Thoracic endovascular aortic repair in pediatric patients: A national analysis, 2018—2022

Christopher Matsko a, * , Andreina Giron b , Bima J. Hasjim c , Jeffry Nahmias c Andrew Ross Doben d , John Schomberg b , Laura F. Goodman b, c

a Nova Southeastern University, Fort Lauderdale, FL, ; b Rady Children's Hospital of Orange County, Orange, CA,; c University of California, Orange, CA; d Saint Francis Hospital and Medical Center, Hartford, CT

Introduction

Blunt Thoracic Aortic Injuries (BTAI) only represent 0.1 % of trauma cases in children but are responsible for a disproportionate 2.1 % of pediatric trauma deaths, with many being preventable with appropriate and timely intervention [1].

BTAI represents a life-threatening emergency for pediatric patients that requires rapid identification and intervention [1]. The overwhelming majority of BTAIs in the pediatric population (80 %) result from motor vehicle collisions (MVCs), and most patients that sustain this type of injury (85 %) die at the scene of injury [2]. BTAIs in children are often in the setting of polytrauma, including severe injuries involving the head, torso, and lower extremities [3]. This association with multiple traumatic injuries can be attributed to the mechanism of injury (i.e., MVC), and the amount of force required to inflict injury through a more compliant chest wall, and on a more flexible aorta, compared to adult patients [1,3]. Due to the rarity of this type of injury in pediatric patients, the optimal management approach has yet to be established.

Roughly 75 % of patients who sustain a BTAI and make it to definitive care undergo non-operative management (NOM) with blood pressure/heart rate control (e.g., beta blockade) while the remaining 25 % are managed operatively. The preferred operative management for BTAIs in adults has become Thoracic Endovascular Aortic Repair (TEVAR) since its introduction in 2005, rapidly replacing Open Aortic Repair (OAR) as the standard of care, accounting for over 94 % of all BTAI repairs in patients 18 years or older by 2015 [2]. Despite this overwhelming shift towards endovascular repair in adults, the indications for the use of this approach in pediatric patients remain unclear. TEVAR is currently used off-label in children with multisystem injuries in patients deemed “anatomically suitable” to undergo the procedure [5].

Study Aims

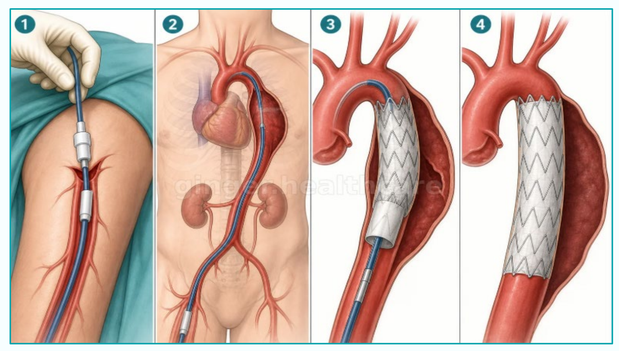
This study investigates pediatric Blunt Thoracic Aortic Injury (BTAI) management and outcomes between Thoracic Endovascular Aortic Repair (TEVAR) and Open Aortic Repair (OAR). We hypothesize that TEVAR yields improved mortality compared to OAR.

Methods

This retrospective study utilized National Trauma Data Bank (NTDB) data (2018—2022) for patients <21 years with BTAI who underwent TEVAR or OAR. Primary endpoints included mortality, hospital and Intensive Care Unit Length of Stay (ICU LOS), discharge disposition, and unplanned Operating Room (OR) visits. Secondary endpoints included clinical and treatment characteristics. Descriptive and bivariate statistics were performed.

Results

Of 1914 pediatric BTAI patients, 520 (27.2 %) underwent operative management; 476 (91.5 %) underwent TEVAR, 44 (8.5 %) underwent OAR. There were no differences in Injury Severity Score (ISS) or Systolic Blood Pressure (SBP) upon arrival (both p > 0.05). OAR patients were younger (17 years [14—19] vs. 19 [17—20], p < 0.001) with more pancreatic injuries (11.3 % vs. 3.15 %, p = 0.02). TEVAR patients had more rib fractures (47.2 % vs. 22.7 %, p = 0.002). There were no differences in mortality (p = 0.63), hospital or ICU LOS (p = 0.56, p = 0.23), or discharge disposition (p = 0.32), but OAR patients had more unplanned OR visits (11.3 % vs. 4.41 %, p < 0.001).



*TEVAR *AI-generated image - for illustration only. Ginger Healthcare, East Delhi, India*

Table 4
Distribution of patient outcomes, complications, and associated injuries by management type.

Characteristic	OAR n = 44	TEVAR n = 476	NOM n = 1394	p-value
Outcome				
Hospital discharge disposition (comparing routine discharge)	22 (50 %)	204 (42.8 %)	215 (15.4 %)	0.32
Patient mortality	4 (9.09 %)	61 (12.8 %)	179 (12.8 %)	0.63
Hemorrhage control surgery type (comparing “none” to all others)	7 (15.9 %)	92 (19.3 %)	231 (16.5 %)	0.15
Length of stay (median, IQR)	11 (8–18)	10 (5–15)	1 (1–6)	0.07
Total ventilator days (median, IQR)	4.5 (2–9.25)	3 (2–8)	2 (1–5)	0.56
ICU Length of stay (median, IQR)	5 (3–12.5)	6 (3–11)	5 (2–11)	0.87
Complication				
Unplanned visit to OR	5 (11.3 %)	21 (4.41 %)	19 (1.36 %)	0.0001
Count of complications other than “unplanned” median (IQR)	0.5 (0–1.75)	1 (1–2)	1 (1–1)	0.17
Injury				
Patient has traumatic brain injury	11 (25 %)	193 (40.5 %)	465 (33.3 %)	0.06
Spleen	11 (25 %)	105 (22.0 %)	196 (14.0 %)	0.79
Liver	12 (27.2 %)	170 (35.7 %)	445 (31.9 %)	0.33
Bladder	2 (4.54 %)	19 (3.99 %)	33 (2.36 %)	1
Kidney	8 (18.1 %)	116 (24.3 %)	214 (15.3 %)	0.46
Pancreas	5 (11.3 %)	15 (3.15 %)	56 (4.01 %)	0.02
Pelvic fracture	3 (6.81 %)	77 (16.1 %)	148 (10.6 %)	0.15
Rib fracture	10 (22.7 %)	225 (47.2 %)	622 (44.6 %)	0.002

Conclusions

TEVAR is increasingly used in pediatric BTAI management, with similar outcomes compared to OAR. OAR patients were younger with more unplanned OR visits. Future research should assess TEVAR's suitability in younger patients and long-term outcomes. Level of Evidence: III.

References

J Pediatr Surg. 2026 Feb;61(2):162767. doi:10.1016/j.jpedsurg.2025.162767. Epub 2025 Oct 27.