Two Stents Implantation Technology of Endovascular Repair in Treatment of Type B Aortic Dissection

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Objective To investigate the feasibility and clinical effect for the endovascular repair of Stanford B aortic dissection using personalized Two stent graft implantation. Methods A retrospective review of 56 patients (47 men; the median of age 57 years, range from 41 to 67 years) who underwent TSI during TEVAR for Stanford B aortic dissection from Jan 2012 to May 2013. Follow-up was performed at discharge, postoperative 3 months, 6 months, and yearly thereafter. Technique success, aortic remodeling and procedure-related complications were evaluated. Results The technical success rate was 100%. 112 thoracic stent grafts and 10 left subclavian artery chimney stents were used. The two-stent had mean length of 197.6±20.3mm and mean tapered span of 7.5±1.8mm. All patients were followed up from 6 to 16 months (mean 10±4 months), of whom 46 had a completely thrombosed false lumen and 1 had a partially thrombosed false lumen in two-stent segment, and 9 had a completely thrombosed false lumen, the total thrombosis rate of false lumen was 98.2% (55/56). Procedure-related complications during follow-up included paraplegia due to acute spinal cord ischemia (n=1) and malposition of distal stent graft (n=1). No death, endoleak and malperfusion complications were observed during perioperative period and follow-up. Conclusion Two stent graft implantation is feasible and clinically effective in the treatment of Stanford B aortic dissection. It could avoid being limited by the stent length and diameter and according to the characteristics of the case for personalized treatment options. The midterm and long term results are not clear, thus, large sample, long term and prospective study are needed.
Objective:
Aneurysms of the ascending aorta put patients at risk for severe adverse events including aortic rupture. Therefore, screening tools would be beneficial. Genetic polymorphisms may play a significant role in aneurysm development and could serve as risk markers. Recent studies identified polymorphisms of the vitamin-K epoxide-reductase-complex-subunit-1 (VKORC1) as risk factor for atherosclerotic vascular disease. VKORC1 gene polymorphisms influence gamma carboxylation of several enzymes including matrix Gla protein (MGP), which is an important structural protein protecting from vascular calcification. Therefore, we hypothesized that the VKORC1-1639G>A polymorphism could be associated with aortic aneurysms.

Methods:
225 patients with aneurysms of the ascending aorta were compared to age-matched controls (n=117). Other forms of aneurysms or known gene defects (e.g. Marfan syndrome) were excluded. VKORC1-1639G>A polymorphism was determined by PCR, and tissue MGP was measured by ELISA. Statistical analyses were carried out in SPSS 21.0.

Results:
Carriers of aneurysms (62±14years old compared with 60±14year-old controls; p=0.2) were more likely male (70% vs. 58%; p=0.03). The VKORC1-1639G>A gene polymorphism was distributed differently between groups (p<0.001). GA and AA genotypes were more common in the aneurysm group (GA: 60% vs. 42% and AA: 16%vs.10%). MGP tissue levels did not differ between groups.

Conclusions:
VKORC1-1639G>A gene polymorphism was associated with ascending aortic aneurysms. MGP protein levels were not significantly different, but enzymatic activity of the protein may be impaired due to deficient gamma carboxylation.
Objective
We reviewed factors influencing sporadic aortic aneurysm (TAA) complications in order to give some suggestions which might be used as possible criteria to surgical indications.

Methods
Aortic specimens were obtained from 161 patients underwent surgical repair of TAA and 18 patients underwent surgical repair for Stanford type A aortic dissection (TAD). A control group of 128 subjects was also enrolled. Histopathological and immunohistochemical analyses were performed using adequate tissue specimens, appropriate techniques and criteria. Genetic risk factors were also investigated.

Results
In the most cases of TAD, ascending aorta is not dilated. TAD is associated with elevated cystic medial degeneration. Very significant associations were observed between -786T/C eNOs, D/I ACE, -735C/T MMP-2 SNPs and TAD risk. In the case of TAA, we identify three phenotypes in case aorta samples: phenotype I (normal wall); phenotype II (moderate wall thickness); phenotype III (thin and weak wall). No significant differences were detected in term of aortic diameter at the time of operation. Significant statistical differences were observed among three phenotypes by comparing abnormalities of extracellular matrix components, genotype distributions and allele frequencies. In particular patients with TAA phenotype III showed the same histological and genetic features of TAD despite the mean diameter of ascending aorta was smaller than TAA phenotype I and II.

Conclusion
Our suggestion is that the median diameter of ascending aorta is not a sure criteria for surgical indication in patient with TAA, other biomarkers need to be used to prevent catastrophic complications of rupture and dissection.
The Influence of an Operative Strategy on Outcomes of Acute Type-A Aortic Dissection Cases

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Objective: The objective of this study was to compare the surgical outcomes of total arch replacement with the outcomes of ascending aorta replacement in patients with acute Stanford type-A aortic dissection. Methods: From April 2002 to May 2014, 84 patients with acute Stanford type-A aortic dissection underwent emergency surgical treatment at our institution. Among them, 16 underwent total arch replacement and 68 underwent ascending aorta replacement. The decision to perform total arch versus ascending aorta replacement was dependent on an individual patient’s condition, intimal tearing site, or the diameter of the distal arch but was eventually at the attending surgeon’s discretion. Results: The intimal tearing sites were likely to be confined to the ascending aorta in the ascending aorta replacement group. There were no statistically significant differences in other characteristics between the 2 groups with regard to the 2 surgical procedures. The percentage of cases of dissection entry tear exclusion was 84% in the ascending aorta replacement group. In the total arch replacement group, all patients underwent entry tear exclusion. The differences between the groups in the duration of operation, cardiopulmonary bypass, cardiac arrest, circulatory arrest, and the cerebral perfusion were statistically significant, with the total arch replacement group having higher values than the ascending aorta replacement group. In addition, more blood transfusions were needed in the total arch replacement group. There were 14 early deaths, without statistically significant differences between the 2 groups. Twenty-three patients developed new-onset neurological dysfunction. Neurological impairment tended to be more severe in the total arch replacement group. Re-thoracotomy for bleeding was performed more frequently in the total arch replacement group than in the ascending aorta replacement group. The rate of discharge to home was 44% in the ascending aorta group, whereas it was 19% in the total arch replacement group. During follow-up, 7 patients died: 4 of aorta-related causes. The aortic operation had to be redone in 6 patients: 3 patients underwent an aortic reoperation because of a pseudo-aneurysm, and the other 3 patients because of progressive aortic pathology. The reoperations were not associated with an increased risk of death or neurological complications. Overall 5-year survival rates were 77% in the ascending aorta replacement group and 68% in the total arch replacement group. There was no statistically significant difference between the 2 groups. The interval between the operation and the final CT scan was 1-107 months. On the final postoperative CT scans, the aortic diameter and the incidence of a patent false lumen were similar in the 2 groups. Conclusions: The surgical outcome and prognosis are satisfactory among patients undergoing ascending aorta replacement for the treatment of acute type-A aortic dissection. Clinicians should consider ascending aorta replacement in patients with this life-threatening condition.
Repairing Ruptured Sinus Valsalvae by Utilizing Skeleton or Solid Structures

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Objective:
Surgery for ruptured sinus valsalvae (SV) is not always free from re-rupture postoperatively in part because the fragile tissue around the rupture site is used for suturing with or without employing a patch. We try to repair the SV by using skeleton structure in order to secure the suture line from tearing or re-rupture.

Methods and Results:
Patient 1 was a 25-year-old man who had had a direct closure of ruptured SVA in another hospital. In 6 months, he developed heart failure due to the rupture of the closure site. We re-operated on him. Under the cross-clamp, ascending Aorta and right atrium was opened. The non-coronary SV near direct closure site was torn. 2-0 spaghettied polypropylene buttress sutures were passed through aortic ring from LV side to SV one, and other sutures above the commissure level were placed on healthy Aortic wall (Figure. RSV, orifice of ruptured SV; LCO, left coronary orifice; RCO right coronary orifice). The top part of the suture line was incorporated to the Aortotomy one. Bovine pericardial patch was placed on the SV which excluded the whole non-coronary SV including the rupture site. Furthermore, the size and shape of the patch was designed to restore normal non-coronary ring and SV, and to avoid Aortic insufficiency in the future. Finally, via right atrium, the rupture area was covered by another patch. He is doing well without shunt 2.5 years postoperatively.

The second patient was a 33-year-old woman who developed recurrent leakage in the non-coronary SV 2 months after the first operation in a nearby hospital. She had had patch closure of a ruptured SVA. Echocardiography showed a large amount of L-R shunt and dilated right heart. Re-operation was performed in the same fashion as the first patient. Postoperative course was uneventful. She has no shunt and enjoys normal activity 21 months postoperatively.

The Last patient was a 60-year-old man who had heart failure with leakage of the SV in the non-coronary sinus. Echocardiography had showed a massive L-R shunt with high velocity (5.3m/s). Furthermore, He had severe pulmonary hypertension with high tricuspid valve regurgitant pressure gradient (TRPG) of 56mmHg. Operation was done in the same fashion although it was the first operation. Postoperative course was uneventful. At the time of a discharge, TRPG improved to 23mmHg. He is doing very well with no shunt 9 months postoperatively.

Conclusions:
Although our experience is just 3 patients, the technique seems promising from anatomical and clinical viewpoints, and it may contribute to improve the surgical results for ruptured SV. Further investigation will be warranted.
Effectiveness of Omental Wrapping to Prevent Infection after Treatment for Infectious Thoracic Aortic Aneurysms

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[Objective]
We previously reported that omentum could prevent or reduce the occurrence of infection after artificial aortic graft implantation, although the long-term outcomes of this strategy remained unknown. Here, we used imaging modalities to evaluate the long-term effectiveness of wrapping prosthetic grafts with omentum to prevent postoperative graft infection even in endovascular treatment for infectious thoracic aortic aneurysms.

[Patients and Methods]
Between July 1995 and December 2014, we surgically treated 594 patients with thoracic aortic aneurysm (TAA) at our hospital. Of these, 22 (3.7%) had infectious TAA located in the 2 ascending, 5 arch, 6 descending and 9 thoracoabdominal aortae who received open thoracic aortic in-situ graft replacement. Seventeen male and mean age was 68 years old. All infectious aneurysms were resected, and all patients received in-situ grafts replacement and 16 grafts were wrapped with omentum.

We started endovascular treatment since 2009 at our hospital. We performed TEVAR for TAA in 218 patients. In these, 4 cases (1.8%) who were high-risk elderly patients underwent TEVAR for lifesaving to prevent rupture of infectious TAA. Of these, 2 patients received infected aortic wall fenestration with omental wrapping secondary.

[Results]
We lost for multiple organ failure in 2, intestinal necrosis in 1, intrathoracic bleeding in 1 and acute pulmonary embolism in 1. Early mortality rate was 22.7% in graft replacement cases. The operative mortality rates were 12.5% and 50.0% among patients with and without omental wrapping, respectively. Infection related late death was occurred in only 1 patient. Postoperative graft infection has not occurred in the 13 surviving patients, 11 of whom underwent omental wrapping. The 5-year infection-free survival rates were 84.6% and 33.3% in patients with and without omental wrapping, respectively (p = 0.025).

In TEVAR cases, 1 patient died for non infection related cause (liver dysfunction) 3 month after the operation. Remaining 3 patients including two omental wrapping cases survived infection free condition for two years after the procedure.

We used CT to annually evaluate postoperative graft infection and the pedicled omental flap around the prosthetic grafts in all survivors. Omental flaps were preserved well in 9 patients (69.2%). Blood circulation in the omental flap was examined by angiography in three patients over the long term. Angiography of right gastro-epiploic artery shows well-preserved blood circulation in omental flap around prosthetic graft six years after repair of infectious arch aortic aneurysm.

[Conclusions]
Our experimental studies demonstrated that omental wrapping could prevent or reduce the occurrence of infection after implantation with an artificial aortic graft even in TEVAR. Our long-term images findings suggest that well-preserved blood circulation in omental flaps around prosthetic grafts is important to prevent recurrent infection.
Oversewing Aortic Valve during Continuous-flow Left Ventricular Assist Device Insertion is Not Associate with Aortic Root or Ascending Aortic Dilation

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Objective:
Significant aortic insufficiency (AI) precludes effective flow of continuous-flow left ventricular assist device (LVAD) implantation. AI is addressed by AV replacement or oversewing of the aortic valve. After aortic valve oversewn, pulse pressure becomes minimal, as arterial flow is entirely the result of the continuous flow LVAD through outflow graft, anastomosed to the ascending aorta. This creates a novel, "non-physiological" aortic wall stress. We aimed to review our case series of patients with oversewn AV at the time of LVAD, to examine whether "non-physiological" pressure and flow in this cohort is associated with postoperative aortic root or ascending aorta dilatation.

Methods:
All patients who underwent aortic valve oversewing with initial LVAD insertion were identified. Patients were excluded if: 1) LVAD was inserted not via median sternotomy (e.g. via left subcostal approach or left thoracotomy), 2) lost to follow-up/no postoperative transthoracic echography, or 3) anastomosis of outflow graft of LVAD was not made to the ascending aorta (e.g. to descending aorta or subclavian).

Diameter of the aortic sinus of valsalva (ASVd) and proximal ascending aortic (AAd) were measured by transthoracic echography via long-axis view before and after surgery. Continuous data were analyzed with student’s t-test and repeated-measures ANOVA, and dichotomous data with Fishers exact test.

Results:
From January 2008 to December 2013, 14 patients had aortic valve oversewn with initial LVAD insertion via medina sternotomy. After excluding 2 operative mortalities, 12 patients were reviewed. Mean duration of follow up was 1.44 ± 1.12 year (median 1.08 year). ASVd and AAd were not significantly different comparing baseline, 1 and 2 year image follow-up (ASVd: baseline 33.4 ± 5.2, 1 year 31.4 ± 4.7, and 2 years 34.6 ± 7.8 mm, p=0.21; AAd: baseline 30.6 ± 4.0, 1 year 28.4 ± 3.6, 2 years 33.7 ± 4.7 mm, p=0.32).

Conclusions:
Continuous flow LVAD insertion with aortic valve oversewing creates a novel, non-physiological wall stress on the ascending aorta which is not associated with dilatation of the aortic root or ascending aorta.
**Initial Experience of Modified Four-branched Graft Technique and Antegrade Thoracic Endovascular Aortic Repair in Acute Type A Aortic Dissection**

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**Objectives.** We report the initial experience of modified four-branched graft technique for proximal aorta and arch repair, feasibly combined with antegrade thoracic endovascular aortic repair (TEVAR) to extend distal aortic reconstruction in acute type A aortic dissection.

**Methods.** From 2011 to 2013, 12 consecutive patients with acute type A aortic dissection were indicated for arch surgery and underwent surgical replacement of proximal aorta, arch replacement or debranching procedure, and concomitant TEVAR for distal aortic repair.

**Results.** A good surgical field was obtained in all patients. No major complications development but two hospital deaths were attributed to end-organs damage preoperatively. Good and fast remodeling of thoracic descending aorta was demonstrated in 11 patients in postoperative CT imaging and no aneurysmal dilatation of visceral aorta had been observed in 10 patients during follow-up periods.

**Conclusions.** Modified four-branched graft technique facilitates proximal aorta and arch repair, and provided excellent neurological outcome and favorable short-term results. Single-stage operation combined with antegrade TEVAR is feasible and effective to extend the repair down to the descending aorta, and thus achieves good remodeling of thoracic descending aorta.
Surgical Strategy in Aortoesophageal Fistulae


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Objective: The surgical treatment of aorto-esophageal fistulae (AEF) still has challenging aspects with extremely high morbidity and mortality rates. We report on our recent experiences of thoracic endovascular aortic repair (TEVAR) and/or open surgical repair (OR) of the descending aorta for AEF.

Methods: In a 4-year period, 7 patients with AEF were treated at our institute. Four patients underwent OR consisting of aortic replacement with a rifampicin soaked woven graft and omentopexy after esophagectomy and irrigation. The other high-risk 3 patients underwent TEVAR. Following long-term antibiotic therapy was carried out in all.

Results: Two of 4 patients with OR, who were once discharged, eventually died from pneumonia and sudden death within one year. All of 3 patients having technically successful TEVAR have been alive with antibiotic treatment, although all of them had been in the poorer medical conditions.

Conclusion: Prompt and definitive OR is the standard therapy for AEF. However, TEVAR is a valuable alternative to in-situ OR for some high-risk or inoperable patients.
Endoanchor-assisted TEVAR: The Endoplegded Technique

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OBJECTIVE: Continued challenges to the long-term success of thoracic endovascular aortic repair (TEVAR) are Type I endoleaks and the possibility of stent-graft migration. Lack of stent-graft apposition in highly angulated portions of the aorta (“bird-beaking”) is an integral technical factor affecting the efficacy of TEVAR procedures. The endoplegded technique is a catheter-based technology which mechanically unites the aortic stent-graft to the aortic wall using an endoanchor. (Figure 1) We reviewed our experience with endoanchors in thoracic endovascular aortic repair (TEVAR) procedures and performed a comprehensive review of the literature.

METHODS: We reviewed our institutional aortic database for the endoplegded technique use in TEVAR procedures from October 2013 to present. In addition, we performed a PubMed query for peer-reviewed publications using the search terms “endoanchors” or “endostapler”. We recorded the type of aortic disease being treated, type of endoleak, location of the aortic pathology and outcome.

RESULTS: Six TEVAR patients were treated with the endoplegded technique; 2 for treatment of a type Ia endoleak and 4 for prophylactic augmentation of the seal zone. Five interventions were in the aortic arch (Figure 1) and 1 was in the supra-celiac aorta. Both type Ia endoleaks resolved following treatment. There were no strokes, incidences of paraplegia or deaths. Mean follow-up of 8 months demonstrated no endoleaks or stent-graft migrations. The PubMed review demonstrated 11 publications pertaining to endoanchors, with 1 publication pertaining to TEVAR. A total of 6 patients were treated, with all interventions being for type Ia endoleaks. Four patients were treated in the aortic arch and 2 in the supra-celiac aorta. All 6 patients had resolution of their endoleak. One patient expired 4 weeks post-op from visceral and cerebral infarctions. At a mean follow-up of 11 months, no stent-graft migration or endoleaks were observed.

CONCLUSIONS: The endoplegded technique is a viable treatment option for preventing stent-graft migration and addressing type I endoleaks associated with TEVAR procedures, potentially avoiding additional stent-graft deployment or coverage of branch vessels. Additional follow-up is needed to understand the role of endoanchors in prophylactically preventing stent-graft migration in hostile landing zones.
Which is Better Procedure, Using the Frozen Elephant Trunk Technique or the Classical Elephant Trunk Technique Followed with the Second Stage TEVAR for Extensive Aortic Arch Repair?

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OBJECTIVES:
Paraplegia is one of the most devastating complications during extensive aortic arch repair. We retrospectively analyzed our results comparing with primary repair using the frozen elephant trunk technique (FET) and the classical elephant trunk technique (CET) followed with the second stage TEVAR. The CET technique followed with the second stage TEVAR had been introduced since 2009.

METHODS:
Between March 1997 and Dec 2014, 69 patients (the mean age: 71 ± 8.6 years old, 57 male and 12 female) underwent total aortic arch replacement with either the FET (42 cases) or the CET (27 cases). The mean follow up time was 60 month in FET and 29 month in CET. The major indication for surgery was true aneurysm 76% in the FET and 96% in the CET. The other indication was aortic dissection. The CET had second stage TEVAR with median duration of 36 days.

RESULTS:
In-hospital death was 2 (4.8%) in FET and none in CET. Late death occurred in 17 (40%) of FET and 4 (15%) of CET. Overall survival was 69% in FET and 80% in CET at 5 years. Kaplan-Meier survival regression showed no significant difference between two groups (p=0.97). Aortic events occurred in 10 (24%) of FET and 3 (11%) of CET. Freedom from aortic events was 80% in FET and 88% in CET at 5 years. Freedom from aortic events between two groups had no significant difference (p=0.97). Five neurologic events (12%) were occurred in FET, and three events (11%) in CET (p=0.99). The occurrence of paraplegia was significantly higher in FET compare to CET (19% vs 0%, p=0.016).

CONCLUSIONS:
The FET technique with primary repair for extensive aortic arch repair had an acceptable hospital mortality rate and aortic events, but had high incidence of paraplegia. Two stage repair with the CET technique followed with the second stage TEVAR may produce a favorable mid-term surgical outcome with low risk of paraplegia.
Simultaneous Repair of Thoracic Aortic Aneurysm and Severe Coronary Artery Disease in High Risk Patients: Debranching Tevar and Opcab

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[Objective]
Coronary artery disease is a major comorbidity affecting the morbidity and mortality in patients undergoing thoracic aortic aneurysm repair. The optimal timing of aneurysm repair in patients with severe coronary artery disease is still a subject of controversial discussion. In our institution, hybrid repair for aortic arch aneurysm without cardiopulmonary bypass is performed in high risk patient and CABG is performed in case of coexisting coronary artery disease basically. We present less invasive technique for thoracic aortic aneurysm and coronary artery disease in a single operation.

[Method]
From January 2013 to April 2015, 21 patients underwent thoracic aortic repair concomitant with CABG in our institution. Of these patients, debranching and antegrade stent-graft deployment (Type I repair) and off-pump CABG was performed in five patients with preoperative severe condition. Basic principle of CABG was aorto-coronary bypass using saphenous vein graft. Left internal mammary artery was not used preserved spinal cord blood flow. Postoperative outcomes were reviewed.

[Results]
All cases were male (octogenarian 3, COPD 3, malignancy1). Mean age was 79.2±4.97 year-old. Mean EuroSCORE was 25.9±8.50. Operative time was 561±92.8 minutes. Intubation time was 91.2±67.8 hours. Hospital stay and ICU stay was 43.2 ± 25.4 and 9.2±7.1 days, respectively. Intraoperative ascending aortic dissection due to side clamp was encountered in one case. Untreated dissection was ruptured 5 days after surgery, and the case was lost. Other 4 cases survived without perioperative cardiac event. (mean CK/CK-MB 573±427/10.3±0.96) Bypass graft was all patent and endoleak of stent-graft was not detected.

[Conclusions]
Combined endovascular thoracic aortic aneurysm repair and off-pump coronary artery bypass grafting is a less invasive procedure, which can be performed without cardiopulmonary bypass for the patients with severe preoperatively condition. The early outcomes of the five cases were acceptable, but procedure was required scrupulous attention.
The Impact of Technical Modification on Surgical Outcomes of Total Arch Replacement for Distal Arch Aneurysm

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(OBJECTIVE)
Total arch replacement for distal arch aneurysm is still challenging and several technical issues are controversial, such as cerebral-spinal protection and distal anastomosis technique. We have modified the operative techniques (distal anastomosis and cerebral perfusion) since April 2013. The objective of this study was to evaluate the efficacy of the technical modification.

(METHODS)
Consecutive 60 patients with distal arch aneurysm undergoing total arch replacement using a 4-branch arch graft between January 2008 and May 2015 were studied (excluding emergency for acute dissection and aortic rupture). Before April 2013, 37 patients (group A: 74±9 y.o) underwent total arch replacement using mini-elephant technique for distal anastomosis under antegrade cerebral perfusion (direct cannulation for brachiocephalic and left carotid arteries) and moderate hypothermic circulatory arrest. After April 2013, 23 patients (group B: 71±8y.o) underwent the surgery using the following modifications. “Turn-up” technique (eversion of the graft end) for distal anastomosis and distal right axillary artery perfusion combined with brachiocephalic and left subclavian perfusion by direct cannulation. The right axillary artery perfusion is started before the circulatory arrest in order to avoid the interruption of cerebral perfusion and emboli into the supra-aortic vessels at the direct cannulation.

(RESULTS)
More patients received concomitant surgeries (CABG and valve surgery) in group B (A:19% vs B:48%). Operation time (A:317±71 vs B:315±112 minutes) and cardiac ischemic time (A:117±29 vs B:110±36 minutes) were not significantly different between the groups. Cardiopulmonary bypass time (A:206±51 vs B:179±44 minutes), circulatory arrest time (A:67±23 vs B:46±10 minutes) were significantly shorter in group B. In-hospital mortality were 5.4% in group A and 0% in group B. Stroke rates were 5% in group A and 0% in group B. There was no spinal cord injury in both groups. Intraoperative bleeding was significantly smaller in group B (A:1473±1093 vs B:683±475 ml). Rates of re-exploration for bleeding were 16.2% in group A and 4.3% in group B. When focusing the cases without concomitant surgery (30 patients in group A and 12 patients in group B), operation time (A:295±47 vs B:233±31 minutes) and cardiac ischemic time (A:111±22 vs B:92±16 minutes) were significantly shorter in group B

(CONCLUSIONS)
“Turn-up” technique enables easy and secure distal anastomosis in total arch replacement for distal arch aneurysm. As a consequence, it significantly shortened circulatory arrest time and operation time, and reduced intraoperative bleeding. Exposure of the distal right axillary artery can be easily performed and its perfusion combined with the other supra-aortic vessel perfusion was protective for cerebral circulation.
Blunt Traumatic Thoracic Aortic Injury - Can We Delay Reparative Surgery Safely?


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Objective: Although blunt traumatic thoracic aortic injury (BTTAI) accounts for approximately 1% of trauma admissions, it remains the second leading cause of death from trauma after brain injury. The optimal strategy for the treatment of BTTAI has still been controversial mainly due to the diversity of patient’s conditions and a wide range of concomitant injuries. In our institution, delayed repair strategy has been employed for BTTAI after strict blood pressure control and stabilizing other significant life-threatening injuries whenever possible. This study aims to analyze the surgical outcomes of BTTAI and to evaluate our strategy for this potentially lethal condition.

Methods: Between January 2005 and December 2014, 35 patients with BTTAI were transferred to our tertiary hospital. Of these, 6 had developed cardiopulmonary arrest before any interventions, and 4 had severe brain damages precluding an indication for aortic intervention. The other 4 had a diminutive aneurysm, and subsequently have been followed at our outpatient clinic. The remaining 21 cases underwent surgical interventions either with open surgical or endovascular repair. The mean age was 40.9±22.0 years old (range: 13 - 88), and 6 patients (28.6%) were female. These patients were categorized into 2 subgroups: the patients who underwent emergent or urgent surgical intervention for aortic rupture associated with mediastinal hematoma within 24 hours after arriving to our emergency room (E-group, 6 patients) and the patients who underwent delayed repair (D-group, 15 patients). The characteristics and clinical outcomes were compared between these 2 groups retrospectively.

Results: There were no significant differences in preoperative patient characteristics between the groups in terms of age, sex, mechanism of injury, Injury Severity Score, Revised Trauma Score and Probability of survival. The mean duration prior to delayed surgical repair was 43.6±24.8 days (range: 9 - 94). No aortic rupture was observed during the waiting period. Endovascular repair was applied for 2 in E-group, and 6 in D-group (p=n.s.). ICU stay period was significantly longer in E-group than D-group (11.3±10.4 versus 2.8±1.6, p<0.01). There were no significant differences in intubation and hospitalization period. There was no early mortality in any groups. One late death was observed in E-group who had cerebral infarction due to shock vital before surgery. Excepting this specific case, there were no mortality and no aortic event such as aortic re-operation or endoleak during the mean follow up period of 5.1±3.1 years (range: 0.5 - 9.4).

Conclusions: Delayed repair strategy for BTTA is safe to be applied unless aortic rupture associated with mediastinal hematoma is encountered. Long-term outcomes after the reparative procedures also appear to be favorable irrespective of mode of treatment strategies.
Management of Aortic Root Pathology - Need for Super Centers?

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OBJECTIVE(S)
It has been shown that an inverse association exists between operative volume and postoperative outcomes especially for surgery of the aortic root. Some health services have established aortic centers for treating patients in high volumes in order to improve outcomes. Latest published United Kingdom (UK) results reported a mortality of 8-12%. Due to a lack of “aortic supercenters”, practice across different UK centers is varied. The aim of this study was to assess short and long-term outcomes of a single surgical team in managing patients with aortic root pathology.

METHODS
From 2005 - 2014, 344 patients who underwent elective and urgent aortic root surgery under a single surgical team were identified. Patient demographics, operative details, and post-operative outcomes were collected prospectively. Median age was 59 years (range 18-86) and 74% were men. Procedures performed included composite root replacement (Bentall) with a mechanical valve (101, 29.4%) and biological valve (177, 51.4%), valve preserving root surgery (57, 16.6%), and homograft (9, 2.6%). Forty two (12.2%) patients underwent concomitant coronary artery surgery, mitral valve repair/replacement, surgery for atrial fibrillation and/or aortic arch surgery. All patients were followed up at 6 weeks, 6 months and then annually. Measured outcomes included in-hospital mortality, late mortality, post-operative complications, freedom from re-intervention, and freedom from moderate or severe aortic insufficiency.

RESULTS
Overall operative in-hospital mortality was 1.2% (4 patients). Six (1.7%) patients underwent re-sternotomy for bleeding. There were no peri-operative strokes, and 8 patients (2.3%) required temporary hemofiltration in the post-operative setting. Median length of ICU stay was 1 day (range 1-17 days), with median length of hospital stay at 6 days (range 4-48 days). Bicuspid aortic valve associated with aortopathy was found in 120 (38.2%) patients, and 105 (33.4%) patients had connective tissue disorder on histopathological and genetic analysis. The remaining patients had hypertensive, atherosclerotic aneurysms. Median cross-clamp and bypass times were 93 minutes (range 54-208 minutes) and 112 minutes (range 75-237 minutes) respectively. Overall late survival was 94.8% at 3 years, 93.5% at 5 years, and 91.3% at 10 years, although patients who had a composite bioprosthesis had the lowest late survival (75.8% at 9.5 years). Overall 98% freedom from re-operation at a median follow-up of 5.6 years (range 6 months - 10 years). For the valve-sparing root surgery group, there was a maximum peak gradient 11.7mmHg and freedom from moderate or severe aortic insufficiency of 90.0% at 7 years.

CONCLUSIONS
We have shown improved outcomes in patients with aortic root pathology when a high volume is sustained with regular follow-up. This supports continued incentive in establishing specialist aortic centers in the United Kingdom.
Aortic Central Cannulation in Type B Dissection Repair Through Left Thoracotomy

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OBJECTIVE: Aortic central cannulation in acute type A dissection has been described as an useful technique. In type B dissection, retrograde perfusion possibly brings about complications associated with the narrowed true lumen and/or clot in the false lumen. In such a situation, antegrade distal perfusion via a cannula indwelled in the ascending aorta may play a preventive role.

METHODS: Forty-three patients undergoing graft replacement of the dissected descending and/or thoracoabdominal aorta using deep hypothermic circulatory arrest were enrolled. Twelve patients were operated upon during acute phase. Surgical approach was through a left thoracotomy. The arterial cannula was indwelled in the ascending aorta through the true lumen of distal aortic arch using the Seldinger technique with epiaortic echocardiographic guidance. Additional partial perfusion through a femoral artery was used in earlier patients.

RESULTS: The duration of circulatory arrest, and total perfusion were 33 +/- 7 and 204 +/- 47 minutes, respectively. Malperfusion of the abdominal organ did not occur. Two patients died in hospital (4.7%). Pre-existing bowel necrosis was fatal in one patient. The other died of postoperative pneumonia. Cerebral infarction occurred in 3 acute patients (7.0%) with thrombosed false lumen. Survival at 5 years was 93%.

CONCLUSION: Aortic central cannulation has a certain impact on surgery of the type-B aortic dissection through a left thoracotomy.
Impact of Sarcopenia on the Outcomes of Elective Total Arch Replacement in Octogenarians

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Objective:
Sarcopenia or loss of skeletal muscle mass is an objective measure of frailty associated with functional impairment and disability. The purpose of this study was to identify the cutoff value of sarcopenia and evaluate the impact of sarcopenia on early and late outcomes of elective total arch replacement in octogenarian.

Methods:
Sarcopenia was assessed by a measurement on the psoas muscle area index [PAI, psoas muscle area at the L3 level in computed tomography (CT) (cm²) / body surface area (m²)]. 464 patients between 18 to 39 years old (males, n=358; females, n=106) who underwent CT examination as part of screening of traumatic injury was enrolled as normal control subjects. The cutoff value for sarcopenia was defined as less than two standard deviations (SDs) below the mean PAI value in the normal control patients (males, 6.89 cm²/m²; females, 4.40 cm²/m²). Between October 1999 and July 2015, 373 patients underwent elective total arch replacement in our institution. 78 of 373 patients who were 80 years or older were examined PAI. Excluding 7 patients who could not evaluate PAI, 71 patients was classified into two groups of sarcopenia (group S, n=23) and non-sarcopenia (group N, n=48). We analyzed early and late outcomes in two groups.

Results:
The mean age was 83.0 ± 3.4 (80-93) years in group S and 82.9 ± 2.3 (80-89) years in group N (p=0.882). Five patients in group S (21.8%) and seventeen patients in group N (35.4%) were female (p=0.235). Apart from chronic dissection, there were no significant differences in preoperative characteristics. Hospital mortality was 4.4% (1 patient) in group S and 4.2% (2 patients) in group N (p=0.972), respectively. Hospital stay was similar in group S (S: 27.0 days vs. N: 23.5 days, p=0.403). There were no differences in incidence of postoperative complications in both groups. Mean follow-up was 37.6 ± 33.9 months. 5-year overall survival was significantly poorer in group S (S: 42.1 ± 12.4% vs. N: 92.9 ± 4.0%, log rank p<0.001). Cox hazard analysis showed that sarcopenia was a significant risk predictor of survival (odds 5.35, 95%CI 1.63-21.0, p=0.005). In addition, patients in group N had relatively better 5-year overall survival compared with whole Japanese people adjusted age and gender (64.8%).

Conclusions:
We established the cutoff value of sarcopenia using PAI of normal control population. Sarcopenia was not a predictor of hospital mortality and postoperative complications following total arch replacement, however sarcopenia had adversely association with long-term survival. Sarcopenia should be recognized as a newly risk predictor of thoracic aortic surgery.
Is Prolonged Unilateral Antegrade Cerebral Perfusion Safe in Acute Type A Aortic Dissection?

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OBJECTIVE. Although unilateral antegrade cerebral perfusion (uniACP) via the right axillary artery minimizes the risk of cannulating the dissected carotid artery, whether prolonged uniACP provides acceptable clinical results during Type A acute aortic dissection (TAAAAD) repair is uncertain. We report our perioperative and long-term results using prolonged uniACP via the right axillary artery, and compare them with another cohort, on which we used femoral artery cannulation with retrograde cerebral perfusion (RCP).

METHODS. We focused on the effect of prolonged cerebral perfusion while retrospectively analyzing 172 patients who had undergone TAAAAD repair between 1995 and 2012: right axillary artery cannulation plus unilateral cerebral perfusion (RAA+uniACP) was used for 111 and femoral artery cannulation plus RCP (FA+RCP) for 61.

RESULTS. Mean age was 58.3 ± 12.8 years; 72.1% were male. Cerebral perfusion time were 77 ± 41 (RAA+uniACP) versus 50 ± 23 (FA+RCP) minutes (p < 0.001). Overall 30-day surgical mortality was 18% (9.9% versus 32.8%, respectively; p < 0.001), but comparable when perfusion lasted under 30 minutes (0% versus 16.7%; p > 0.999). Mortality was significantly lower using RAA+uniACP: 8.3% versus 31.0% (31-60 minutes), p = 0.006; 7.4% versus 44.4% (61-90 minutes), p = 0.024; 15.2% versus 50.0% (> 91 minutes), p = 0.155. (Figure) Postoperative transient neurological dysfunction was 10.6% (RAA+uniACP) versus 3.9% (FA+RCP) (p = 0.221); permanent dysfunction was 7.7% versus 15.7% (p = 0.124). The FA+RCP group had more postoperative reexploration for bleeding, renal failure, wound infection, and sepsis (p < 0.001-0.036). Multivariate risk factor analysis showed that cardiopulmonary bypass time and pre-incision cardiopulmonary cerebral resuscitation and coronary artery involvement predicted mortality, and that RAA+uniACP predicted surgical survival (p < 0.001-0.040). The overall survival rates of surgical patients at 1 and 5 years were (RAA+uniACP versus FA+RCP) 85% versus 55% and 78% versus 50% (p < 0.001). For the patients who survived until they were discharged from the hospital, the survival rates at 1 (98% versus 92%) and 5 (90% versus 82%) years were nonsignificantly (p = 0.451) different.

CONCLUSIONS. RAA+uniACP, but not RCP, offered adequate safe-time for delicate distal reconstruction in TAAAAD, which translated into less postoperative bleeding, renal failure, and infection, and into a lower incidence of surgical mortality, especially when the cerebral perfusion time was longer than 30 minutes. Extended uniACP up to 90 minutes still permitted adequate safety for TAAAAD repair.
The Role of External Suture Annuloplasty in Addition to Aortic Valve Repair with or without Root Replacement

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Objective:
Nowadays the aortic valve is still not preserved frequently for patients with aortic root dilatation and aortic valve regurgitation. Among them, aortic root remodeling technique (remodeling) was performed still in minority. Drawback of remodeling is the lack of annular stabilization, which may be overcome by annuloplasty. We sought to clarify the role of external suture annuloplasty in addition to aortic valve repair with or without root replacement.

Methods:
From December 2013 to April 2015, 37 patients underwent aortic valve repair in our institution (23 isolated valve repair and 14 remodeling). Thirty patients were male and their mean age was 60±14 years. Body height, body weight, and body surface area were 166±10 cm, 67±12kg, and 1.74±0.19m², respectively. Fourteen patients had acute type A aortic dissection and five patients had bicuspid aortic valve. No Marfan's syndrome was present. Nine patients underwent concomitant cardiac procedures. External suture annuloplasty was performed in 22 patients (8 isolated valve repair and 14 remodeling) using single CV-0 suture. In these 22 patients, mean size of prosthesis was 25±1 mm (24 or 26 mm) and mean size of annuloplasty was 22±1 mm (20-24 mm).

Results:
There was no in-hospital mortality. Postoperative course was uneventful in all patients. Mean aortic cross clamp and cardiopulmonary bypass time for elective remodeling were 108±13 min. and 130±14 min., respectively. Both postoperative and follow-up echocardiography showed aortic valve regurgitation less than grade I in all patients except two patients. Postoperative annular size proved to be almost identical as annuloplasty size. One patient developed progressive aortic valve regurgitation from the middle of the fused-cusp due to a tear of the suture hole on the first postoperative day after remodeling. He underwent successful re-repair on the same day. Another patient developed progressive aortic valve regurgitation from the middle of the non-coronary cusp unrelated to the suture line on the first postoperative week after remodeling. He underwent successful aortic valve replacement because he did not want to be repaired again. The cause of failure of these patients was extremely thin cusp tissue. The other patient who underwent remodeling using 26 mm prosthesis, 24mm annuloplasty did not seem enough, so that an annuloplasty suture was removed and annuloplasty was revised to 22 mm, resulting in the good coaptation of the cusps. In two patients who underwent isolated aortic valve repair in addition to mitral valve repair or replacement of the ascending aorta, annuloplasty alone was enough to enhance cusp coaptation without cusp plication procedure.

Conclusions:
External suture annuloplasty seems very simple (not time-consuming), effective, and reproducible to enhance the cusp coaptation in both isolated aortic valve repair and remodeling operation, although long-term follow-up is lacking. Meticulous care should be taken to extremely thin cusp tissue.
Prognostic Impact of Preoperative Cardiac Tamponade in Acute Type A Dissection

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Objective: Acute type A aortic dissection requires emergency surgery and is associated with considerable mortality. The aim of the study was to evaluate prognostic impact of preoperative cardiac tamponade.

Methods: A retrospective cohort study included 33 patients undergoing emergency graft replacement of the ascending aorta or aortic arch for acute type A aortic dissection between October 2013 and March 2015. Replacement was performed with an open distal anastomosis using selective antegrade cerebral perfusion with hypothermic circulatory arrest. We investigated clinical outcome in patients with or without preoperative cardiac tamponade. Cardiac tamponade without palpable pulses were found in six patients (18.2%, group 1). Pericardiocentesis was performed in three, and surgical drainage in three immediately at the emergency department. 27 Patients without cardiac tamponade (81.8%, group 2) included 12 patients having pericardial fluid with palpable pulses and 15 patients without pericardial effusion.

Results: Compared with group 2, group 1 was associated with higher age (75.0 vs 67.6 years old; P<0.05). At presentation, two patients (33.3%) in group 1 and two (7.4%) in group 2 had neurologic dysfunction (P=0.14), and one (3.7%) in group 2 had coronary ischemia. Operative procedures were as follows; ascending aortic replace in four (66.7%) in group 1 vs 25 (92.6%) in Group 2, total aortic arch replace in two (33.3%) in group 1 vs one (3.7%) in group 2, and Bentall operation in one (3.7%) in group 2. Concomitant coronary artery bypass grafting was performed in one (3.7%) in group 2. Operative time and cardiopulmonary bypass time were similar in two groups. All patients in group 1 were survived and discharged uneventfully. Two patients (7.4%) in group 2 died due to multiple organ failure. New postoperative stroke occurred in two patients (7.4%) in group 2. Pulmonary failure (defined as prolonged ventilation>72hours, need for reintubation, or trachotomy) occurred in one (16.7%) in group 1 and eight (29.6%) in group 2. Renal failure requiring hemodialysis occurred in four (14.8%) in group 2. No significant difference was seen in in-hospital mortality or those morbidity.

Conclusions: Preoperative cardiac tamponade without palpable pulses did not increase postoperative mortality or morbidity in the present study. Timely diagnosis, resuscitation by pericardiocentesis or surgical drainage, and immediate surgery are critical to improving survival of type A aortic dissection with preoperative cardiac tamponade.
Remodeling of True Lumen of Aorta after the Use of Fresh Elephant Trunk in Open Surgery for Aortic Dissection

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OBJECTIVE: Hans Borst first introduced elephant trunk in the repair of aortic dissection in 1983. It eliminated the need of distal anastomosis, but was not regularly used due to the difficulty in the insertion of the soft vascular graft into the distal aorta. Recently, the introduction of stent graft regained its popularity in the treatment of aortic dissection (frozen elephant trunk). However, high incidence of stent induced new entry (SINE) was noted. We invented a technique of insertion of soft graft in the aorta (fresh elephant trunk) and would like to know the outcome of the true lumen after surgery.

METHODS: From 2010/11-2014/3, we had used fresh elephant trunks in reconstructive surgeries for aortic dissection in consecutive 78 (27 type A and 51 type B) patients. Segments of aorta replaced by grafts are: ascending aorta + total aortic arch in 19, distal aortic arch in 44, and proximal descending thoracic aorta in 15. The fresh elephant trunks were pulled into the descending thoracic aorta through the aortic opening with a guide wire inserted from the femoral artery (guide-wire pulling technique). A vascular ring was used to fix the proximal end of the elephant trunk to the aorta. We used serial CT scan to calculate the area of the true and false lumens of the aorta at the diaphragmatic level in each patient.

RESULTS: The surgical mortality rate was 2.6% (2/78). There was no need of blood transfusion in 47.3% (37/78) of patients.

The areas of true/false lumens calculated by CT scans (before surgery, 1 year after surgery, 2 years surgery, and 3 years after surgery) are:

(1) Acute dissection: The true lumen increased from 2.6±1.0 to 3.3±1.3, 4.2±1.8, and 4.3±1.9, respectively; and the false lumen decreased from 4.5±1.3 to 4.0±1.2, 1.2±0.5, and 0.2±0.1, respectively.

(2) Chronic dissection: The true lumen increased from 2.2±0.8 to 3.4±1.3, 3.3±1.7, and 3.4±1.9, respectively; and the false lumen decreased from 7.1±2.3 to 6.8±2.1, 4.0±1.1, and 1.8±1.0, respectively.

CONCLUSIONS: We conclude that the true lumens might increase significantly after the use of fresh elephant trunk in the surgical reconstruction for aortic dissection.
Aortic-related versus Non-aortic-related Mortality in Patients with Aortic Intramural Hematoma


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OBJECTIVES
The prognosis of patients with intramural hematoma (IMH) of the aorta beyond the 1st year after diagnosis remains largely unknown. Patient counseling and choice of therapeutic approaches is limited by lack of specific follow-up data and mostly relies on data from other forms of acute aortic syndromes. Aim of the present study was to assess therapeutic approaches and outcome in patients with IMH.

METHODS
Retrospective analysis of 63 consecutive patients initially presenting with IMH that were followed at this institution between 2001 and 2013. Diagnostic criteria for IMH were absence of dissecting membrane, intimal disruption or false lumen flow in presence of a circular or crescent-shaped thickening >5mm of the aortic wall. Patients with PAU were excluded. Patients meeting imaging criteria at the time of first presentation were included even if follow-up imaging showed evidence of intimal disruption or false lumen flow.

RESULTS
Eighteen patients presented with type A and 45 with type B IMH (29% vs. 71%, p<0.0001). Mean age was 71±9.2y, range 42-88y. Mean follow-up was 4.7±3.5y and 100% complete. Patients with type A IMH were more likely to receive any form of intervention compared to patients with type B IMH (89% vs. 60%, p<0.036). Patients with type B IMH were managed with best medical treatment only in 40%. TEVAR was performed in 47% (38% <24h, 43% <2w, 19% >2w but <1y) due to development of an entry tear (57%), progression to acute dissection (24%) or dilation of the aorta (19%). Open repair was performed in 13% (50% <2w, 17% >2w but <1y, 33% >1y) due to dilation of the descending aorta. None of these patients had received TEVAR before. In type A IMH, 89% underwent open repair (78% <24h, 5.5% <2w, 5.5% >2w but <1y). Aortic-related 30d, 6m, 1y and late mortality was 1.6%, 6.3%, 6.3% and 8%, respectively, for all IMH patients. Operative mortality was zero. All-cause 30d, 6m, 1y and late mortality was 1.6%, 6.3%, 6.3% and 29%, respectively, for all IMH patients. Late-mortality in type B IMH after intervention (TEVAR or open repair) or best medical treatment only, was 26% and 22%, respectively (p=1.0). Late-mortality in type B IMH did not differ whether patients underwent TEVAR, open repair or received best medical treatment only.

CONCLUSIONS
Aortic-related mortality in IMH represents less than one-third of the overall mortality after the first year of follow-up. The current data suggests that aortic-related mortality in IMH patients basically only occurs during the 1st after diagnosis and interventions after the 1st year are rarely necessary.
Aortic Root Replacement in Young Patients: Disease Characteristics and Outcomes: A Single Centre Experience over 20 Years

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Introduction - Aortic pathology requiring replacement of the aortic root is uncommon in young adults and may be a group prone to atypical presentation. We studied the disease characteristics and outcome of young adults undergoing aortic root replacement at this institution between 1995 and 2014.

Methods - All the patients less than 40 years of age who underwent aortic root replacement at this institute between January 1995 and December 2014 were retrospectively analyzed. The pre-operative and post-operative data was filled in a preformed proforma.

Results - Total 98 patients underwent aortic root replacement for various indications. Mean age was 32.3±0.7 years. There were 83 males (84.69%) and 15 females (15.3%). Seventy patients (71.42%) had atypical chest pain and 82 (83.67%) had dyspnoea on exertion as their major presenting complaint. Forty-eight (48.97%) of patients had a preoperative diagnosis of either bicuspid or rheumatic aortic valve disease; Most patients had aorto-annular ectasia with 38 patients (38.7%) having aortic dissection. Aortic stenosis was the predominant lesion in forty-two patients (42.85%), combined aortic stenosis and regurgitation in 26 (26.53%) and aortic regurgitation in thirty patients (30.61%). The dissecting flap arose at or near the aortic root in 12 patients (31.57%), the sino-tubular junction in 25 (65.78%) and in one patient it was limited to ascending aorta only. The tear was found in ascending aorta in all the patients and flap was limited to ascending aorta in 17 patients (44.73%) and it was going beyond in 21 patients (55.27%). Eight-seven (88.77%) patients received modified Bentall’s procedure; 10 patients had aortic valve replacement with supra-coronary conduit repair and one patient had only ascending aortic replacement. Only one patient needed coronary artery bypass grafting for flap extending to both coronary arteries origin. Six patients were operated upon with deep hypothermic circulatory arrest with retrograde cerebral perfusion. There were 3(0.6%) in-hospital mortalities. Mean ICU stay was 72.36 hours and mean hospital stay was 8.32 days. Follow up was 82% at mean follow up of 11.68 years after surgery. No patient has required redo surgery. 7 (7.1%) patients needed admission for high INR sometime during their follow-up. No patient suffered stroke and one (1.02%) patient had struck valve that needed thrombolysis.

Conclusion - The clinical presentation of the patients in this group is atypical and disease characteristics are favourable. Modified Bentall’s procedure offers excellent early and late clinical outcomes.
Minimally Invasive Single Stage Repair of Extensive Thoracic Aortic Pathologies: Proof of Concept

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Objectives: Classically, repair of extensive thoracic aortic pathologies including the aortic arch and descending aorta required 2 separate major surgical procedures via full sternotomy and subsequent left lateral thoracotomy. We describe herein our preliminary institutional experience of minimally invasive single stage complete thoracic aortic replacement with Frozen Elephant Trunk technique via partial upper sternotomy (PUS-FET) in twelve consecutive patients.

Methods: Between December 2013 and April 2015, twelve patients underwent PUS-FET during moderate systemic (28°C) hypothermia and selective antegrade cerebral perfusion (ACP) using the E-vita Open® hybrid prosthesis (Jotec GmbH, Hechingen, Germany). Patients mean age was 67±9 years and eight patients were male. The arch vessels were re-implanted en-bloc in all patients. Clinical data were prospectively entered into our institutional database.

Results: The surgical procedure was successful in all patients. Additional David procedure was performed in one patient. There was no perioperative or thirty day mortality. Mean CPB time was 221 ± 39 minutes, and mean myocardial ischemic time accounted for 139 ± 17 minutes. ACP time was 53 ± 9 minutes. Mean ventilation time was 10 ± 7 hours. Mean intensive care unit stay was 3 ± 2 days. Mean chest tube drainage within the first 24 hours was 410 ± 120 mL. One of the twelve patients required re-exploration for bleeding. Median hospital length of stay was 8 ± 3 days. No postoperative permanent neurologic complication occurred. Three Patients experienced a temporary delirium with complete resolution of symptoms prior to discharge from the hospital.

Conclusions: Our preliminary experience suggests that minimally invasive single stage complete thoracic aortic replacement can safely and reproducibly be performed employing the concept of PUS-FET.
Early and Late Outcomes Following Emergent Surgery for Iatrogenic Type A Aortic Dissection

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Objectives: Iatrogenic ascending aortic dissection (iAAD) is a rare but potentially lethal complication of cardiac surgery and cardiac catheterization. Previous clinical outcomes studies have yielded controversial results. The aim of the study is to describe the clinical characteristics of patients with iAAD and to evaluate the early and the late clinical outcomes after emergent surgical treatment.

Methods: From January 2005 to January 2015, 51 patients underwent emergent surgery for iAAD during moderate systemic hypothermia (≥28°C) and selective antegrade cerebral perfusion at two referral cardiac surgery centers in Germany. The patients mean age was 68 ± 11 years and 29 (57%) were men. Isolated ascending aortic replacement, bentall procedure, hemi-arch replacement and total arch replacement were performed in 6 patients (12%), 3 patients (6%), 32 patients (68%) and 10 patients (20%), respectively. Operative data were prospectively entered into our computerized database. Mean late follow up was 4±2 years and was 100 % complete.

Results: Mean cardiopulmonary bypass time was 174 ± 79 minutes and mean myocardial ischemic time was 106 ± 52 minutes. Isolated cerebral perfusion was performed for 41 ± 21 minutes. Mean core temperature amounted to 29,1°C ± 0,9 °C. Unilateral cerebral perfusion was performed in 33 patients (65%), bilateral in 18 patients (35%). Mean intensive care unit stay was 5 ± 6 days. We observed new postoperative permanent neurologic deficits in 4 patients (8%) and transient neurologic deficits in 6 patients (12%). Thirty day mortality was 8% (n=4). Late survival at 5 years was 75 ± 9%.

Conclusions: Operative outcomes after emergent surgery for iAAD are favorable, bearing in mind that all patients present relevant cardiac co-morbidities. Early and mid-term results are comparable to those after spontaneous aortic dissection.
Direct Axillary Artery Cannulation Does Not Increase Stroke or Mortality in Acute Type A Aortic Dissection Repair with Innominate Artery Dissection

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OBJECTIVE
The ideal arterial cannulation strategy in acute type A aortic dissection repair remains controversial. Axillary artery cannulation is commonly used, which permits selective antegrade cerebral perfusion during open distal repair, but the innominate artery is often dissected in acute type A aortic dissection, raising the concern that axillary artery cannulation in this scenario may cause or worsen malperfusion. To date, outcomes for axillary artery cannulation with or without innominate artery dissection in acute type A aortic dissection repair have not been reported. We hypothesized direct axillary artery cannulation was safe and did not increase stroke in acute type A aortic dissection repair with innominate artery dissection.

METHODS
From 5/2005-4/2014, 124 (84%) of 148 consecutive acute type A aortic dissection repairs had direct axillary artery cannulation (84% right, 16% left) with the Edwards axillary perfusion cannula. 116 (94%) patients had an accessible pre-operative CT scan: 44 (38%) with and 77 (62%) without innominate artery dissection. All patients underwent at a minimum an ascending aorta and hemiarch replacement under deep hypothermic circulatory arrest. Five patients had prior cardiac surgery. State-defined postoperative outcomes were assessed.

RESULTS
The innominate dissection group had fewer females (21% vs 40%, p=0.04) and Wheat procedures performed (0% vs 13%, p=0.01), but longer circulatory arrest and cardiopulmonary bypass times during repair. In-hospital mortality, temporary neurological deficit and stroke were similar between the 2 groups, as well as 30-day mortality. Direct axillary artery cannulation was not an independent predictor of in-hospital mortality or stroke.

CONCLUSIONS
Direct axillary artery cannulation is quick, safe and did not increase early stroke or mortality in acute type A aortic dissection repair, including patients with innominate artery dissection. The technique offers the additional advantage of selective antegrade cerebral perfusion in the setting of hypothermic circulatory arrest in total arch replacement for acute type A aortic dissection. Direct axillary artery cannulation should be considered the preferred approach in acute type A aortic dissection repair.
Super-fast Track Management with Extubation in the OR for Total Aortic Arch Replacement

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OBJECTIVES: The aim of this study was to confirm feasibility and effectiveness of superfast track management with extubation in the operating room for elective total aortic arch replacement.

METHODS: We retrospectively reviewed 21 consecutive patients underwent elective total aortic arch replacement via median sternotomy by single surgeon including 2 re-operative cases following ascending aortic replacement for type A acute aortic dissection. Concomitant coronary arterial bypass surgery (CABG) was done in 2 patients and aortic valve replacement (AVR) was in 1. The operative procedure was simply standardized. CPB was started by antegrade fashion. Distal aortic anastomosis was done first by open distal fashion under systemic circulatory arrest at rectal temperature of 28 °C. Then, antegrade systemic circulation was restarted via the side branch of the prosthesis with rewarming of the whole body to 36 °C. After proximal aortic anastomosis, coronary circulation was started and three arch branches’ reconstruction was done under partial CPB condition. Selective antegrade cerebral perfusion was done for cerebral protection until each branch reconstruction was completed. Tracheal tube extubation in the operating room was one of our routine basic strategies. After successful extubation, speech therapist evaluated patient’s laryngeal function in the ICU. Physiotherapists always supported postoperative physical rehabilitation.

RESULTS: The median operation time was 258 (176-550) minutes. The cardiopulmonary bypass time, coronary ischemic time, systemic circulatory arrest time, and selective antegrade cerebral perfusion time were 154 (115-354), 77 (49-188), 40 (30-93), and 104 (77-221) minutes, respectively. Nineteen patients except 2 re-operation cases could be extubated in the operating room safely just after the procedure including combined cases with 2 CABG and 1 AVR. Among these, 18 (95%) patients started dining and 15 (79%) started walking rehabilitation on postoperative day 1 (POD1). Eighteen (95%) of the patients started walking rehabilitation within 2 days. Re-operation cases were extubated in the ICU on POD1 and POD2. Both cases had severe preoperative respiratory failure (FEV1=1L), and moderate valvular heart diseases (mitral valve regurgitation and aortic stenosis), and cerebrovascular diseases. Even they could start walking rehabilitation within 2 days successfully.

CONCLUSIONS: Our superfast track strategy with extubation in the operating room for elective total aortic arch replacement was safely feasible and effective for early postoperative recovery.
Impact of Proximal Anastomosis Failure in Type A Acute Aortic Dissection; Utility of Proximal Stepwise Anastomosis


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OBJECTIVES: Proximal anastomosis is one of the most important operative elements in type A acute aortic dissection. The failure of the proximal anastomosis often leads accidental root surgery. The aim of this study is to investigate the influence of the proximal anastomotic failure to the in-hospital mortality and report the utility of proximal stepwise anastomosis (PSA) to overcome the complications.

METHODS: Between January 2000 and December 2014, 307 (Mean age 67±13 years, 143 male) patients underwent aortic surgery for type A acute aortic dissection. Among the population 27 patients who had cardio-pulmonary arrest on arrival at hospital were excluded for this retrospective review. The PSA has been utilized since June 2011, and it was used in 39 patients. The definition of the accidental root surgery is the status forced to perform unplanned root surgery due to the failure of proximal anastomosis. For the PSA, inverted short segment of Dacron graft was carefully inserted into aortic root, and anastomosed at the level of sino-tubular junction using 4/0 polypropylene running suture with felt strip. Resuspension stay suture for each commissure was routinely performed. The proximal graft was pulled out, and was anastomosed to distal graft using 3/0 polypropylene running suture.

RESULTS: Surgical procedures included hemiarch replacement (n = 156) and total or partial arch replacement (n = 151), and those for proximal reconstruction included modified Bentall procedure or David type root repair (n = 35). Fourteen patients (4%) were forced to undergo accidental root surgery. Operation, cardiopulmonary, ischemic heart and hypothermic circulatory arrest time were 454±186, 241±111, 139±57 and 55±19 minutes, respectively. In-hospital mortality was 4% (12/307). Age>80, preoperative shock state, mulperfusion of visceral arteries and accidental root surgery had significant differences between in-hospital death and hospital survivors. Multivariate analysis demonstrated predictors influenced in-hospital death were Age>80 (P<0.001), and accidental root surgery (P=0.006). Patients with the PSA were free from the accidental root surgery.

CONCLUSIONS:
Accidental root surgery was an independent predictor of in-hospital death. For secure and safe proximal anastomosis to prevent the accidental root surgery, the PSA could be the one of good options.
Surgical Outcomes of Aortic Repair in Young Adult Patients Associated with Smooth Muscle Cell Alpha Actin (ACTA2) Mutations


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Objectives: ACTA2 mutations are one of the major causes of familial thoracic aortic aneurysms and dissections. The aim of this study is to review our clinical results of young patients with aortic disease by smooth muscle cell alpha actin (ACTA2) mutations.

Methods: We reviewed medical records of 359 patients (less than 50 years old) who underwent surgery for thoracic aortic diseases between 2004 and 2014. Eight patients (2.2%) had ACTA2 mutations. Their average age was 34 years (range, 22 to 47) and 2 patients (25.0%) were male. Average body height was 168 cm (range, 162 to 175) and body weight was 66 kg (range, 59 to 70). No patients fulfilled the diagnostic criteria for Marfan syndrome. Preoperative diagnosis included Annulo-aortic ectasia (AAE) (n=1), localized dissection of the sinus of Valsalva with AAE (n=2), acute type B aortic dissection (n=1), and chronic type B aortic dissection (n=4), respectively. Surgical procedures were descending aortic replacement in 3 patients, thoracoabdominal aortic replacement in 1, TEVAR in 1, and valve-sparing aortic root replacement in 3. Seven patients (87.5%) had hypertension. Four patients (50%) had family history of the aortic disease. Histological examinations were available in 7 patients (87.5%). Mean follow-up period was 73 months (range, 6 to 148).

Results: There were no in-hospital and late deaths. Thoracoabdominal aortic replacement was required in 3 patients who had descending replacement for residual chronic type B aortic dissection. A patient who had TEVAR for complicated acute type B aortic dissection showed no problem for 7 years. Histological results revealed cystic medial necrosis (CMN) in patients, and elastin fragmentation in 1.

Conclusions: Surgical outcomes for patients with ACTA2 mutations were satisfactory. Once aortic dissection occurred, however, residual dissection was expanding in the follow-up periods. CMN was a major histological finding and family history of aortic event was detected only in half of the patients with ACTA2 mutations in these settings. In spite of no characteristic physical findings besides hypertension, connective tissue disease should be considered for aortic dissection in young adult patients.