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Bleeding is associated with severely impaired outcomes in surgery for acute type a aortic dissection

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Surgery for acute type A aortic dissection confers a risk for significant bleeding. We analyzed the impact of massive bleeding on complications after surgery for acute type A aortic dissection.

Patients undergoing surgery for acute type A aortic dissection from the retrospective multicenter Nordic Consortium for Acute Type A Aortic Dissection database 2005-2014 were eligible. Massive bleeding was defined according to the Universal Definition of Perioperative Bleeding. The primary outcome measure was early mortality and secondary outcome measures were perioperative stroke, mechanical ventilation more than 48 h, new-onset dialysis, and intensive care unit stay. Propensity score matching was performed to adjust for differences in covariates.

Nine hundred ninety-seven patients were included, of whom 403 had massive bleeding. In the propensity score-matched cohort, patients with massive bleeding had higher: 30-day mortality, mechanical ventilation more than 48 h, perioperative stroke, new-onset dialysis, and longer intensive care unit stay, compared with patients without massive bleeding. Risk factors for massive bleeding were previous cardiac surgery, preoperative clopidogrel or ticagrelor therapy, DeBakey type I dissection, and localized or generalized malperfusion.

Massive bleeding in surgery for acute type A aortic dissection is associated with a markedly increased risk for severe complications as well as early death. Further improvement of surgical technique and pharmacological optimization of coagulation is paramount to possibly improve outcomes in acute type A aortic dissection repair.

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An off-pump technique of total aortic arch debranching for hybrid thoracic endovascular aortic repair of aortic arch pathologies

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Introduction: Supra-aortic debranching for hybrid thoracic endovascular repair (TEVAR) of aortic arch pathologies often require multi-branched graft, extracorporeal circulation (ECC) and even circulatory arrest, leading to increased perioperative morbidity and mortality. In this study, we describe an off-pump technique for total arch debranching.

Methods: Six patients with ages of 53 to 80 years (average age of 67 years) and aneurysms or dissection in the arch or proximal descending aorta underwent total arch debranching and hybrid TEVAR. Five of them were male (83.3%). The proximal end of a bifurcated vascular graft was anastomosed end-to-side to ascending aorta with assistance of side-biting clamp. A shunt from ascending aorta to the right carotid artery was established by using two cardioplegia cannulas connected with 15 cm long tube (Figure 1). Innominate artery was divided from the arch and anastomosed end-to-end to the first branch of the bifurcated vascular graft under protection of the shunt flow (Figure 2). Left common carotid artery was divided and anastomosed end-to-side to the second branch of the bifurcated graft under the shunt protection. Left subclavian was divided and anastomosed end-to-end to the second branch. TEVAR was then carried out after total debranching procedure (Figure 3).

Results: All patients survived with no postoperative stroke, paraplegia, graft migration or endo-leak of any type. CT Angiography confirmed complete exclusion of the aortic lesions in the arch and graft patency at 1 year follow-up.

Results: The total arch debranching technique can be performed safely without ECC. Short term postoperative result was optimal.

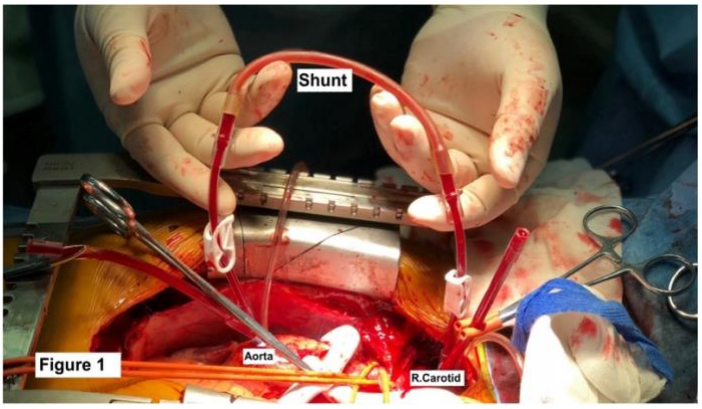

Figure 1

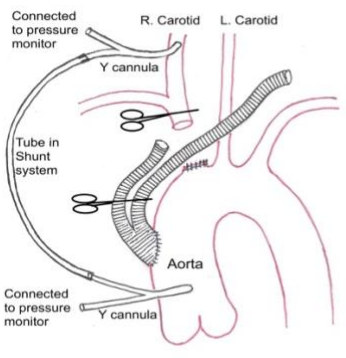

Figure 2

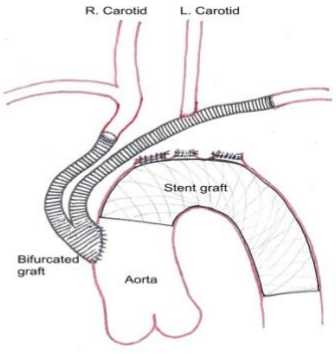

Figure 3

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Aortic Height Index as a Predictor for Complications in Elective Surgery for Ascending Aortic Aneurysm

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Background: Aortic height index (AHI) is a better predictor of adverse aortic events (AAE) than absolute diameter in patients with thoracic aortic aneurysm (TAA). This study aims to assess whether AHI is associated with more extensive aortic surgery and postoperative complications.

Methods: We analysed all patients enrolled in the local quality register Carath that underwent elective surgery for TAA between 2010-2024. Aortic diameter was measured using preoperative computed tomography scans and AHI was calculated; aortic diameter/patient height (cm/m). The patients were stratified into a high-AHI group (AHI≥3.18) and low-AHI group (AHI<3.18) based on when prophylactic aortic surgery is recommended.

Results: The high-AHI group (n=197 (31%)), compared to the low-AHI group (n=440 (69%)) were more often women (49% vs 19%), older (68 vs 60 years) and had higher rate of comorbidities (p<0.01). After adjusting for confounders, high-AHI was associated with three times higher odds of extensive aortic surgery with circulatory arrest (aOR 3.32; 95%CI 2.16-5.09) and twice the odds of intrahospital stroke (aOR 2.21; 95%CI 1.01-4.82). Patients that underwent surgery in circulatory arrest had 2.5 times higher odds of intrahospital stroke (OR 2.58; 95%CI 1.26-5.29). High-AHI group was associated with a higher 30-day mortality (OR 3.19; 95%CI 1.26-8.01), but not after adjusting for confounders.

Conclusions: A larger aortic height index is associated with a higher risk of more extensive aortic surgery with an open distal anastomosis and circulatory arrest and intrahospital stroke.

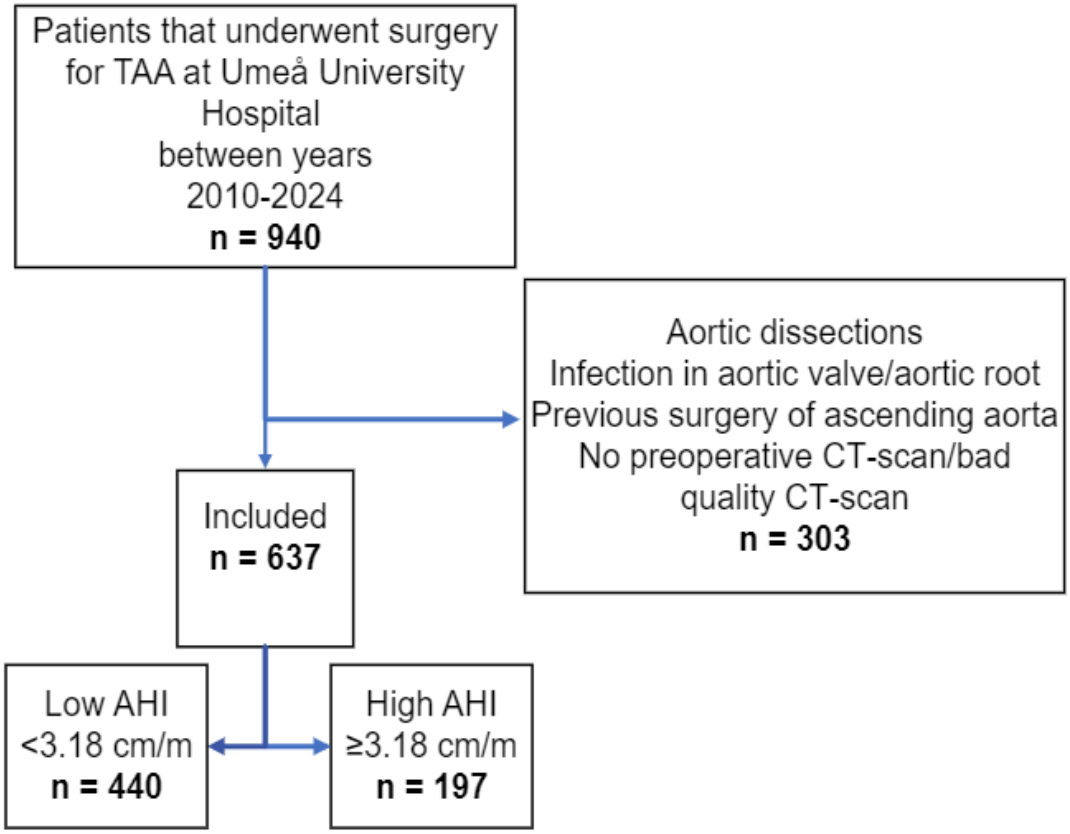

Figure 1: Flow chart of patient selection. *TAA, thoracic aortic aneurysm; AHI, aortic height index, CT-scan, computed tomography scan*

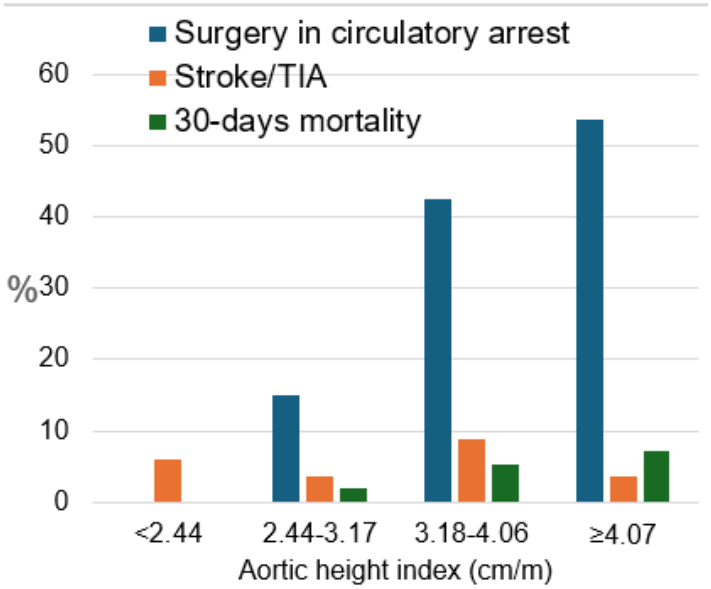

Figure 2: Proportion of patients experiencing surgery with circulatory arrest, stroke or TIA and 30-days mortality at various aortic height indexes.

TIA, transient ischemic attack.

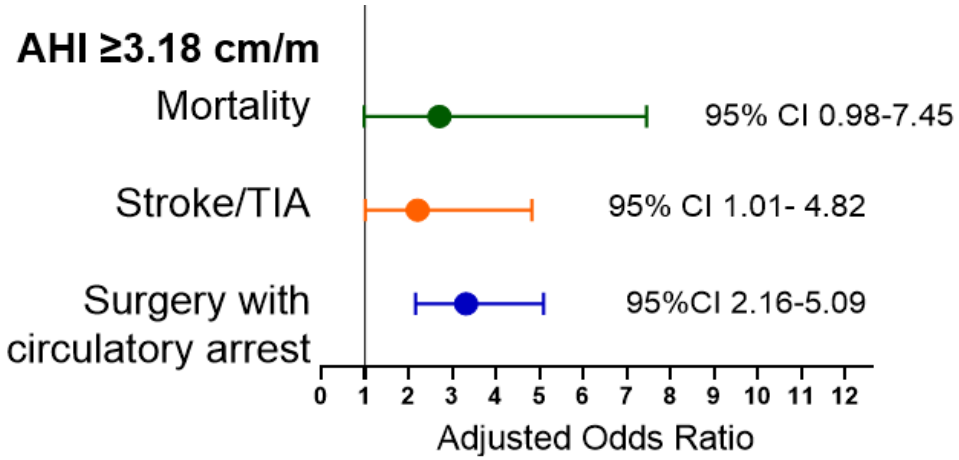

Figure 3: The effect of aortic height index on outcomes after multivariable analysis.

AHI, aortic height index; TIA, transient ischemic attack; CI, confidence interval

Characteristics	Low AHI n=440	High AHI n=197	P-value	Missing
Females, n (%)	82 (19)	97 (49)	**<0.001**	0
Age, y, mean, (SD)	60 (12)	68 (10)	**<0.001**	0
Height, m, mean (SD)	1,77 (0.09)	1,70 (0.09)	**<0.001**	0
Medical history				
Active smoker/ex-smoker, n (%)	174 (40)	110 (56)	**<0.001**	1 (0.2)
COPD, n (%)	12 (3)	20 (10)	**<0.001**	0
Cerebrovascular Disease, n (%)	22 (5)	22 (11)	**0.005**	0
Hypertension, n (%)	287 (65)	161 (82)	**<0.001**	0
Moderate to poor EF <45%, n (%)	30 (7)	30 (15)	**<0.001**	0
Thoracic aortic measurements				0
Maximal diameter mm, mean (SD)	50 (5)	61 (8)	**<0.001**	0
Maximal diameter >55 mm, n (%)	53 (12)	176 (89)	**<0.001**	0
Ascending aortic length, mm, mean (SD)	101 (14)	105 (17)	**0.015**	0
Type of surgery				
Supracoronary aortic replacement **without** aortic valve replacement, n (%)	64 (15)	52 (26)	**<0.001**	0
Supracoronary aortic replacement **with** aortic valve replacement, n (%)	171 (39)	48 (24)	**<0.001**	0
Aortic root replacement with aortic valve replacement (composite graft), n (%)	172 (39)	81 (41)	0.629	0
Valvesparing aortic root replacement, n (%)	33 (8)	14 (7)	0.861	0
Concomitant total aortic arch surgery, n (%)	5 (1)	15 (8)	**<0.001**	0
Circulatory arrest, n (%)	61 (14)	87 (44)	**<0.001**	0
Primary indication TAA, n (%)	222 (51)	161 (82)	**<0.001**	0
Postoperative complications				
Stroke/TIA, n (%)	17 (4)	16 (8)	**0.025**	0
Highest postoperative NuDESC, mean (SD)	0.6 (1,5)	1,24 (2)	**0.02**	194 (30)
30-day postoperative mortality, n (%)	8 (2)	11 (6)	**0.010**	0

Table 1: *Patient characteristics and aortic measurements at time of surgery, type of surgery and postoperative complications.*

TAA, Thoracic aortic aneurysm; COPD, chronic obstructive pulmonary disease; EF, ejection fraction; NuDESC, nurse delirium screening scale.

P36

Outcomes Following Aortic Arch Debranching vs Frozen Elephant Trunk Procedures

Yousaf Ahmad, Matthias Corbascio

The authors have chosen not to publish the abstract

P37

Circulatory arrest versus aortic cross clamping in proximal thoracic aortic aneurysm repair– A single center study

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Objective: The aim of this study was to investigate if a moderate to mild hypothermic circulatory arrest with antegrade cerebral perfusion and an open distal anastomosis was associated with increased incidence of 30-day mortality, acute kidney injury or stroke in patients with a distal ascending aortic diameter of 40 to 50 mm measured below the brachiocephalic trunk, undergoing elective proximal thoracic aortic surgery, compared to the aortic cross-clamp technique.

Methods: This is a single center observational study made at Karolinska University Hospital, with patients from 2016-2024. After identification of eligible patients, X-ray revisions were made to identify those who had an aortic width of 40-50 mm below the brachiocephalic trunk. Patients were the divided into two groups depending on surgical technique.

Results: 399 patients with the inclusion measurement were divided into two groups, the aortic cross clamp group (n=261) and the moderate hypothermic arrest (MHCA) group (n=138). Baseline characteristics were generally well balanced. Two patients (0.5%) died within 30 days, both in the MHCA group. Overall complications were more common in the MHCA group, even though event rates were low. In a propensity score matched cohort, MHCA was associated with an increased OR to die within 30 days of surgery, have a perioperative stroke or new onset dialysis.

Conclusion: Both aortic cross clamp and MHCA is linked to a low mortality risk but MHCA had a higher rate of known complications. This conclusion is however limited by the low number of events in this study.

P38

Systemic review on thoracic aortic dissection

Ivana Kholová[1], Eemeli Jämsen[2], Tero Halmesmäki[2], David Kalfert[3], Ari Mennander[4], Timo Paavonen[2]
[1] Kuopio University Hospital, [2] Tampere University, [3] Charles University Hospital Motol Prague, [4] Tampere Heart Hospital

Background: Systematic review on thoracic aortas operated on due to dissection was performed. The inclusion criteria were the application of the Society for Cardiovascular Pathology and the Association for European Cardiovascular Pathology consensus statement to analyze histopathological features in media aortic layer in surgical specimens.

Methods: The Pubmed search resulted in 174 articles out of which ten articles met inclusion criteria. Data on all histopathological features presence and grading were collected in Microsoft Excel and further analyzed with Open Meta-Analyst program.

Results: A total of 871 cases out of ten studies were analyzed. The pooled prevalence of cases diagnosed with moderate overall medial degeneration as moderate among 264 cases of dissection from 5 studies was 47.1% (95% CI from 32.1 to 62.1%, I2 was 85.34%). Out of all cases of dissection, 46.3% (95% CI from 28.7 to 63.9%, I2 was 72.44%.) reported overall MEMA as moderate. Interlamellar MEMA was severe in most dissected cases (38.6% (95% CI from - 4.5 to 81.6%), I2 was 98.13%). Translamellar MEMA was moderate in most analyzed cases (46.6% (95% CI from 15.2 to 78.1%), I2 was 94.97%).

Conclusion: The Society for Cardiovascular Pathology and the Association for European Cardiovascular Pathology consensus statement is a practical toolkit for assessment of thoracic dissected aorta samples in routine practice. Nevertheless, its rigorous application is limited to several centres and most users do not apply the consensus in its extent.

P39

Systematic review on the histopathology of surgical specimens of aneurysmatic thoracic aortas

Ivana Kholová[1], Eemeli Jämsen[2], Tero Halmesmäki[2], David Kalfert[3], Ari Mennander[4], Timo Paavonen[2]

[1] Kuopio University Hospital, [2] Tampere University, [3] Charles University Hospital Motol Prague, [4] Tampere Heart Hospital

Background: Systematic review on the histopathology of surgical specimens of aneurysmatic thoracic aortas with application of the Society for Cardiovascular Pathology and the Association for European Cardiovascular Pathology consensus statement was performed.

Methods: The Pubmed search resulted in 174 articles out of which ten articles met inclusion criteria. Histopathological features and grading were collected in Microsoft Excel and analyzed with Open Meta-Analyst program.

Results: The most prevalent grade of overall medial degeneration was moderate with prevalence of 48.0% in 408 aneurysmatic samples across five studies (95% CI 43.2 - 52.8% with inconsistency index I2 of 0.0%). The second most prevalent grade was severe with 24.8% of samples (95% CI 14.5-35.1%, I2 of 77.75%) and 8.2% were graded as mild. Only in 7.5% of samples medial degeneration was absent. In “elastic fibre fragmentation/loss” the most prevalent grade was mild with prevalence of 44.2% in 369 samples across four studies (95% CI 25.3-63.1%, I2 of 0%) In smooth muscle cell nuclei loss the most prevalent grade was also mild with prevalence of 41.3% in 96 samples across two studies (95% CI 30.1 - 52.4%, I2 of 22.45%)

Conclusion: The Society for Cardiovascular Pathology and the Association for European Cardiovascular Pathology consensus statement works well for assessment of thoracic aneurysmatic aorta samples in routine practice. The strict application is unfortunately limited to several tertiary/academic centres and the consensus is not often applied in its whole extent.

P40

Zone 2 Arch Reconstruction with Valve Preservation

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[1] Intermountain Medical Center

Background.

Reoperations for concomitant aortic root, ascending and aortic arch pathology after prior aortic dissection are technically challenging. Valve-preserving techniques combined with zone 2 arch reconstruction retain the native aortic valve and simplify the arch operation.

Methods.

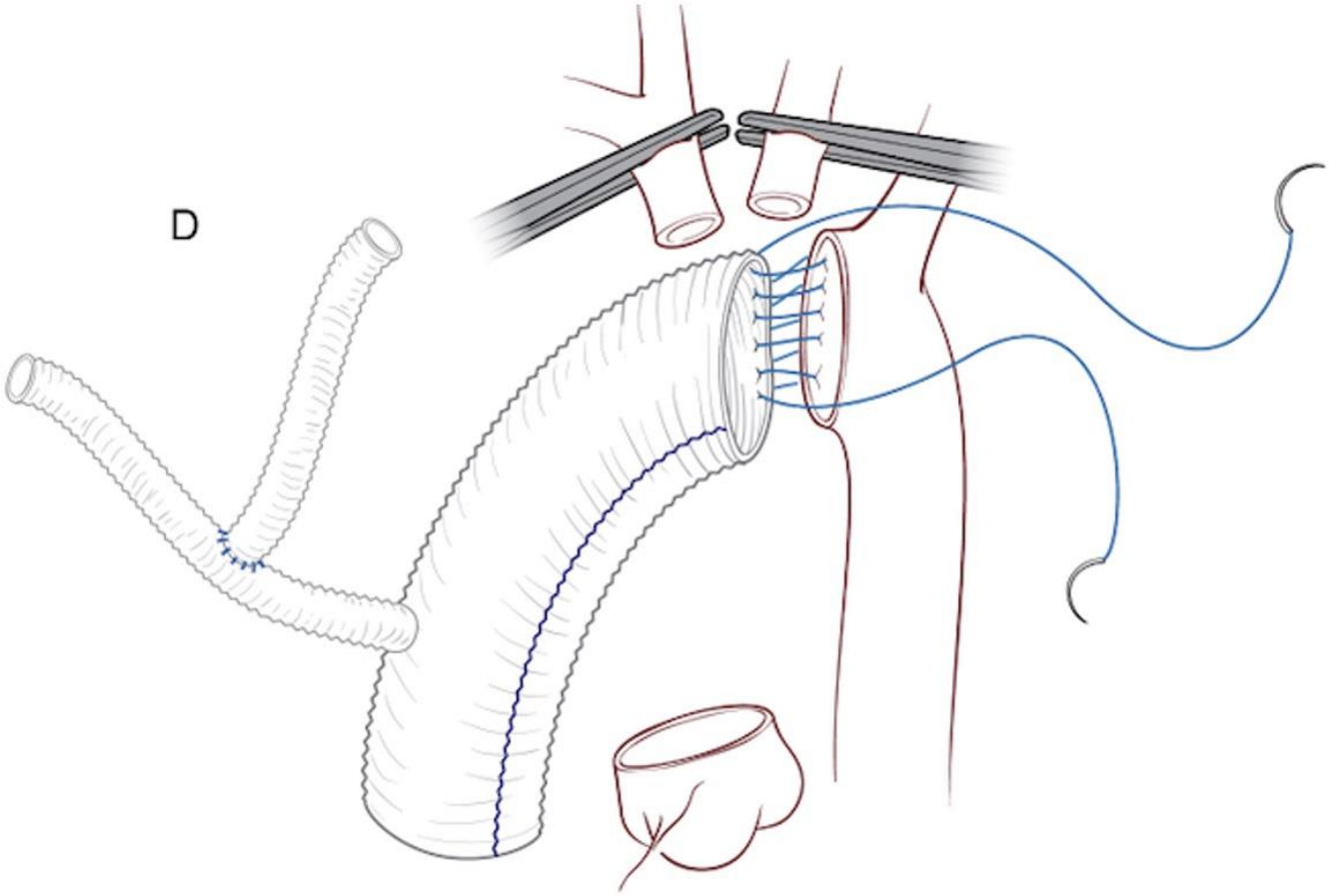
Three patients underwent reoperation consisting of either valve-sparing aortic root replacement (2 patients) or partial root reconstruction (1 patient), replacement of the ascending aorta, and zone 2 arch reconstruction. The arch reconstruction was performed using a 30 mm main body graft with a 10 mm side graft to the innominate artery and an 8 mm side graft to the left common carotid artery (figure 1). Moderate hypothermia with continuous antegrade cerebral perfusion was used during the arch reconstruction. The root/ascending graft was then attached in an end-to-end fashion to the arch graft.

Results.

All patients survived the operation. Intraoperative echocardiography showed no or trace aortic insufficiency (AI) in 2 patients and mild in 1 patient after repair. Mean cross-clamp, cardiopulmonary bypass, and circulatory arrest times were 151 minutes, 247 minutes, and 34 minutes, respectively. No patient suffered stroke or other neurologic injury. One patient required delayed sternal closure due to coagulopathy. All patients had subsequent extension endografting to complete the repair of the distal arch and descending thoracic aorta.

Conclusions.

Valve-preserving root replacement combined with zone 2 arch reconstruction is an excellent option for treatment of extensive root and arch aortic disease. Antegrade cerebral perfusion and the distal zone 2 anastomosis are key components.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P41

Acute type A aortic dissection and cysts

Ari Mennander[1,2], Essi Pirskanen[2], Ivana Kholova[2,3,4,5], Timo Paavonen[2,3]

[1] Tampere University Hospital, Heart Hospital, [2] Tampere University, [3] Fimlab Laboratories, [4] University of Eastern Finland, [5] Kuopio University Hospital

Background: Aortic wall degeneration characterizes acute type A aortic dissection (ATAAD). The extent of aortic wall degeneration may be associated with the presence of cyst development. We investigated whether the presence of renal, liver and/or ovarian cysts is associated with degeneration of the ascending aortic wall in patients with ATAAD.

Methods: Altogether, 125 consecutive patients undergoing ATAAD surgery at XXX Hospital were evaluated. The ascending aortic wall resected in surgery was processed for histopathology. Patients with and without cysts (n=49 and n=76) were compared during a mean 6.5-year follow-up.

Results. The mean age for all patients was 65 years (standard deviation [SD] 12). Chronic obstructive pulmonary disease was more frequent in patients with cysts versus not (30.6% versus 13.2%, P=0.022, respectively). Most of the patients with cysts included a biological conduit prosthesis as compared with those without cysts (44.9% versus 17.1%, P=0.001) An aortic root-sparing operation was less often offered to patients with cysts versus without (40.8% versus 63.2%, P=0.017). The extent of elastic fiber thinning was more prominent in patients with cysts as compared to patients without (1.3 ± 0.8 vs. 0.9 ± 0.9, P=0.012, respectively). During follow-up, there were 57 deaths among patients (log rank P=0.248).

Conclusions. Histopathology of the ascending aorta during ATAAD reveals increased extent of elastic fiber thinning in patients with cysts versus not. Patients with cysts may have a distinctive pattern of aortic wall degeneration associated with ATAAD.

P42

Diabetes mellitus and aortic atherosclerosis during dissection

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Background: Diabetes mellitus may impact surgical decision-making and outcome after acute type A aortic dissection (ATAAD). The aim of the study was to compare histopathology and surgical solutions in patients with versus without diabetes mellitus during ATAAD.

Methods: Altogether, 123 consecutive patients undergoing surgery for ATAAD at X Hospital were evaluated. The ascending aortic wall resected in surgery was histopathologically analyzed. Patients with and without diabetes mellitus were compared during a mean 5-year follow-up.

Results: Out of 123 patients, there were 11 patients with diabetes mellitus. The mean age for all patients was 64 years (standard deviation [SD] 13). Most of the patients (n=74, 60.2%) received a supracoronary tube prosthesis. Altogether, 48 patients had a conduit aortic prosthesis replacing the aortic root together with the ascending aorta, including only one patient with diabetes (p=0.049). Nine patients received a frozen elephant trunk prosthesis to treat the aortic arch together with the ascending aorta. The severity of ascending aorta atherosclerosis was more prominent in patients with diabetes mellitus as compared to patients without (0.8 [0.4] vs 0.3 [0.5], p=0.009, respectively). During follow-up, respectively, eight and 78 patients with and without diabetes died (logarithmic rank p=0.19).

Conclusions: Patients with diabetes mellitus have increased severity of the ascending aortic wall atherosclerosis during ATAAD. The degree of atherosclerosis may add to treatment and follow-up protocol.

P43

Vegvisir Technique for Valve-Sparing Aortic Root Replacement

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[1] Intermountain Medical Center

Background.

Valve-sparing aortic root replacement (VSRR) is the preferred operation for patients with aortic root aneurysm and well-functioning native aortic valve leaflets. The CardioRoot prosthesis (Getinge, Inc.) facilitates this operation using a simple, reproducible technique for valve reimplantation termed the “Vegvisir” operation.

Methods.

Sixty-five patients (51 men, 14 women, mean age = 47 years) underwent VSRR using a reimplantation technique consisting of: 1) annular sizing and graft selection, 2) subannular sutures following the natural annular shape, 3) “runic” prosthesis markings to guide suture placement (figure 1), and 4) precise commissure reattachment. The most common concomitant operations were reconstruction of the ascending aorta (n=28), native valve repair (n=4), and Maze procedure (n=7). 36 patients (55%) had heritable thoracic aortic disease. 60 patients had a tricuspid valve and 5 had a bicuspid valve. Preoperative aortic insufficiency (AI) was severe in 7 patients, moderate in 7 patients, and mild/no in 51 patients.

Results.

Intraoperative echocardiography showed no/trace AI in 57 (88%) patients and mild AI in 8 patients after repair. One patient sustained an intraoperative aortic dissection and died 8 days later from multiple cerebral infarcts. Mean follow-up was 2.5 years (max 13 years). Echocardiography was obtained in 36 patients; AI was no/trace in 30 patients (83%), mild in 5 patients, and moderate in 1 patient.

Conclusions.

This study demonstrates that the “Vegvisir” reimplantation technique using the CardioRoot prosthesis provides excellent outcomes for valve-sparing aortic root surgery. This technique “shows the way” to provide patients with well-functioning, durable native aortic valves.