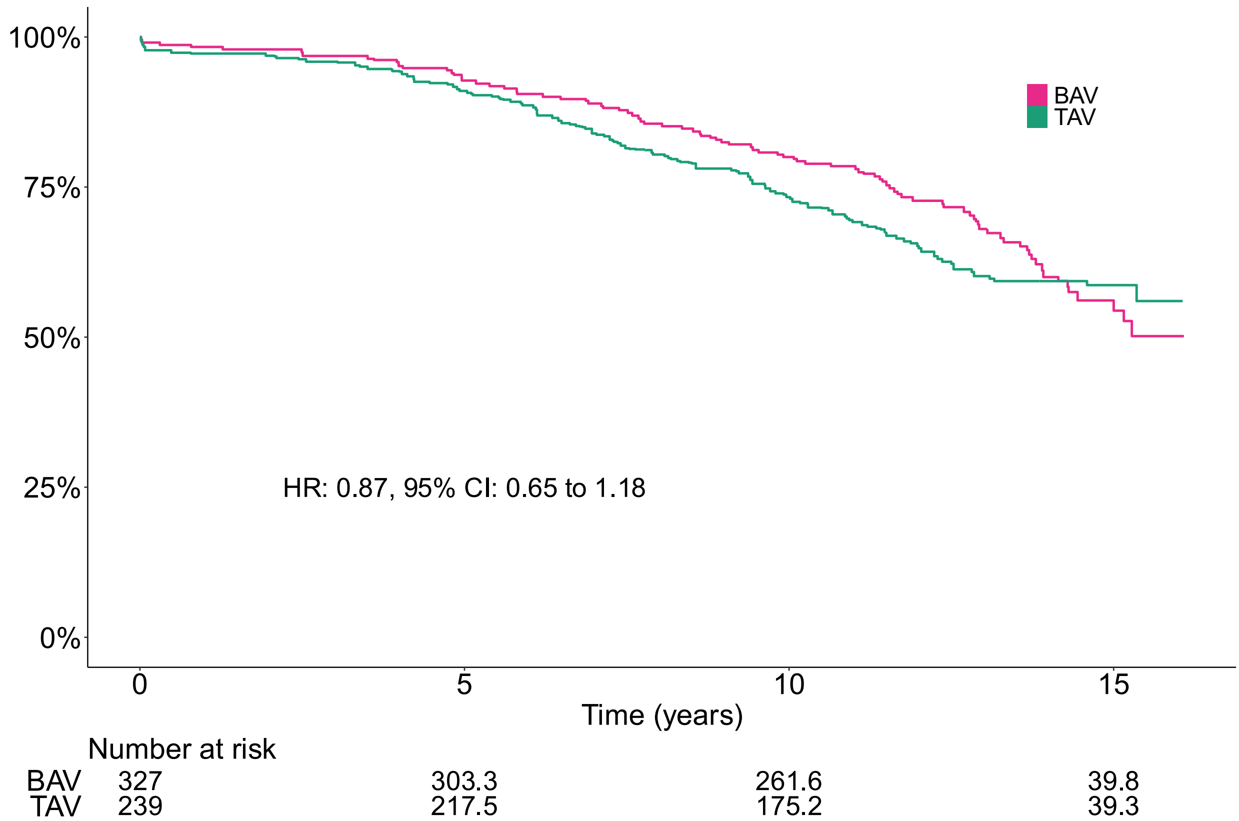
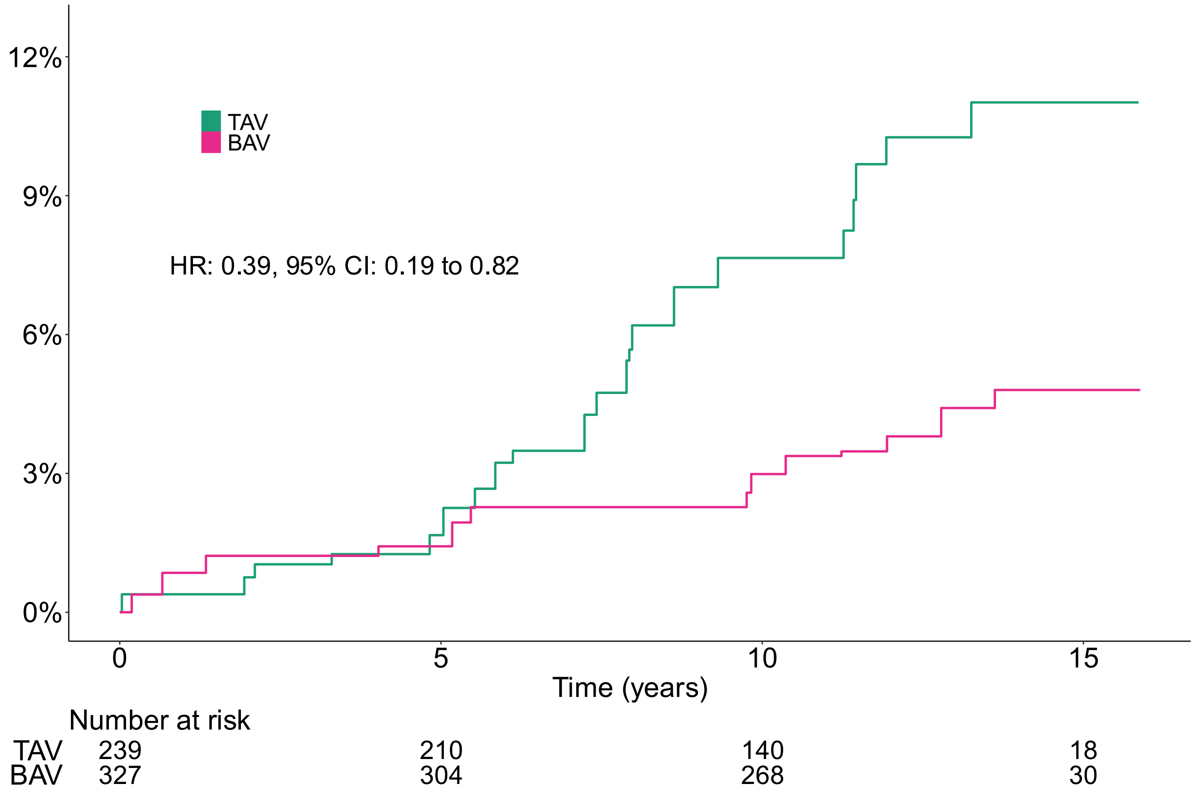


Figure 2

Weighting adjusted Aalen-Johansen estimated cumulative incidence of aortic events according to bicuspid native aortic valve morphology. TAV = tricuspid aortic valve, BAV = bicuspid aortic valve, HR = hazard ratio, CI = confidence interval.



A-3

Effects of optimal medical therapy on clinical outcomes in patients with reduced ejection fraction undergoing coronary artery bypass graft surgery - A single center observational study

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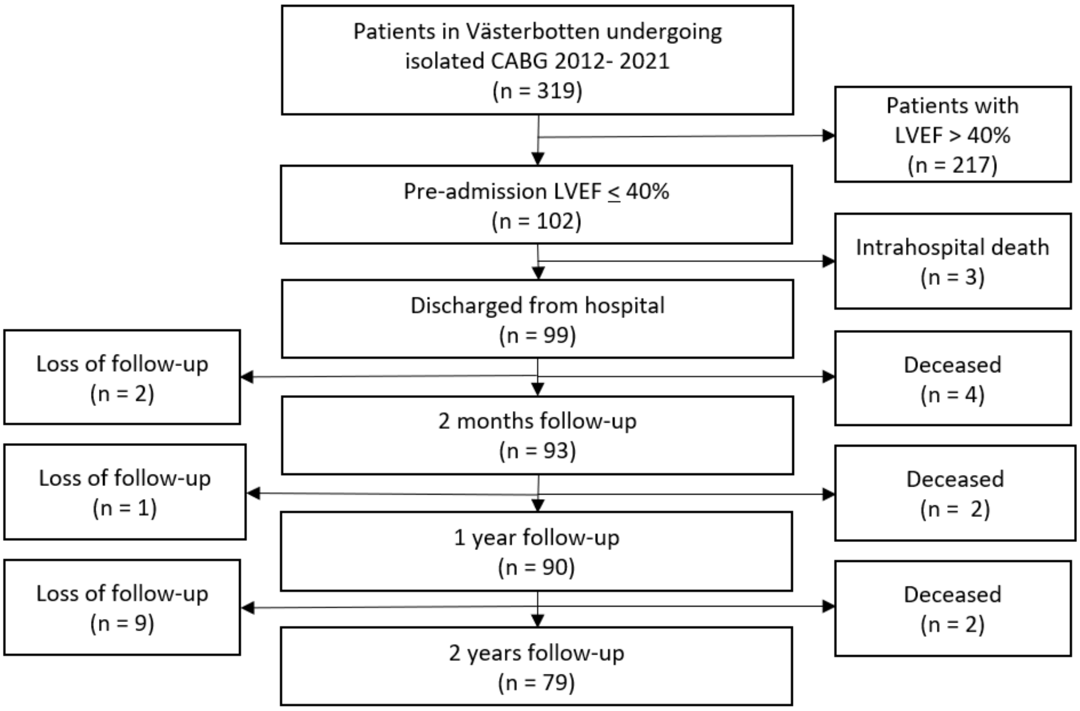
Background: Our aim was to explore clinical outcomes of optimal medical therapy (OMT) in patients with reduced left ventricular ejection fraction (LVEF) after coronary artery bypass surgery (CABG).

Materials and methods: All patients in Västerbotten county undergoing isolated CABG with a preoperative LVEF of ≤ 40% between 2012-2021 were included. The patients were identified by the quality register Carath. Drug prescription and clinical outcomes were collected from the medical health record. OMT was defined as prescription of renin-angiotensin-aldosterone system inhibitor (RAAS-I), beta-blocker (BB), Acetylsalicylic acid (ASA) and statins.

Results: 102 patients were identified. The frequency of patients with OMT was 44% at admission and 67% 72%, 69% and 68% at discharge, 2 months, 1 year and 2 years follow-up. The rate of OMT prescription increased until the 2 months follow-up ($p<0.05$). For all patients the LVEF improved during follow-up (34 % to 39 %, $p<0.001$). The Kaplan-Meier estimates showed a reduced risk of all cause-mortality and hospitalization for heart failure in the OMT group compared to the No-OMT group (log rank $p=0.002$) with a median follow up of 3,6 years (IQR 2,7-6,0 years). In a multivariable Cox regression model, OMT at discharge was associated with a lower adjusted risk of all-cause mortality and hospitalization for heart failure (adjusted hazard ratio, 0,32; confidence interval, 0,13-0,76; $p=0.01$).

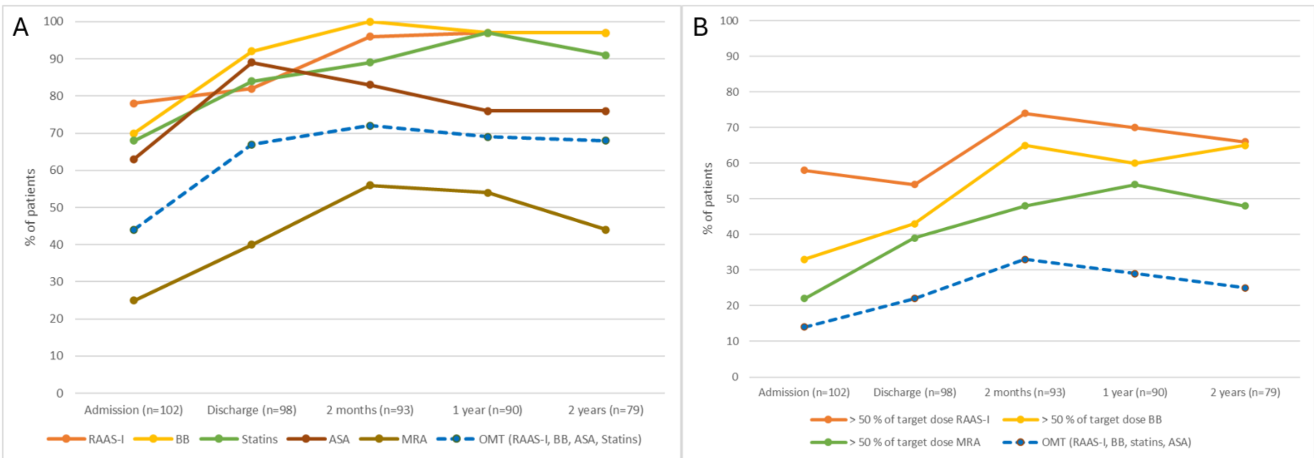
Conclusion: Prescription of OMT at discharge in patients with reduced LVEF undergoing CABG is associated with lower mortality and risk of rehospitalization for heart failure after surgery.

Figure 1. Flowchart of patient selection.



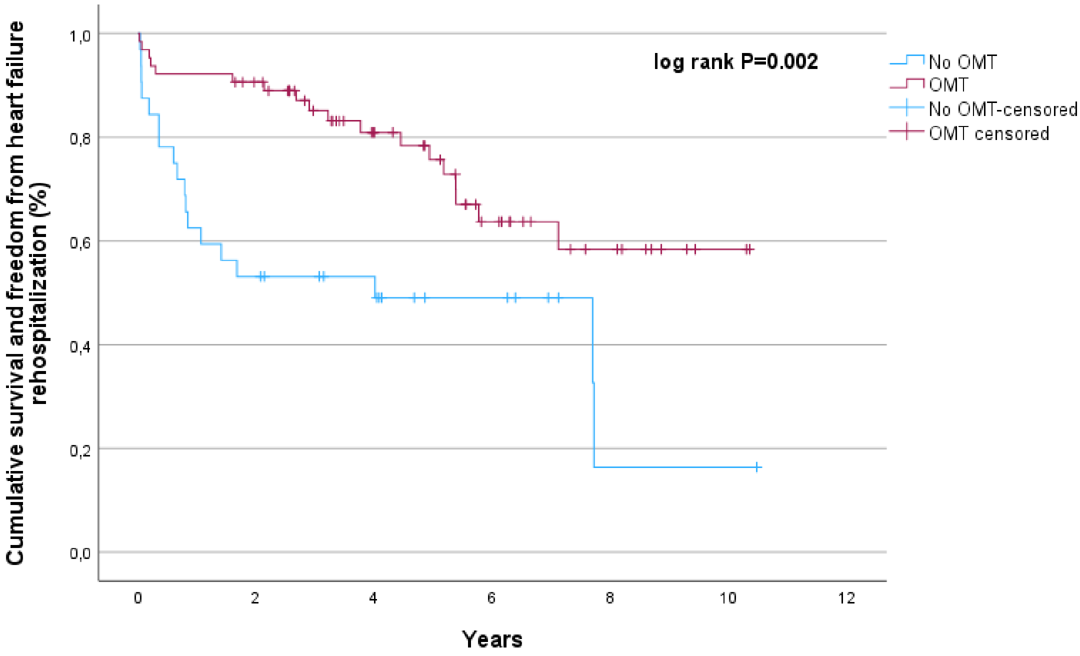
CABG = coronary artery bypass graft surgery. LVEF = left ventricular ejection fraction.

Figure 2. A. Prescription rate of optimal medical therapy. B. Prescription rate of OMT defined as $\geq$50 % of target doses for RAAS-I, BB and MRA.



RAAS-I=renin–angiotensin–aldosterone system inhibitor. BB = beta blockers. ASA = acetylsalicylic Acid. MRA = mineralocorticoid receptor antagonist. OMT = optimal medical therapy.

Figure 3. Kaplan-Meier estimates of cumulative survival and freedom from heart failure rehospitalization by OMT and no-OMT at discharge



OMT = optimal medical therapy.

Table 1. Patients characteristics at hospital admission for CABG.

Characteristics	All patients at admission (n=102)
Women - n (%)	13 (13)
Age - years, mean (SD)	67 (9)
Age category	
18-74 years	78 (77)
$\geq$ 75 years	24 (24)
BMI - kg/m2 mean (SD)	27 (4)
NYHA III-IV - n (%)	71 (70)
EuroScore II (%), median (IQR)	2 (2-4)
eGFR category (ml/min/1.73 m2) mean (SD)	
$\geq$ 90	5 (5)
60-<90	78 (77)
30-<60	18 (18)
<30	1 (1)

Haemoglobin (g/L) mean (SD)	140 (16)
Left ventricular ejection fraction	
30-40%	84 (83)
20-<30%	17 (17)
<20%	1 (1)
Medical history - n (%)	
Smoking	57 (56)
Diabetes	33 (32)
Prior PCI intervention	18 (18)
COPD	3 (3)
Cerebrovascular disease	15 (15)
Non-cardiac vascular disease	8 (8)
Hypertension	80 (80)
Hyperlipidemia	78 (77)
Previous heart failure diagnosis	70 (69)
Pulmonary hypertension	8 (8)
Atrial fibrillation/atrial flutter	11 (11)
Previous heart surgery	2 (2)
Indication for surgery – n(%)	
Stable coronary disease	45 (44)
Instable angina	46 (45)
Recent myocardial infarction (within 3 weeks)	53 (52)
Emergency or Urgent CABG surgery	66 (65)
Inotropes	12 (12)
Medical treatment at admission – n (%)	
Statins	69 (68)
ASA	64 (63)
Beta blocker	70 (67)
RAAS inhibitor	79 (78)
MRA	25 (25)
Post-operative complications	
Atrial fibrillation/atrial flutter at discharge – n (%)	20 (20)
Postoperative pneumonia – n (%)	4 (4)
Permanent pacemaker - n (%)	3 (3)
Pleural effusion drainage - n (%)	3 (3)
Stroke - n (%)	3(3)
Reoperation for bleeding - (%)	10 (10)
Postoperative p-creatinine value over threshold of 221 µmol/L – n (%)	5 (5)
Postoperative s-potassium value over threshold of 5.0 mmol/L – n (%)	17 (17)

BMI = Body mass index. COPD = chronic obstructive pulmonary disease. NYHA = New York Heart Association Functional Classification. PCI = Percutaneous coronary intervention. ASA = acetylsalicylic Acid. RAAS=renin–angiotensin–aldosterone system MRA = mineralocorticoid receptor antagonist

Table 2. Patients characteristics by prescription of target-dose OMT at discharge

Characteristics	Target-dose **OMT n=22)**	**No** target-dose **OMT (n=76)**	**p**
Women - n (%)	2 (9)	10 (13)	1.000
Age - years, mean (SD)	64 (9)	67 (9)	0.137
≥ 75 years	3 (14)	19 (25)	0.386
BMI - kg/m2 median (IQR)	28 (26-31)	27 (24-29)	0.067
NYHA III-IV - n (%)	16 (73)	52 (68)	0.700
EuroScore II (%), median (IQR)	2,6 (1,6-3,7)	2,2 (1,6-3,8)	0.838
eGFR category (ml/min/1.73 m2)			
≥ 90	2 (9)	3 (4)	0.312
60-<90	15 (68)	62 (82)	0.237
30-<60	5 (23)	10 (13)	0.316
<30	0	1 (1)	1.000
Haemoglobin (g/L) mean (SD)	138 (16)	140 (16)	0.585
Left ventricular ejection fraction			0.524
30-40%	17 (77)	64 (84)	
<30%	5 (23)	12 (16)	
Medical history - n (%)			
Smoking	9 (41)	48 (63)	0.062
Diabetes	10 (46)	22 (29)	0.146
Prior PCI intervention	2 (9)	16 (21)	0.202
COPD	0	3 (4)	1.000
Cerebrovascular disease	3 (14)	12 (16)	1.000
Non-cardiac vascular disease	2 (9)	6 (8)	1.000
Hypertension	20 (91)	60 (79)	0.348
Hyperlipidemia	19 (86)	56 (74)	0.217
Previous heart failure diagnosis	17 (77)	50 (66)	0.308
Pulmonary hypertension	2 (9)	5 (7)	0.652
Atrial fibrillation/atrial flutter	5 (23)	6 (8)	0.117
Previous heart surgery	1 (4,5)	1 (1)	0.400
Indication for surgery			
Instable angina	6 (27)	37 (49)	0.075
Recent myocardial infarction (within 3 w)	8 (36)	39 (51)	0.335
Emergency or Urgent CABG surgery	10 (46)	53 (70)	0.036
Inotropes	3 (14)	7 (9)	0.689
Medical treatment at admission, n (%)			
Statins	22 (100)	60 (79)	0.019
ASA	22 (100)	65 (86)	0.066
Beta blocker ≥ 50 % of target dose	22 (100)	20 (26)	<0.001
RAAS inhibitor > 50 % of target dose	22 (100)	31 (41)	<0.001
MRA > 50 % of target dose	15 (68)	23 (30)	0.001
Anticoagulants (Warfarin/DOAC)	4 (18)	5 (7)	0.202
Post-operative complications			
Atrial fibrillation/atrial flutter at discharge – n	4 (18)	15 (20)	1.000

(%)			
Postoperative pneumonia – n (%)	2 (9)	2 (3)	0.217
Permanent pacemaker - n (%)	0	3 (4)	1.000
Pleural effusion drainage - n (%)	0	3 (4)	1.000
Stroke - n (%)	2 (9)	0	0.049
Reoperation for bleedning - (%)	3 (14)	5 (7)	0.373
Postoperative p-creatinine value over threshold of 221 µmol/L – n (%)	1 (1)	4 (5)	1.000
Postoperative s-potassium value over threshold of 5.0 mmol/L – n (%)	6 (27)	11 (15)	0.205

BMI = Body mass index. NYHA = New York Heart Association Functional Classification. COPD = chronic obstructive pulmonary disease. PCI = Percutaneous coronary intervention. CABG = coronary artery bypass graft surgery. ASA = Acetylsalicylic Acid. RAAS=renin–angiotensin–aldosterone system. MRA = mineralocorticoid receptor antagonist. DOAC = direct oral anticoagulants. OMT = optimal medical therapy.

Table 3. Prescription of optimal medical therapy at discharge and risk for the composite endpoint of heart failure hospitalization or death

Medical treatment at discharge	HR (95 % CI)	p	aHR*	p-value
RAAS inhibitor (% of target dose)	0,31 (0,11-0,87)	0,03	0,14 (0,03-0,67)	0,014
Beta blockers (% of target dose)	0,18 (0,09-1,59)	0,18	1,03 (0,21-5,16)	0,969
MRA	0,90 (0,45-1,80)	0,764	1,67 (0,57-4,92)	0,353
Statins	0,26 (0,13-0,53)	<0,001	0,74 (0,19-2,89)	0,667
ASA	0,28 (0,13-0,62)	0,002	0,14 (0,02-0,97)	0,047
OMT	0,31 (0,17-0,58)	<0,001	0,32 (0,13-0,76)	0,01

HR= hazard ratio. aHR= adjusted hazard ratio. ASA = Acetylsalicylic Acid. RAAS=renin–angiotensin–aldosterone system MRA = mineralocorticoid receptor antagonist. OMT= optimal medical therapy.
*adjusting for following variables at admission: age, sex, body mass index (BMI), diabetes mellitus, hypertension, hyperlipidemia, previous stroke, previous heart failure diagnosis, previous myocardial infarction, chronic obstructive pulmonary disease (COPD), peripheral artery disease, acute coronary syndrome as indication for CABG (unstable angina or recent myocardial infarction), left ventricular ejection fraction, estimated glomerular filtration rate (eGFR), pulmonary hypertension, stroke after surgery, atrial fibrillation after surgery. OMT was defined as prescription of RAAS inhibitors and betablockers in addition to statins and ASA at hospital discharge.

A-4

Stroke and bleeding risk assessment in patients with new-onset postoperative atrial fibrillation after coronary artery bypass grafting

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Background

Current guidelines state that oral anticoagulation (OAC) may be considered in patients with new-onset postoperative atrial fibrillation (POAF) after cardiac surgery, after taking stroke and bleeding risk into consideration. CHA2DS2-VASc assesses stroke risk in POAF patients, but no score for bleeding risk has been evaluated. We explored if the PRECISE-DAPT score, originally developed to predict post-discharge bleeding risk in PCI patients, can be applied in POAF patients.

Material and methods

This observational study included 4991 POAF patients without OAC, who underwent isolated CABG in Sweden 2009-2020. PRECISE-DAPT (based on age, creatinine clearance, haemoglobin concentration, and previous bleeding), and CHA2DS2-VASc were calculated. High bleeding risk was defined as PRECISE-DAPT ≥25, medium 16-24, and low bleeding risk ≤15 points. High stroke risk as CHA2DS2-VASc ≥4 and low stroke risk as <4 points. Associations between scores and outcomes during the first 12 postoperative months were assessed by Cox regression models.

Results

Major bleeding and ischemic stroke occurred during the first postoperative year in 2.3% and 0.8% of the patients, respectively. The PRECISE-DAPT identified 36.0% of the patients as high bleeding risk, and CHA2DS2-VASc 51.3% as high stroke risk. 25.7% of the patients had both high stroke and bleeding risk. The hazard ratio was 4.1 (2.4-7.1) for high vs. low bleeding risk, and 2.4 (1.2-4.7) for high vs low stroke risk, see figure.

Conclusions

The PRECISE-DAPT and CHA2DS2-VASc scores identified POAF patients with increased post-discharge risk for major bleeding and ischemic stroke.

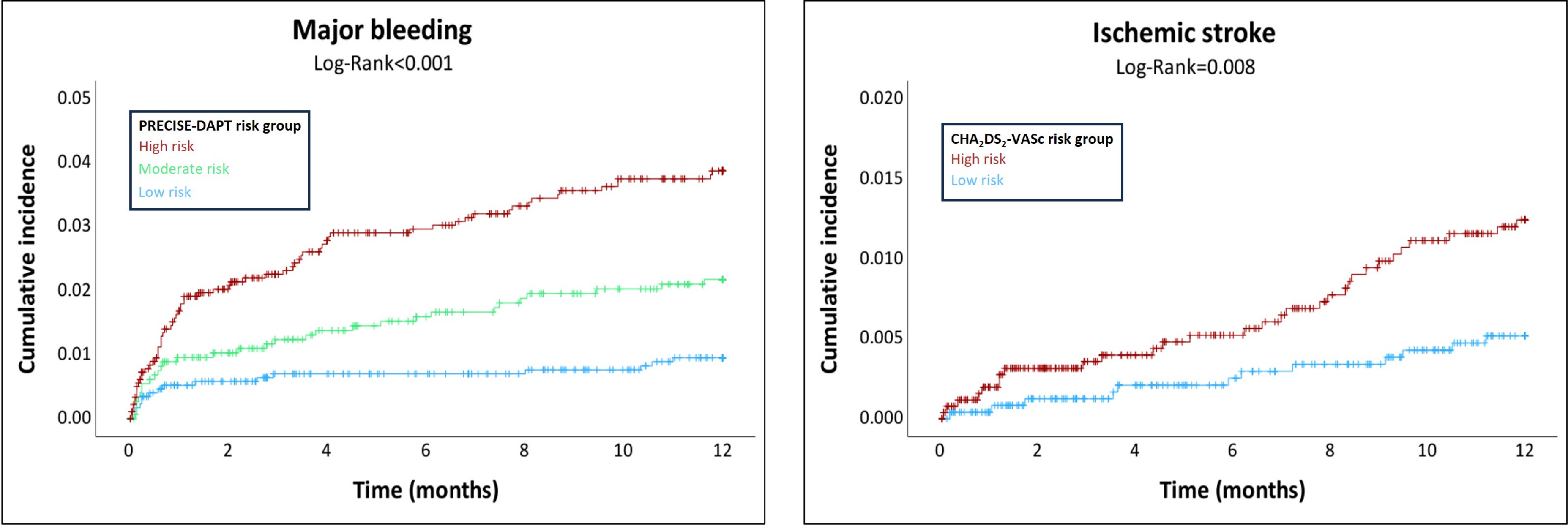

Figure. The cumulative incidence of major bleeding and ischemic stroke during the first 12 postoperative months in relation to PRECISE-DAPT and CHA_2DS_2-VASc risk scores for POAF patients

A-5

Copeptin levels during cardiac surgery
Selma Samuelsson, Jonas Holm, Lars Engerström

The authors have chosen not to publish the abstract

A-6

Decreased rate of perioperative blood transfusions following coronary artery bypass grafting (CABG) surgery in Iceland

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Background: Coronary artery bypass grafting (CABG) carries a high risk of bleeding and allogeneic blood transfusion, both of which are associated with poor outcomes. This study aimed to evaluate the perioperative transfusion rates and predictors of transfusion in CABG patients in Iceland.

Materials and methods: This nationwide retrospective study included 1,850 isolated primary CABG patients at Landspitali from 2005-2022. Clinical data and transfusions of red blood cells (RBCs), fresh-frozen plasma (FFP) and platelets (PLTs) were obtained from medical records and the Icelandic Blood Bank, and were analyzed across three 6-year periods. Logistic regression models identified predictors of perioperative transfusion.

Results: Among 1,173 (63%) transfused patients, 93% received RBCs, 47% FFP and 34% PLTs. Most transfused patients received exclusively RBCs (47%). The perioperative transfusion rate dropped significantly during the last 6-year period compared to the first (48% vs. 74%, $p<0.001$), primarily due to decreased RBC and FFP transfusions. In the first vs. last 6-year periods, reoperation rates for bleeding decreased (6% vs. 3%, $p=0.128$), while aspirin (38% vs. 81%, $p<0.05$) and clopidogrel use (3% vs. 11%, $p<0.001$) increased significantly. Transfusion predictors included advancing age, female sex, lower body mass index (BMI), renal failure, lower preoperative hemoglobin, emergency operation and preoperative use of clopidogrel, but not aspirin.

Conclusion: The perioperative transfusion rate following CABG is high but has decreased significantly. This is most likely due to the implementation of transfusion guidelines, routine intraoperative use of thromboelastometry and improved surgical technique, as reflected in lower reoperation rates.

A-7

Aortic valve regurgitation is not associated with increased aortic degeneration during acute type A aortic dissection

Mona Laaksonen, Aada Lattu

Background: Patients with aortic valve regurgitation (AVI) may have an increased risk for aortic dilatation leading to acute aortic events. We investigated whether AVI is associated with aortic wall degeneration and dilatation during acute type A aortic dissection (ATAAD).

Materials and methods: The study included 125 consecutive patients who underwent emergency surgery for ATAAD between February 2006 and November 2020. The patients were grouped according to the presence of moderate to severe AVI. The cross-sectional aortic diameters were measured from computer tomography. Extensive ascending aortic wall histopathology was performed.

Results: Patient characteristics were similar with and without AVI (n=84 and n=41, respectively). Earlier aortic valve replacement (AVR) was performed in 4 patients with AVI vs 1 without. The aortic annulus diameter, the size of the sinotubular junction, and the ascending aorta, but not the size of the aortic root, were increased in patients with AVI vs without (41.8±5.9 vs 38.6±4.7, mm, P=0.002; 47.1±8.4 vs 41.9±7.6, mm, P=0.001; 50.7±8.7 vs 47.0±10.0, mm, P=0.019; and 46.5±7.0 vs 44.8±7.0, mm, P=0.141, respectively). The extent of elastic fragmentation and loss, smooth muscle cell nuclei loss, and medial fibrosis were similar in aortas with and without AVI (2.0±0.5 vs 2.0±0.5; point score units (PSU), P=0.390; 1.4 ±0.7 vs 1.4±0.8; PSU, P=0.653; and 0.3±0.6 vs 0.4±0.9; PSU, P=0.474, respectively).

Conclusions: Though AVI may be associated with ascending aortic dilatation, it is not associated with increased aortic wall degeneration during ATAAD as compared with patients without AVI. AVR alone for AVI may not prevent the risk for ATAAD.

A-8

Ten Years' Experience with the Thoraflex Hybrid Prosthesis: A Retrospective, Single-center Cohort Study

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Maria Devold Soknes, Runar Lundblad, Per Snorre Lingaas, Siri Rostoft, Eric Dorenberg, Beate Lindberg, John Peder Kvitting

Background: The frozen elephant trunk (FET) procedure is an established treatment option recommended for several settings in the EACTS aortic guidelines 2024. The purpose of this study was to assess our mid- and long-term results using the Thoraflex hybrid prosthesis.

Materials and Methods: This was a retrospective, single-center cohort study. All patients undergoing FET between December 2014 and May 2024 were included.

Results: 55 FET patients with a mean age of 69 years were included. 28 patients had a preoperative dissection, 8 patients were operated in an urgent/emergent setting. The rate of stroke was 18% (10/55), paraparesis was 7 % (4/55), recurrent laryngeal nerve injury 20 % (11/55). No patient needed permanent dialysis. 22 patients underwent treatment of the descending aorta through open (7) or endovascular (15) repair after the index operation. Four patients died within the first 30 days postoperatively, all due to stroke. During the follow-up an additional 8 patients died. Average follow-up was 44 months. Survival at 20, 40 and 80 months was 87 6,6%, 82 8,4% and 71 12,1% respectively.

Conclusion: The Thoraflex hybrid prosthesis is an established treatment option for complex aortic disease. Stroke and spinal complications remain an important driver for early and late morbidity and mortality.

A-9

Reconstruction of Right Sinus Valsalva and Coronary Artery in Patients with Giant Coronary Aneurysm with Fistula to Ventricle

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Background: Giant coronary artery aneurysm complicated with sinus Valsalva aneurysm and fistula to ventricles is rare. There is no general consensus for standard surgical treatment. We present herein successful surgical reconstruction of right sinus Valsalva and coronary artery in two cases.

Materials and methods: Case1, 61 year-old male with chest distress for 3 months and atrial fibrillation. Coronary angiography (CAG) revealed a giant aneurysm of right sinus of Valsalva and an right coronary artery aneurysm measuring 19 mm with a 7 mm fistule to the right ventricle. Case 2, 52-year-old male with giant right coronary aneurysm, CAG and cardiac CT angiography revealed a giant aneurysm involving right sinus Valsalva and the right coronary artery with maximal diameter of 41.6mm and a fistula of 8 mm to the left ventricle. Surgical resection of the aneurysms, anatomical reconstruction of right sinus Valsalva with an autolougus pericardial patch, reconstructin of right coronary artery with saphenous vein grafts anastomosed to all branches of both ventricles and ligation of the fistules were performed successfully in both cases. Mitral annuloplasty and modified MAZE procedure was carried out in the case 1 in adition to the above procedures.

Results: Both patients had uneventful postoperative recovery. They have been symptom-free during follow-up period of 5 years and 1 year respectively.

Conclusion: Surgical resection of giant aneurysms and reconstruction of right sinus Valsalva and right coronary artery with saphenous vein graft are safe procedure with satisfactory long term result after up to 5 years follow-up.