

# Thoracic Endovascular Stent Graft Removal is Associated with Favorable Short and Long-Term Outcomes

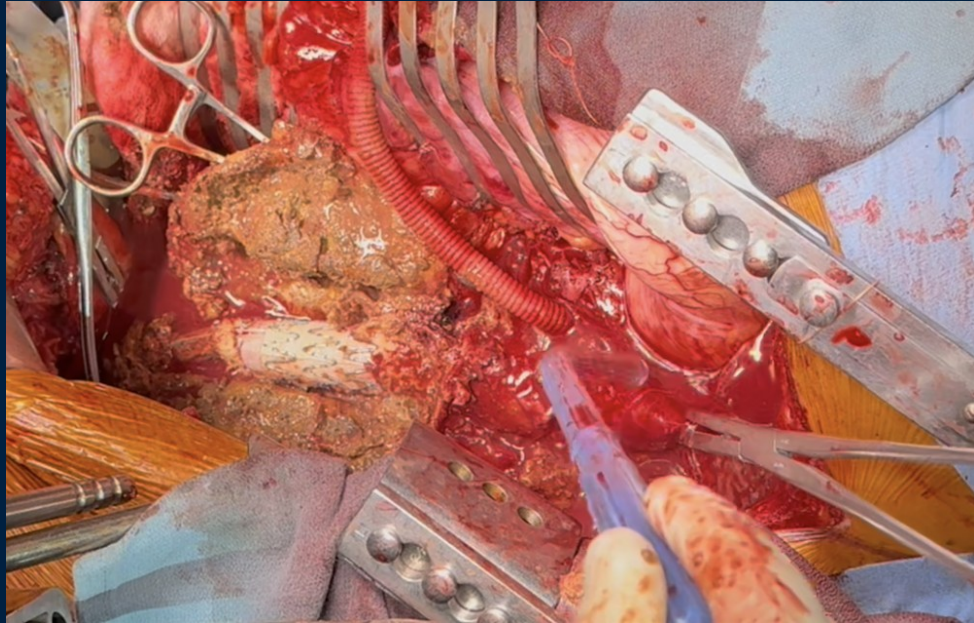


Yuliya Voloshyn, Eimaan Singh Shergill, Maja Grubisic, Farhad Udwardia, Joel Price, Jason Faulds, Jong Moo Kim, Michael Janusz

Division of Vascular Surgery  
Division of Cardiac Surgery  
University of British Columbia  
Vancouver, Canada

# Disclosures

The authors have no conflicts of interest to disclose



TEVAR explant (permission for photograph obtained)

# Introduction

- **University of British Columbia**
  - 4000 km north-south distance
  - 500000 mi<sup>2</sup>
- **Multidisciplinary aortic program**
- **25 – 30 open descending/thoracoabdominal aortic cases per year and about 30-40 TEVARs**



# Background

Open descending thoracic aortic replacement (ODTAR) is feasible with acceptable morbidity & mortality



However, TEVAR removal (either for stent failure or infection) is thought to increase operative complexity and may be associated with poor outcomes

Study goal: Compare outcomes of ODTAR with vs without TEVAR explant to quantify additional risks associated with TEVAR removal

# Methods

Retrospective single-centre review comparing ODTAR with and without TEVAR removal



## Study population:

- All patients undergoing ODTAR from 2008-2023
- Divided patients into two groups: TEVAR removal cohort and Other Indication cohort

## Data collected

- Demographics, comorbidities, diagnosis, operative details, outcomes
- Binary variables were evaluated with Chi-square test or Fisher's exact test
- Continuous variables were evaluated using Wilcoxon rank-sum test

# Results

Between 2008 and 2023, 156 patients underwent ODTAR

- 13 TEVAR explants
- 143 other indication

## TEVAR removal:

- Younger
- Less hypertension
- Prior aortic surgery
- Other comorbidities similar

Table 1: Baseline demographic features

	TEVAR Removal Cohort N=13 n(%)	Descending Thoracic Cohort N = 143 n(%)	p-value
Sex (Male)	9 (69.2)	102 (71.3)	0.99
Age, median (Q <sub>1</sub> , Q <sub>3</sub> )	54.0 (38.0, 63.0)	62.0 (47.0, 69.0)	0.10*
Peripheral Arterial Disease	0 (0)	8 (5.59)	0.99
Hypertension	6 (46.2)	112 (78.3)	0.02*
Dyslipidemia	3 (23.1)	47 (32.9)	0.55
Diabetes	0 (0)	15 (10.5)	0.62
Previous Stroke	2 (15.4)	19 (13.3)	0.69
Congestive Heart Failure	0 (0)	2 (1.4)	0.99
Active Smoker	3 (23.1)	23 (16.1)	0.46
COPD	1 (7.7)	24 (16.8)	0.69
Renal failure on dialysis	0	0	-
Previous Abdominal Aortic Surgery	1 (7.7)	9 (6.3)	0.59
Previous Thoracic Aortic Surgery	11 (84.6)	58 (40.6)	0.003*

# Operative Characteristics

Table 2: Operative Details

	TEVAR Removal Cohort N=13 n(%)	Descending Thoracic Cohort N=143 n(%)	p-value
Elective Surgery	11 (84.6)	115 (81.0)	0.99
Urgent/Emergent Surgery	2 (15.4)	11 (7.8)	0.30
Infection	3 (23.1)	11 (7.7)	0.10
Zone of proximal anastomosis median (Q <sub>1</sub> , Q <sub>3</sub> )	3.0 (3.0, 3.0)	3.0 (3.0, 3.0)	0.46
Zone of distal anastomosis median (Q <sub>1</sub> , Q <sub>3</sub> )	4.0 (4.0, 4.0)	4.0 (4.0, 4.0)	0.69
Intra-operative RBC, median (Q <sub>1</sub> , Q <sub>3</sub> )	4.0 (0.5, 7.0) <sup>1</sup>	3.0 (1.0, 5.0) <sup>2</sup>	0.67
Post-operative RBC, median (Q <sub>1</sub> , Q <sub>3</sub> )	1.5 (1.0, 3.0) <sup>1</sup>	0.0 (0.0, 2.0) <sup>2</sup>	0.046 *
Total RBC, median (Q <sub>1</sub> , Q <sub>3</sub> )	5.5 (1.5, 5.5) <sup>1</sup>	4.0 (2.0, 6.0) <sup>2</sup>	0.49
Intercostals re-implanted	0 (0)	10 (7.6)	0.61
Operative time, median (Q <sub>1</sub> , Q <sub>3</sub> )	323.0 (315.5, 425.0)	320.0 (261.5, 373.0)	0.32
Spinal drain	7 (63.6)	105 (78.4)	0.27
Days intubated, median (Q <sub>1</sub> , Q <sub>3</sub> )	1.0 (1.0, 2.0)	1.0 (1.0, 1.0)	0.20
Left heart bypass (LHB)	9 (69.2)	106 (74.1)	0.74
VA-ECMO	2 (15.4)	27 (18.9)	0.99
Circulatory arrest	2 (15.4)	9 (6.3)	0.23

<sup>1</sup> 1 missing; <sup>2</sup> 12 missing



# Postoperative Outcomes

Table 3: Post-operative results

	TEVAR Removal Cohort N=13 n(%)	Descending Thoracic Cohort N=143 n(%)	p-value
Length of stay, median (Q <sub>1</sub> , Q <sub>3</sub> )	7.0 (7.0, 22.0)	10.0 (7.0, 15.0)	0.47
In hospital mortality	0 (0.0)	5 (3.5)	0.99
Long-term mortality	1 (7.7)	34 (23.8)	0.30
Stroke (combine anterior and posterior stroke to 1)	0 (0.0)	7 (4.9)	0.99
Paraplegia	0 (0.0)	2 (1.4)	0.99
Re-operation	1 (7.7)	16 (11.3)	0.99
Unplanned re-operation	1 (7.7)	8 (5.6)	0.56
Composite*	2 (15.4)	53 (37.1)	0.14

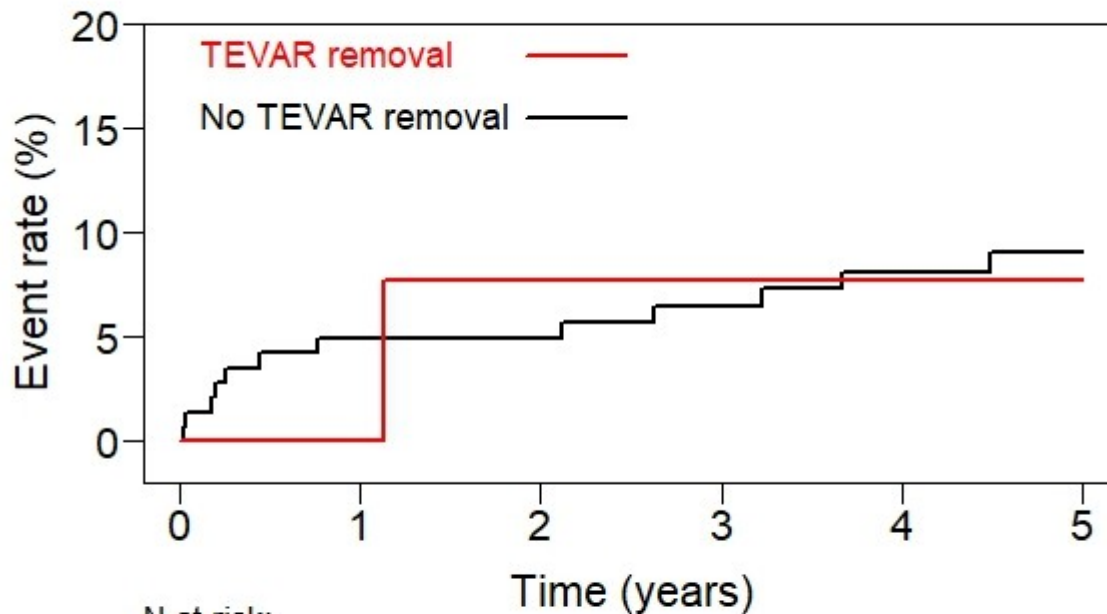
\* Composite outcome consists of in-hospital mortality or long-term mortality or stroke or paraplegia or re-operation or unplanned re-operation



# Predictors of Adverse Outcomes

Predictor	Odds Ratio (95% CI)	p-value
PAD	5.23 (1.28, 29.27)	0.04
Age (unit=10 years)	1.41 (1.11, 1.83)	0.0066
Days Intubated	1.38 (1.14, 1.77)	0.0035
Length of Stay (days)	1.05 (1.02, 1.08)	0.0044
Emergent Surgery	3.47 (1.25, 10.34)	0.023
VA ECMO	0.35 (0.12, 0.87)	0.038
Intraoperative RBC	1.14 (1.04, 1.26)	0.0071
Postoperative RBC	1.10 (1.01, 1.21)	0.039
Total RBC	1.10 (1.03, 1.15)	0.0077

# Long-Term Survival



N at risk:

No TEVAR removal  
140      133

117

97

TEVAR removal  
13      13

10

7

# Conclusion

- **TEVAR removal is feasible with low perioperative morbidity and mortality**
  - Low rates of peri-operative complications including stroke and death
  - Comparable operative time and outcomes to standard ODTAR
  - Trend toward better survival in TEVAR removal cohort
  - Challenges: transfusion needs, prior surgical history

