TEVAR IN BLUNT THORACIC AORTIC INJURY: PWH EXPERIENCE

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BLUNT THORACIC AORTIC INJURY (BTAI)

Devastating condition usually associated with polytrauma

>80% of patients with BTAI would present death on scene or arrival to hospital.

Reported in 0.5-1% of all trauma patients worldwide

Aortic injury → aortic transection

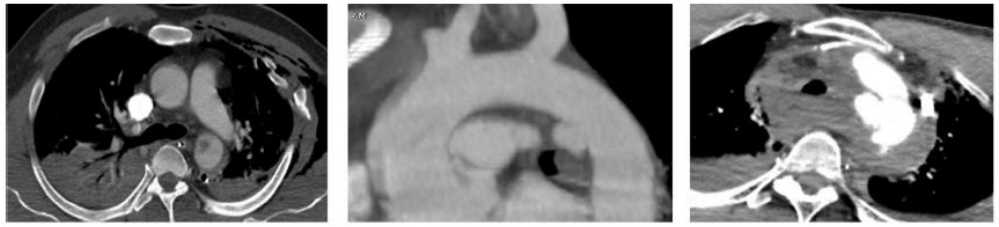
Location: aortic isthmus: 90% ascending aorta: 5% diaphragmatic hiatus: 5%

Open replacement prior TEVAR era was reported operative mortality of ~30-50%

TEVAR brought the operative risk down to within 10%

SOCIETY OF VASCULAR SURGERY GRADING

In 2011, the SVS has established the grading of aortic injury/ transection



MINIMAL	MODERATE	SEVERE
▪ No external contour abnormality ▪ Intimal tear and/or thrombus is <10mm	▪ External contour abnormality or intimal tear >10mm	▪ Active extravasation ▪ LSA hematoma >15mm
NO INTERVENTION	**SEMI-ELECTIVE REPAIR**	**IMMEDIATE REPAIR**
▪ Optional follow-up imaging	▪ Stabilization of concomittant injuries ▪ Impulse control	▪ BAI takes first priority

Fig 2. Harborview blunt aortic injury (*BAI*) classification system.

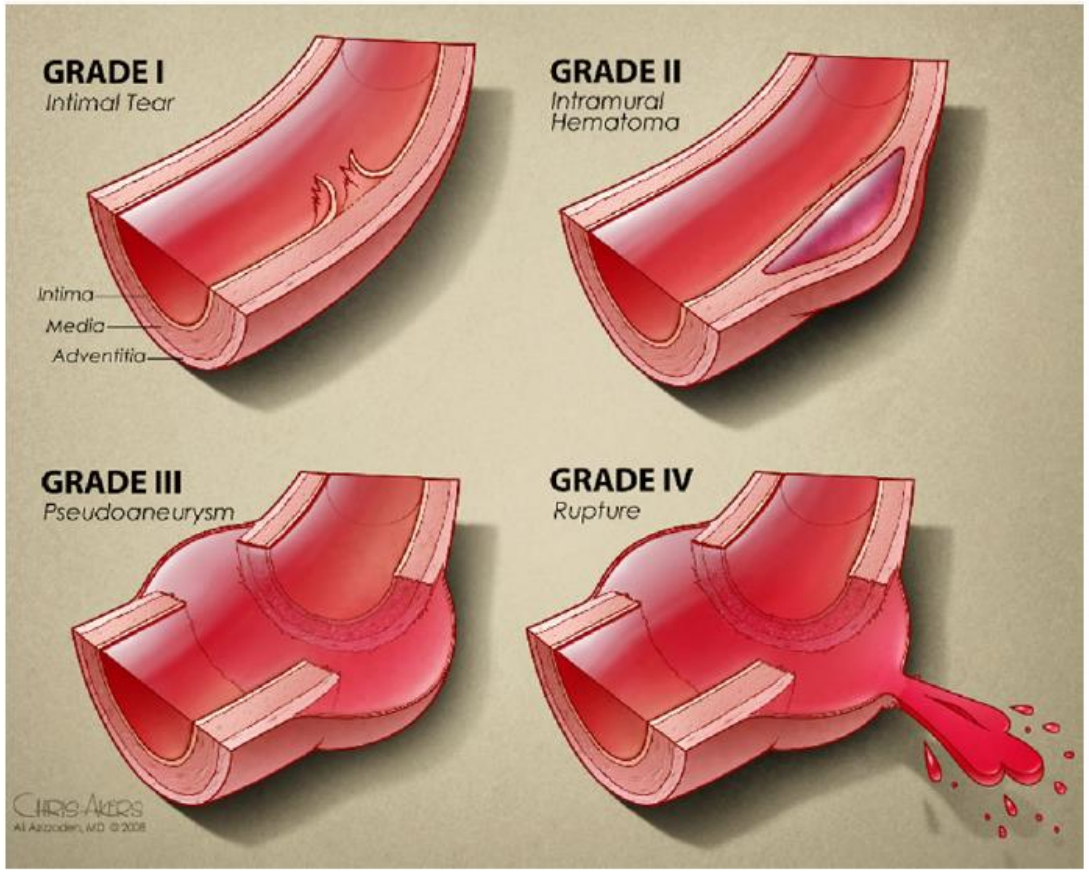


Fig. Classifications of traumatic aortic injury.[12]

SOCIETY OF VASCULAR SURGERY RECOMMENDATION

Table II. Summary of guidelines for thoracic endovascular aortic repair (*TEVAR*) in traumatic thoracic aortic injuries

Guideline	*Consensus*	*Grade of recommendation 1—strong 2—weak*	*Quality of evidence A—high B—moderate C—low or very low*
Choice of treatment	We suggest that endovascular repair be performed preferentially over open surgical repair or nonoperative management.	2	C
Timing of repair	We suggest urgent (<24 hours) repair, and at the latest prior to hospital discharge.	2	C
Management of minimal aortic injury	We suggest expectant management with serial imaging for type I injuries.	2	C
Type of repair in the young patient	We suggest endovascular repair regardless of age if anatomically suitable.	2	C
Management of left subclavian artery	We suggest selective revascularization of the left subclavian artery.	2	C
Systemic heparinization	We suggest routine heparinization but at a lower dose than in elective TEVAR.	2	C
Spinal drainage	We do not suggest routine spinal drainage.	2	C
Choice of anesthesia	We suggest general anesthesia.	2	C
Femoral access technique	We suggest open femoral exposure.	2	C

CONTROVERSIES ON THE WEAK EVIDENCE

Timing of interventions

Concomitant injuries

Open vs endovascular vs Nonoperative management

Heparinisation

Subclavian artery embolization or revascularisation

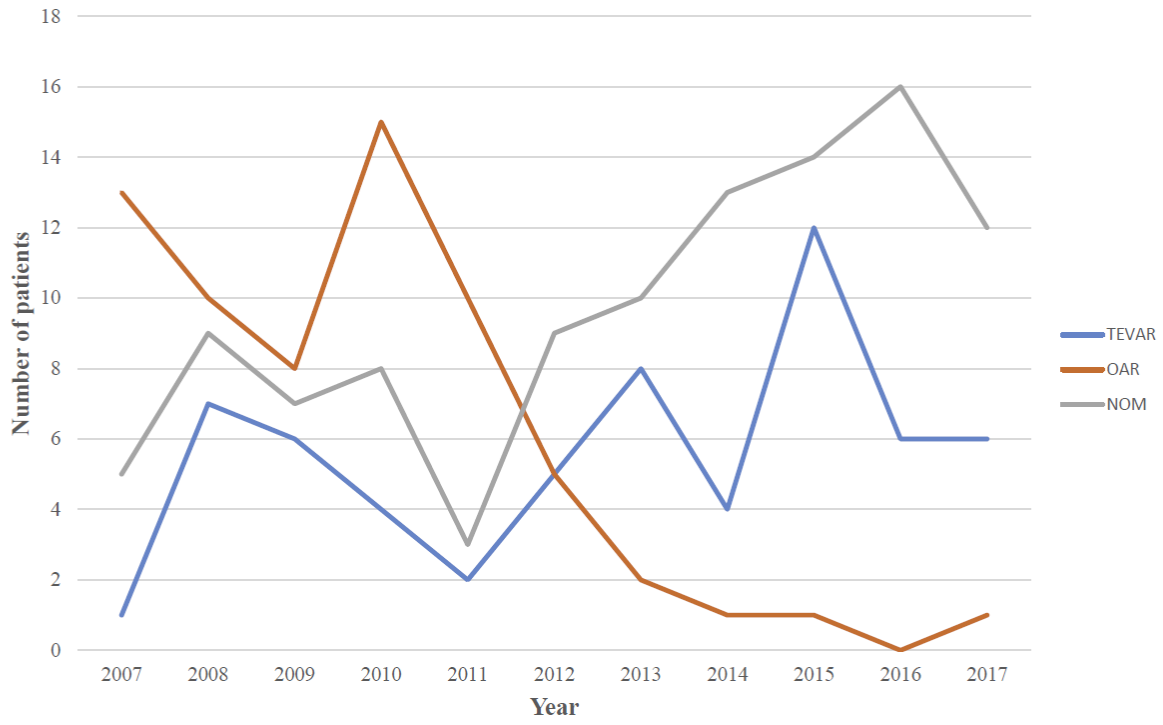
ALTHOUGH WITH THE SEEMINGLY WEAK EVIDENCE

The choice of intervention is inclining towards TEVAR

- Lower mortality and mobidity

229 patients from a center in the US, eleven years outcome

Figure 2. Blunt thoracic aortic injury treatment selection over time: nonoperative management (gray line); open aortic repair (orange line); or thoracic endovascular aortic repair (blue line).



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PWH EXPERIENCE OF TEVAR FOR BTAI

From 2007–2020

COMMON AORTIC INJURY PATHWAY

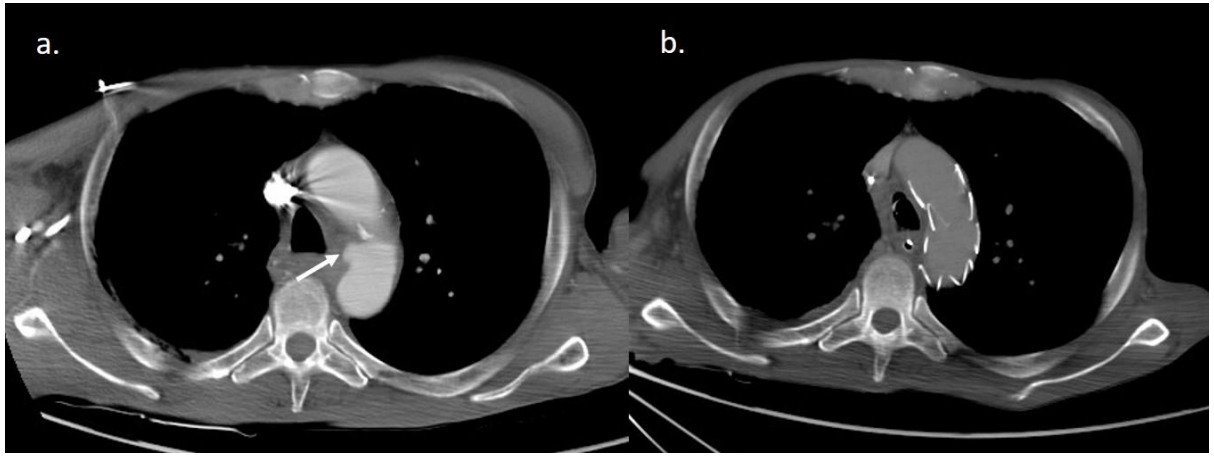
Trauma call activation

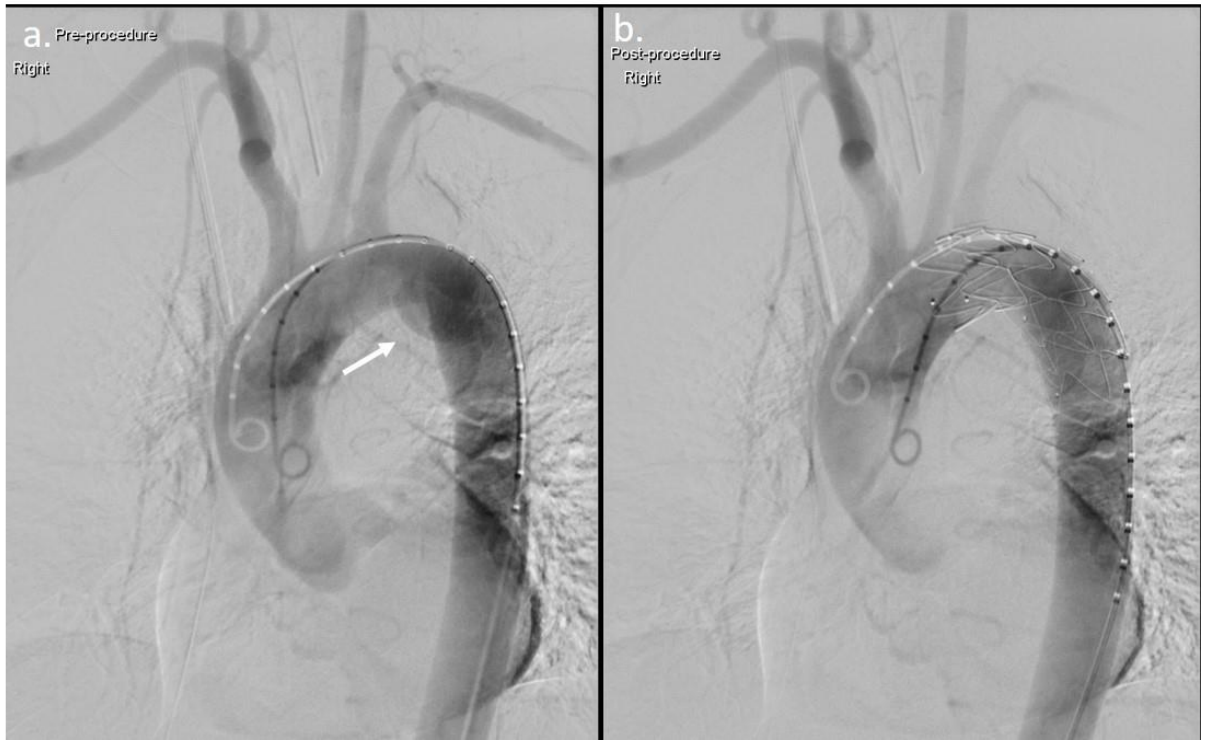
- ATLS protocol
- Stabilisation and CT scan

Diagnosis and management prioritisation within the trauma team

Further resuscitation in ICU

- Proceed EOT when stent available
  - Usually within 1 hour





OUR SETUP

Multidisciplinary approach involving IR colleagues, cardiac anaesthetists

- Hybrid theatre or IR suite, under GA
- Sizing of aortic stent, allowing 10-20% oversizing in the concern of haemorrhagic shock

Bilateral percutaneous femoral access

- Usually stent system via right femoral artery
- Roadmapping via pigtail catheter via left femoral artery

Not for systemic heparinisation

Covering Zone II/III without embolization of the LSA

Deployment with SBP ~ 90mmHg

DEMOGRAPHICS

Between 2007 and 2019, total of 1013 cases of trauma requiring activation of trauma call in the NTEC Trauma Registry.

- Total 29 BTAI patients (3.5%)
- Mostly from RTA
- High Injury Severity Score and New Injury Severity Score
- No isolated aortic injury in our cohort

	Total (n=29)	TEVAR (n=13)	NOM (n=16)	
Age	41.5±18.6	47.3±17	36.1±18.6	P=0.12
Gender (Male)	76%	92%	63%	
Mechanism of injury				
- Fell from heigh	9, 30%	5, 38%	4, 24%	
- RTA	21, 70%	8, 62%	13, 76%	
Grade of injury				
-1	2	0	2	
-2	2	0	1	
-3	20	12	8	
-4	6	1	5	
ISS Score	42±15	39.5±13.1	45.5±15	p=0.27
NISS Score	53.8±13.7	52.1±12.9	57.4±11	P=0.26

OPERATIVE DATA

- First TEVAR for BTAI in PWH was performed in 2007
- Incidence of BTAI diagnosed with TEVAR performed was increasing
- No superiority of graft could be demonstrated worldwide
  - Depends on the availability of graft and experience
  - Opt for a shorter graft to prevent spinal cord injury
- Generally short procedure

Year	Stent used	Size of stent	Length of stent	Landing zone	Procedural time (min)
2007	Cooks Zenith	30	120	2	75
2008	Cooks Zenith TX2 TAA	28	80	3	
2015	Medtronic Valiant	22	100	2	240
2015	Medtronic Valiant	28	100	2	90
2015	Cook Zenith TX2 TAA	32	80	2	90
2016	COOK Alpha	32	152	2	60
2018	COOK alpha	34 -26	159	3	40
2018	Medtronic Valiant Captivia	34	150	2	70
2019	Medtronic Valiant Navion	31	90	2	30
2019	Medtronic Valiant Navion	31	90	3	55
2019	Medtronic Valiant Navion	31	90	2	60
2019	Medtronic Valiant Navion	34	90	2	87
2019	Medtronic Valiant Navion	31	90	2	82
					82±51

CLINICAL OUTCOMES

- TEVAR for BTAI is demonstrating a 100% survival
  - None of the patient had stroke or TEVAR related paraplegia
  - 2 patient (15%) had type II endoleak
  - None required 2nd stage aortic procedure
- In our cohort, Grade 1 and 2 transection are managed conservatively with good outcome
- LOS was expectedly long for the patients are generally with polytrauma

	Total (n=29)	TEVAR (n=13)	NOM (n=16)	
30 Days Survival	67.6%	100%	63.2%	
Survival on Grade				
-1	5, 100%	N.A	5, 100%	
-2	2, 100%	N.A.	2, 100%	
-3	14/16, 87.5%	12, 100%	2/4, 50%	
-4	1/6, 17%	1, 100%	5, 0%	
LOS	33±47	35±38	31±53	p=0.81

CONTROVERSIES/ OUR EXPERIENCE

Timing of interventions

- Earliest possible in Grade 3 to 4 injury

Concomitant injuries

- Benefits of Hybrid theatre for concomitant procedures
  - (Pelvic embolization/ hepatic artery embolization/ ex-fix or other orthopaedics procedures)

Open vs endovascular vs Nonoperative management

- Open is less common in the present era, we have the experience in DsAo replacement with respectable results
- Nonoperative management requires close survillence in Grade 1 to 2 injury

Heparinisation

- Not routinely given, provided the polytrauma status

Subclavian artery embolization or revascularisation

- To shorten the procedure and our experience showed no significant endoleak

DISCUSSION

Adopting the use of TEVAR in BTAI with promising survival

- Similar to world data with favourable outcomes

Aortic injury is not the only injury in BTAI patients

- Polytrauma patients requires multi-disciplinary team approach
  - Most commonly with Orthopaedics and Neurosurgical colleagues

Further follow up to observe late complications from TEVAR and the progression of aortic pathology

ACKNOWLEDGEMENT

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- Aortic MDT and emergency TEVAR arrangements

REFERENCE LIST

JVS (2011) 53: 187–192

JVS (2016) 64: 171–176

JVS (2019) 1–13

EJTES (2019) 45: 951–957

ATS (2020) In press

CONDITIONS FOR NON TEVAR MANAGEMENT

(1) the aorta caliber is too small to safely accept an endograft without significant oversizing;

(2) the patient is aged less than 20 years;

(3) the aortic injury is located in the arch between the left common carotid and subclavian artery.