

# Long-term survival and reintervention following thoracic endovascular aortic repair in blunt traumatic thoracic aortic injury: A systematic review and meta-analysis

Aya Hammad<sup>1</sup>, Matti Jubouri<sup>1</sup>, Abdelaziz O. Surkhi<sup>2</sup>, Mohamad Bashir<sup>3</sup>

<sup>1</sup>University of York, York

<sup>2</sup>Faculty of Medicine, Al-Quds University, Jerusalem, Palestine

<sup>3</sup>Velindre University NHS Trust, Cardiff

## Background

Blunt thoracic aortic injury (BTAI) represents one of the most devastating scenarios of vascular trauma. Different management strategies are available with varying clinical outcomes. However, thoracic endovascular aortic repair (TEVAR) has become the first-line option for most BTAI patients, mainly owing to its minimally invasive nature, yielding improved immediate results. This meta-analysis aims to investigate mortality, long-term survival, and reintervention following TEVAR in BTAI.

## Method

A systematic review conducted a comprehensive literature search on multiple electronic databases using strict search terms. Twenty-seven studies met the set inclusion/exclusion criteria. A proportional meta-analysis of extracted data was conducted using the Comprehensive Meta-Analysis Software v.4.

## Results

1498 BTAI patients who underwent TEVAR were included. Using the SVS grading system, 2.6% of the population had Grade 1 injuries, 13.6% Grade 2, 62.2% Grade 3, 19.6% Grade 4, and 1.9% unspecified. All-cause mortality did not exceed 20% in all studies except one outlier with a 37% mortality rate. Using the random-effects model, the pooled estimate of overall mortality was 12% (95%CI 5.35-8.55%; I<sup>2</sup> = 70.6%). This was 91% (95%CI, 88.6-93.2; I<sup>2</sup> = 30.2%) at 6 months, 90.1% (95%CI, 86.7-92.3; I<sup>2</sup> = 53.6%) at 1-year, 89.2% (95%CI, 85.2-91.8; I<sup>2</sup> = 62.3%) at 2 years, and 88.1% (95%CI, 83.3-90.9; I<sup>2</sup> = 69.6%) at 5 years. Moreover, the pooled estimate of reintervention was 6.4% (95%CI, 0.1-0.49%; I<sup>2</sup> = 81.7%).

## Conclusion

Despite the high morbidity and mortality associated with BTAI, TEVAR has proven to be a safe and effective management strategy with favourable long-term survival and minimal need for reintervention. Nevertheless, diagnosis of BTAI requires a high index of suspicion with appropriate grading and prompt transfer to trauma centres with appropriate TEVAR facilities.

## **The association between social deprivation and survival after ruptured aortic aneurysms in a UK population**

James Budge<sup>1</sup>, Keith Farrell-Dillon<sup>2</sup>, Oliver Rees<sup>2</sup>, Bilal Azhar<sup>1</sup>, Iain Roy<sup>2</sup>, William Selway<sup>2</sup>, Barnaby Farquharson<sup>2</sup>, Aurelien Gueroult<sup>2</sup>, Ian Loftus<sup>2</sup>, Peter Holt<sup>1</sup>

<sup>1</sup>St George's University of London, London

<sup>2</sup>St George's University Hospitals NHS Foundation Trust, London

### **Background**

Social deprivation is associated with presentation of ruptured Abdominal Aortic Aneurysms (rAAA) in USA populations, this association has not been demonstrated in the UK. This study aims to examine the relationship between social deprivation and survival of rAAA in the UK.

### **Method**

All ruptured aortic aneurysms from a tertiary teaching hospital from 2015 to 2019 were identified. Demographics, operative or palliative management, 30-day mortality, Harborview rAAA mortality risk score domains (Age at presentation, pH, lowest systolic blood pressure and creatinine; 4 domains), and patient's social deprivation (Index of Multiple Deprivation) was retrospectively collected. Logistic regression was performed to test the association between social deprivation and mortality. Chi-squared testing was utilised to examine the association between Harborview rAAA mortality risk score and social deprivation.

### **Results**

214 patients were identified, median age 79, 75.7% male, and mortality rate of 57%. 91 (42.5%) patients were palliated, 65 (30.4%) underwent EVAR, 21 (9.8%) TEVAR, 12 (5.6%) complex EVAR and 25 (11.7%) redo repair. The mortality rate in the EVAR group was 29.2%, 9.5% for TEVAR, 16.7% for complex EVAR, 32% for redo cases, and 100% those palliated.

Social deprivation was significantly associated with in-patient mortality ( $p=0.026$ ), with greater deprivation being associated with higher mortality rates. A difference was found between levels of deprivation and presenting Harborview rAAA mortality risk score ( $p=0.001$ ).

### **Conclusion**

Increased social deprivation is strongly correlated with risk of in-patient death in this study. Social deprivation is also associated with severity of presentation as measured by Harborview rAAA mortality risk score.

# **Multimodality approach to the repair of chronic post-dissection thoracic and thoracoabdominal aortic aneurysms**

Katarzyna Powezka, Maciej Juszcak, Massimo Vezzosi, Martin Claridge, Paul Clift, Eshan Senanayake, Jorge Mascaro, Donald J. Adam

University Hospitals of Birmingham NHS FT, Birmingham

## **Background**

A multi-disciplinary approach offering open surgical (OSR) and endovascular repair (EVAR) is essential for the management of chronic post-dissection descending thoracic (DTA) and thoracoabdominal aortic aneurysms (TAAA). This study reports the early and mid-term outcomes in a United Kingdom aortic centre.

## **Method**

Retrospective study of patients treated between January 2010 and December 2022. Low risk patients were offered OSR, and EVAR employed in anatomically suitable higher risk patients. Primary endpoint was 30-day/in-hospital mortality. Secondary endpoint was Kaplan-Meier estimates of mid-term survival.

## **Results**

130 patients with residual DeBakey I (n=47) and DeBakey III (n=83) aneurysms underwent repair (OSR 84, EVAR 46; 87 elective, 43 non-elective) with a 30-day mortality of 6.2% (n=8; elective 5.7%, non-elective 7%). 30-day mortality after OSR was 8.3% [elective 9.6% (5/52), non-elective 6.3% (2/32)] and after EVAR was 2.2% [elective 0% (0/35), non-elective 9.1% (1/11)]. Estimated survival (SE) at 5 years for the entire cohort was 74.0% (4.0%) and was significantly better after OSR [82.9% (4.2%) vs. EVAR 56.3% (8.0%); OR 0.32 (0.17;0.61);  $p<.001$ ] but was not related to DeBakey type [OR 0.93 (0.48;1.80);  $p=.83$ ] or acuity of presentation [OR 1.09 (0.56;2.13);  $p=.8$ ]. The 5-year freedom from re-intervention was 66.3% (4.6%). There was no significant difference related to treatment modality [OR0.58 (0.3;1.1); $p=.09$ ], DeBakey type [OR1.3 (0.69;2.46);  $p=.42$ ] or presentation [OR0.99 (0.52;1.89);  $p=.97$ ].

## **Conclusion**

A multi-disciplinary approach offering OSR and EVAR can deliver good early and mid-term outcomes. OSR is associated with improved mid-term survival. There was no difference between treatment modalities regarding late re-intervention rates.

## **Long-term outcomes of Fenestrated Endovascular Repair (FEVAR): a GLOBALSTAR registry study, preliminary results**

Aurélien Guérout<sup>1</sup>, BSET Committee<sup>2</sup>, GLOBALSTAR Collaborators<sup>3</sup>

<sup>1</sup>St George's Vascular Institute, London

<sup>2</sup>BSET, London

<sup>3</sup>Globalstar, London

### **Background**

GLOBALSTAR is a registry of 1229 complex EVAR (UK, 2003-2022); it represents a largest mature dataset for FEVAR. The aims of this study are to report long-term outcomes for survival and freedom from re-intervention for FEVAR.

### **Methods**

For this study of GLOBALSTAR, inclusion criteria were: all aneurysm morphologies, custom-made FEVAR. Exclusion criteria were: dissection, other complex EVAR techniques (BEVAR, ChEVAR). Time-to-event analyses were conducted for survival and freedom from re-intervention. A cox proportional hazards model was applied to survival for all pre-operative variables. A 10% Pocock threshold was applied to determine data maturity.

### **Results**

757 patients were included in this analysis from 6 different centres. Median age was 75.4 years [69.2-79.7 IQR] and 88.0% patients were male. This population had significant co-morbidities including 42.9% ischaemic heart disease. Data maturity reached 10 years and estimated survival [n= 757] at 3, 5 and 10 years were 82.3% [79.6-85.1%, 95% CI], 66.4% [63.0-70.0%] and 36.0% [31.8-40.9%]. Median survival was 7.1 years. Data maturity reached 8 years and estimated freedom from re-intervention [n= 564] at 3, 5 and 8 years were 80.3% [76.8-83.9%], 73.9% [69.8-78.2%] and 68.4% [63.3-74.0%]. Mean time to reintervention was 3.9 years. Cox proportional hazards analysis demonstrated a significant increase in risk of mortality of 90% for octogenarians [1.4-2.5, 95% CI, p< 0.0001] and 3.2% per 10 units of creatinine [1.01-1.05, 95% CI, p< 0.01].

### **Conclusion**

These preliminary results demonstrate study feasibility and its potential impact on understanding of long-term outcomes and durability of FEVAR.

## **Stent Migration following EVAR: predicting migration in contemporary practice**

Ammar Adel Abdullah<sup>1</sup>, Lydia Hanna<sup>1</sup>, Ahmed Bakr<sup>2</sup>, Asif Mahmood<sup>2</sup>, Celia Riga<sup>1</sup>, Colin Bicknell<sup>1</sup>

<sup>1</sup>Imperial College London, London

<sup>2</sup>University Coventry Hospital, Coventry

### **Background**

Significant heterogeneity in the published definitions of stent-graft (SG) migration following EVAR, the failure in addressing all its contributing factors and in predicting subsequent SG migration, following intervention, warrants a standardised and more representative definition, with subsequent analysis of contemporary practice.

### **Method**

A retrospective review of infrarenal EVAR's from two vascular tertiary referral centres from 2008-2018, was undertaken. Patient baseline demographics, anatomical measurements, procedural details and subsequent radiological and clinical follow up and aortic reinterventions were recorded. 5mm of caudal displacement of any part of the proximal SG, was categorised as radiological significant migration (RSM) and those migrating >10mm or migrating with a loss of proximal seal were recorded as clinically significant migration (CSM).

### **Results**

20.7% (48/232) were found to have RSM and 14.7% (34/232) CSM, over a median follow up of 66 months (18-120months). Pre-operative predictive factors for CSM were AAA size (61.2 vs 66.7, p=0.021), Aortic diameter 5 and 10mm below the lowest renal artery (24.4 vs 27mm p=0.000), post-operative endo-leak (15 vs 38%, p=0.00) and degree of SG tilt (11vs17°, p=0.035). Sub-analysis of migratory patterns found that cases found to migrate at least 5mm within 18 months post-intervention were more likely to have CSM, (Positive-Predictive-Value 81.5%, Negative-Predictive Value 94.1%).

### **Conclusion**

SG migration is a long-term complication which persists, despite advancements in technology, adherence to IFU, and patient selection. Predictive risk factors are in-keeping with previous literature. However, these long long-term complications may be identified early with the employment of a CT angiogram, 18 months post intervention.

## **Unstented coeliac axis in custom-made 4-vessel FEVAR is safe and durable**

Anisha Perera<sup>1</sup>, James Budge<sup>2</sup>, Aurelien Gueroult<sup>1</sup>, Iain Roy<sup>1</sup>, Bilal Azhar<sup>2</sup>, Ian Loftus<sup>1</sup>, Peter Holt<sup>2</sup>

<sup>1</sup>St George's Vascular Institute, London

<sup>2</sup>St George's, University of London, London

### **Background**

In fenestrated endovascular grafts for juxta-renal and thoraco-abdominal aortic aneurysm repair, covered stents to the visceral vessels provide continuity between graft and target vessel to maintain perfusion and prevent endoleak. This study explores the need to routinely stent the coeliac axis in 4-vessel FEVAR.

### **Method**

A retrospective review of all 4-vessel FEVAR performed at our institution was conducted. Kaplan-Meier analyses were performed and outcomes between stented and unstented coeliac axis groups were compared. Radiation dose, as measured by dose area product, was compared between the groups using Mann-Whitney U test.

### **Results**

117 4-vessel FEVAR (98 male, median age 74 years, range 41-87 years) were performed between December 2008 and November 2022. A custom-made Cook Zenith® Fenestrated endovascular graft was used in all cases, with balloon-expandable covered stents to the visceral vessels. Median follow up was 2.47 years, range 0-11 years. 25 patients had a stented coeliac axis, and 92 patients an unstented coeliac fenestration. There was no significant difference between the two groups for intra-operative total radiation dose ( $p=0.39$ ), and Kaplan-Meier event analysis for target vessel patency ( $p=0.44$ ), coeliac patency ( $p=0.23$ ), endoleak detection ( $p=0.49$ ), any reintervention ( $p=0.09$ ), stable sac size ( $p=0.09$ ) and all-cause mortality ( $p=0.17$ ). There was only one type 2 endoleak from an unstented coeliac axis, which did not require reintervention.

### **Conclusion**

It is both safe and durable to leave the coeliac axis unstented in 4-vessel FEVAR, which may reduce case complexity, with no increased risk of visceral vessel occlusion, endoleak, reintervention, sac expansion or mortality.