Methods: Clinical and resource data were collected for all patients treated with b/FEVAR at Uppsala University Hospital 2010–2015. Patient records and administrative data were examined to assess health care resources used and material cost. Cost and resources for all adjunctive preparatory procedures (such as access operation, debranching, and staged aortic procedures) as well as for all related post-operative procedures (such as extension and relining of stent grafts) were included in the analysis.

Results: A total of 56 patients were included (19 women), mean age 72 years (range 52–83), average aneurysm size 62 mm (range 36–98). The patients were ASA class 2 (n = 11), 3 (n = 36) and 4 (n = 9). Pre-operative risk factors included cardiac (n = 31), pulmonary (n = 22), cerebrovascular (n = 8), renal disease (n = 5) and previous aortic surgery (n = 17). Aneurysm types were TAAA type I n = 1, II n = 10, III n = 4, IV n = 9, JPRAA n = 32. Treatment was performed with f-EVAR n = 38, b-EVAR n = 12 and f/b-EVAR n = 6. Mortality was 3.6% at 30 days (TAAA 4.2%, JPRAA 3.1%) and 19% at 1 year (TAAA 33.3%, JPRAA 8.3%). Post-operative complications included cardiac event (n = 7), cerebrovascular event (n = 5, 4 permanent), renal impairment (n = 6, 4 permanent), paraplegia (n = 4, 1 permanent), and graft-oclusion (n = 4, 3 symptomatic). Median total hospital-stay (for all procedures) was 26 days (range 2–114) for TAAA and 8 days (2–50) for JPRAA. Median time spent in ICU was 0.9 days (0–42) for TAAA and 0 days (0–43) for JPRAA. Median operating time for the main procedure was 464 minutes (101–1025) for TAAA and 273 minutes (62–677) for JPRAA, and for the adjunctive procedures was 97 minutes (10–734) for TAAA, and 0 minutes (0–1609) for JPRAA. The estimated total cost for hospital stay, intensive care, anaesthesiology, surgeries and materials was 117971 € for TAAA and 63362 € for JPRAA. Average material cost including stent grafts was 34625€ for TAAA, and 23732€ for JPRAA.

Conclusion: Endovascular treatment of complex aortic aneurysms results in acceptable clinical outcome, but is associated with high cost and resource utilisation. Stent grafts and material stand for 1/3 of the treatment cost in these patients.

Long-term Results of Iliofemoral Revascularizations in High-performance Athletes.

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Methods: From 1991 to 2013, 56 women and 435 men (mean age = 34 ± 11 years) were operated on for a symptomatic iliofemoral arterial occlusive disease in a single vascular institution. They were 26 professional athletes, 235 amateur competitors and 230 amateurs. 427 were cyclists (87%), 38 were triathletes (8%), 23 were long-distance runners (5%) and 3 were practicing another sport. Bilateral surgery was performed in 43 patients (8.7%). Pain during supra-maximal exercise, limb claudication and sub-acute ischemia were diagnosed in 475 (89%), 47 (9%) and 12 cases (2%) respectively. External iliac artery lesions were the most frequent (428 lesions, 67%). Locations were multiple in 103 cases (19% of procedures). The surgical indications were: a stenotic endofibrosis in 463 cases (87%), a native iliac thrombosis in 37 cases (7%), an unsuccessful endofibrosectomy or bypass performed in another center in 34 cases (6%). The surgical procedure consisted of an endofibrosectomy with patch in 332 cases (62%), a venous calibrated iliofemoral bypass in 202 cases (38%). 10 iliac PTA without stenting, prior to the optimal surgical treatment (average delay of 4.2 months) were performed, with the aim finishing sports season. An antplatelet therapy was prescribed for 6 months or for life. Medical data and duplex-scan follow ups were kept prospectively in a database and analyzed.

Results: A 28 years-old professional patient died three weeks after an endofibrosectomy, of iliac rupture because he retrained too early. A post-operative thrombosis required an iliac thrombectomy in 11 cases. This procedure was associated 1 times with a popliteal thrombectomy. 26 patients were lost to follow up within 3 years. The mean follow up was 15.7 ± 5.7 years. Sport resumption was possible in 97%. The mean delay for athletic recovery was 3.2 ± 1.5 months. Long-term athletic performances were improved at 3, 5 and 7 years, 97%, 95% and 91% respectively. Iliac revascularization, endofibrosectomy and iliofemoral bypass primary actuarial patencies were at 3, 5 and 10 years: 97%, 96%, 94/96%, 94%, 92%/98%, 98% and 95% respectively. Secondary patencies were 100%. No predictive factor of failure was found.

Conclusion: The long-term benefits of iliofemoral revascularizations are good. They validate surgical indications. However, a sports rehabilitation protocol and a strict selection of the indications must be further confirmed.

Mid-term Outcomes of Renal Branches versus Renal Fenestrations for Complex Aneurysm Repair

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Introduction: To investigate renal outcomes following endovascular repair of thoraco-abdominal aneurysms (TAAAs) with renal fenestrated or branched endografts.

Methods: Renal outcomes following TAAA endovascular repair performed with renal branches were collected in 5 European high volume centers and compared with renal outcomes following TAAA endovascular repair performed with renal fenestrations. Renal re-intervention and occlusion rates and freedom from any renal outcome and death were analyzed per-patient and per-target vessel.

Results: 449 patients were included in this retrospective study (235 treated with branched devices (BEVAR) and 214 with fenestrated devices (FEVAR)). 841 renal vessels were analyzed (436 perfused by branches and 411 by fenestrations). Both groups were comparable except for sex, smoking habit and anti-vitamin K treatment. Technical success rate was 98.7% and 99.1% respectively.

The mean follow up was 19.2 months (SD 18.2) after BEVAR and 24.3 months (SD 20.6) after FEVAR. During follow up, renal re-intervention rates were similar in both groups (4.7% vs. 5.2%). The renal occlusion rate was significantly higher following BEVAR (9.4% vs. 2.3%, P = 0.002), and the 2-year freedom for renal occlusion rate was 94.4% (±SE, 92.2%-96.6%) following BEVAR and 98.9% (±SE, 98.1%-99.7%) following FEVAR (P < 0.001). The 2-year survival rate was 73.4% (±SE, 69.8%-77%) and 80.7% (±SE, 77.4%-84%) following BEVAR and FEVAR respectively.

Conclusion: Mid-term renal outcomes following endovascular repair of TAAA are satisfactory. Endograft designs incorporating renal fenestrations rather than renal branches are associated with significantly improved mid-term patency rates.

Arch Aneurysm Repair with Branched Endografts

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Introduction: Following the pioneering experience and the initial learning curve, we evaluated the subsequent results in 3 aortic endovascular centers with significant experience (>10 cases) with this new technique.

Methods: Between April 2013 and November 2014, all patients with arch aneurysms >55 mm deemed unfit for open surgery after multidisciplinary evaluation, and treated with 2 inner branches endografts, were included. Inner branches were designed to perfuse the brachiocephalic trunk and the left common carotid artery (LCCA) in all cases. According to reporting standards, technical success, endoleaks, procedure length, fluoroscopy duration and contrast volume injected, early and late complications and mortality were retrospectively collected in a unique electronic database.

Results: Twenty-seven patients were included and treated for arch aneurysms (70%) or chronic dissections (30%). Technical success was always achieved. No patients died during the 30 day post-operative period. Early
neurologic events included 2 major and one minor stroke (11%). Transient spinal cord ischemia with full recovery was observed in 2 patients (7%). One myocardial infarction required medical treatment (4%) and 2 renal function impairment (7%) were depicted. Early (<30 day) re-interventions (11%) were performed to treat one access complication, one left ventricle false aneurysm suspicion and one limb ischemia. During follow up (median 12 months), 1 patient (4%) died from a remote TAAA rupture. Two type 2 (7%) and one type 3 endoleaks (4%) were depicted. During follow up, 2 (7%) re-interventions were performed to treat the type 3 endoleak and a septic aortic false aneurysm.

**Conclusion:** The outcomes associated with this new technique are favourable when the procedure is performed in experienced centres. Branched endografting of arch aneurysms should be considered in patients unfit for open surgery.

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**Long-term Survival after TEVAR depends on Indication for Surgery, and is Shorter than Expected after Ruptured Thoracic Aneurysm**

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**Introduction:** Thoracic endovascular aortic repair (TEVAR) is used in treatment of type B aortic dissections and descending aortic aneurysms increasingly often. TEVAR is associated with lower peri-operative mortality when compared to open surgery in retrospective studies. We assessed long-term survival after TEVAR depending on diagnosis.

**Methods:** All patients who underwent TEVAR for type B aortic dissection or thoracic aortic aneurysm at Upsala University Hospital between December 1999 and December 2013 were included. Traumatic aortic transections, thoraco-abdominal- and mycotic aneurysms, as well as type A dissections were not included. Patient characteristics and survival data were collected from medical records. 30 day survival was analyzed with chi² and 5 year survival was estimated with Kaplan-Meier. Age-adjusted survival was estimated with a Cox regression analysis.

**Results:** Of the 250 patients who underwent TEVAR, 190 were included (excluded: traumatic transections n = 17; thoraco-abdominal hybrid procedures n = 20, mycotic aneurysms n = 5, type A dissections n = 8, others n = 10). Diagnosis distribution was acute type B aortic dissection (ABAD) n = 63; chronic type B aortic dissection (CBAD) n = 45; intact aneurysm (ITAA) n = 57 and ruptured aneurysm (rTAA) n = 25. Mean follow up was 49 months. Mean age of the patients was ABAD 66.5 years; CBAD 61.9; ITAA 71.6; rTAA 74.5 (p < 0.001). The male to female ratio was ABAD 41:22; CBAD 34:11; ITAA 34:23; rTAA 12:13 (p = 0.132). 30 day survival was ABAD 92.1%; CBAD 95.6%; ITAA 96.5%; rTAA 72.0% (p = 0.002). 5 year survival was ABAD 79.2%; CBAD 79.6%; ITAA 66.0%; no patient with 5 year follow up after rTAA was alive, and 3 year survival was 30.8%, see attached figure (Log-Rank p < 0.001). In a Cox regression analysis of mid-term survival for patients who survived the initial 30 day peri-operative period, age-adjusted hazard ratio for death was 5.7 after rTAA compared to the other diagnoses.

**Conclusion:** Long-term survival after TEVAR was adequate for patients with type B aortic dissection and intact aortic aneurysm. Considering the poor long-term survival after TEVAR for ruptured aortic aneurysm, it may be necessary to be more selective when deciding which of these patients benefit from active treatment.

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**Renal Dysfunction following Thoraco-abdominal Aortic Surgery: Occurrence and Long-Term Mortality**


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**Introduction:** Renal failure is a significant source of morbidity and mortality in patients who require thoraco-abdominal (TAA) aortic repair. We reviewed our 25 year experience with open descending thoracic and thoraco-abdominal repair to identify risk factors for and potential therapeutc targets to prevent renal failure.

**Methods:** We performed 1896 operations in 1795 patients. The majority of cases were performed using cerebrospinal fluid drainage and distal aortic perfusion, and visceral perfusion was used selectively in patients with repairs that involved the origins of the celiac, superior mesenteric and renal arteries. Renal failure was defined as new-onset renal insufficiency postoperative in patients without existing chronic renal disease, and included an increase in post-op creatinine >1 mg/dl/day over the first two post-op days, an absolute creatinine >4 mg/dl or need for dialysis. Multivariable statistics were used to assess pre-and intra-operative risk factors for renal dysfunction, and the effect of renal morbidity on long-term survival was evaluated by Kaplan-Meier analysis.

**Results:** Mean population age was 64.2 +/- 13.9, and 669/1795 (37%) patients were female. Renal dysfunction occurred after 488/1896 (25.7%) operations. Multivariable pre-operative predictors of post-operative renal failure were patient age (OR 1.03/yr, p < 0.0001), TAA extent 1 (OR 2.02, p < 0.0001), TAA2 (OR 5.9, p < 0.0001), TAA3 (OR 4.2, p < 0.0001), TAA4 (OR 2.9, p < 0.0001), emergency presentation (OR 1.4, p < 0.04) and coronary artery disease (CAD; OR 1.3, p < 0.04). Addition of intra-operative variables identified patient age (OR 1.03/yr, p < 0.0001), aortic dissection (OR 0.62, p < 0.002), involvement of the aortic segment containing the visceral vessel origins (OR 1.5, p < 0.005), COPD (OR 1.3, p < 0.02), aortic cross clamp time (OR1.02/min, p < 0.0001), and PRBC use (OR 1.04/unit, p < 0.0001). Visceral perfusion was associated with modestly increased risk (OR 1.3, p < 0.04) among patients with aneurysm extents (TAA 1, 2, and 4) involving the visceral vessels. Incidence of renal dysfunction has risen gradually over time. Long-term survival is strongly influenced by post-operative renal failure (Figure, p < 0.0001).

**Conclusion:** New-onset renal dysfunction is common after thoraco-abdominal aortic surgery, and is strongly associated with reduced long-term survival. Renal protection strategies are urgently needed, and treatments that can reduce the effects of ischemic time and transfusion are likely intervention targets.

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**Acute Endovascular Repair of Ruptured Thoraco-abdominal Aneurysms with Branched Stentgrafts**

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**Introduction:** Endovascular repair of thoraco-abdominal aneurysms with branched stent grafts (bEVAR) has shown promising results in the elective situation. Off the shelf devices have been introduced recently allowing endovascular treatment of TAAA in the acute setting, including rupture (rTAAA). However, very little is known about acute bEVAR for the treatment of rTAAA. Our aim is to report the results of acute bEVAR in patients with rTAAA.

**Methods:** A retrospective review of patients undergoing acute bEVAR between 2008 and April 2015 in a single centre with large experience of the elective procedures. Stent grafts used consisted mostly of off the shelf endograft with 4 caudally oriented branches. Spinal drainage use was decided depending on the emergency character of the operation. Values are presented as median and range when not stated otherwise.

**Results:** 10 patients, (5 males, 64 (34–77) years old) underwent bEVAR during the study period. TAAA had a median pre-operative diameter of 70 (57–90) mm and the anatomy according to Crawford was: 2 type I, 4 type II, 3 type III and 1 type IV. Median operative time was 436 (245–785) minutes. Endovascular conduit had to be used in 2 patients. Six patients had all 4 visceral arteries incorporated in the repair while 2 and 1 patient had 3 and 2 arteries, respectively. One patient died intra-operatively before the branches could be extended, making the immediate technical success 90% (n = 9). Two more patients died within 30 days post bEVAR (30 day mortality of 30%). Four of the nine patients surviving bEVAR (44%) developed signs of post-operative spinal cord ischemia. Three of the patients recovered completely while one developing the symptoms 4 days after bEVAR remained paraplegic. The 7 patients surviving more than 30 days were followed-up for 13 (1–38) months). During this period only one patient died of unrelated causes. During the CT follow up (median of 13 (1–38) months) no aneurysms expanded. One patient underwent an arch repair 9 months post-