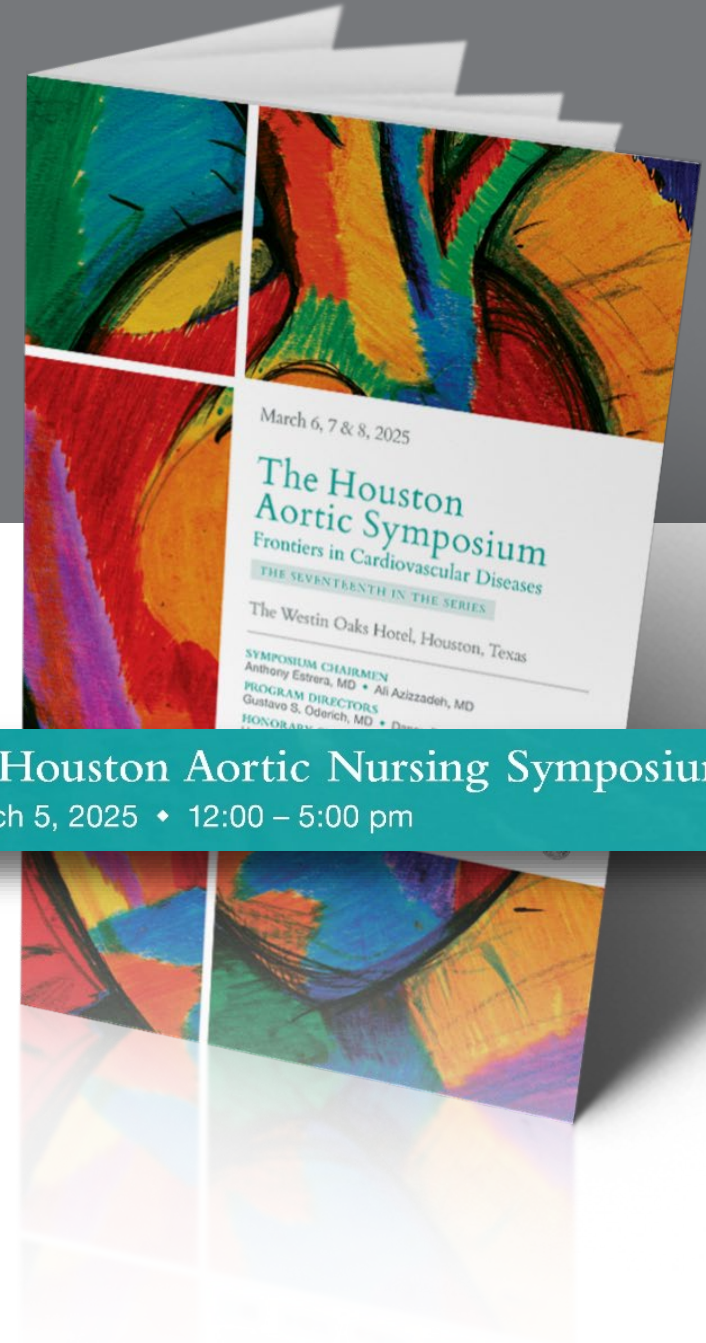


Blunt Traumatic Aortic Injury

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Department of
**Cardiothoracic &
Vascular Surgery** |  **UTHealth Houston**
McGovern Medical School



7th Annual Houston Aortic Nursing Symposium
Wednesday, March 5, 2025 ♦ 12:00 – 5:00 pm

Incidence/Etiology

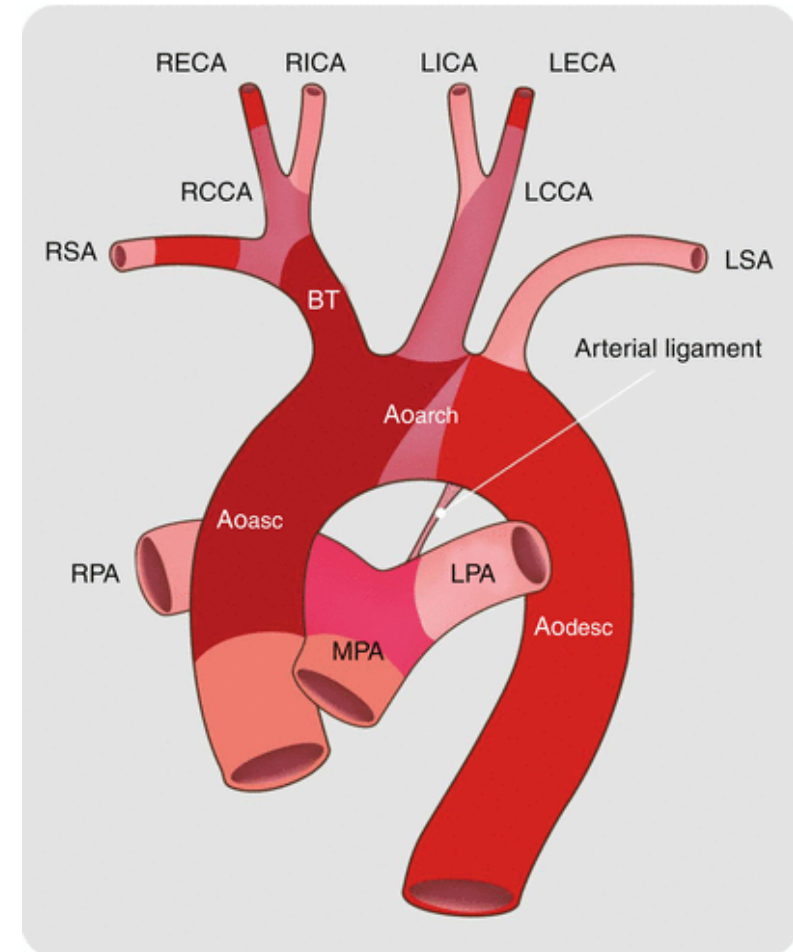


- Blunt thoracic aortic injury
 - Leading cause of death in non-penetrating trauma
 - >80% mortality in prehospital setting
 - MVC (most common), Scooters, Bicycles
 - High energy, rapid deceleration
 - <25% live to hospital evaluation, and of those who do, up to 50% die within 24 hours.
 - ~1% of admitted trauma patients

Anatomy of BTAI

Most injuries occur at the level of the ligamentum arteriosum just distal to the left subclavian artery

The **ligamentum arteriosum** (or arteriosus) is the **small fibrous remnant** of the fetal ductus arteriosum, located between and connecting the proximal left pulmonary artery and the undersurface of the junction of the aortic arch and descending aorta, at the aortic isthmus.



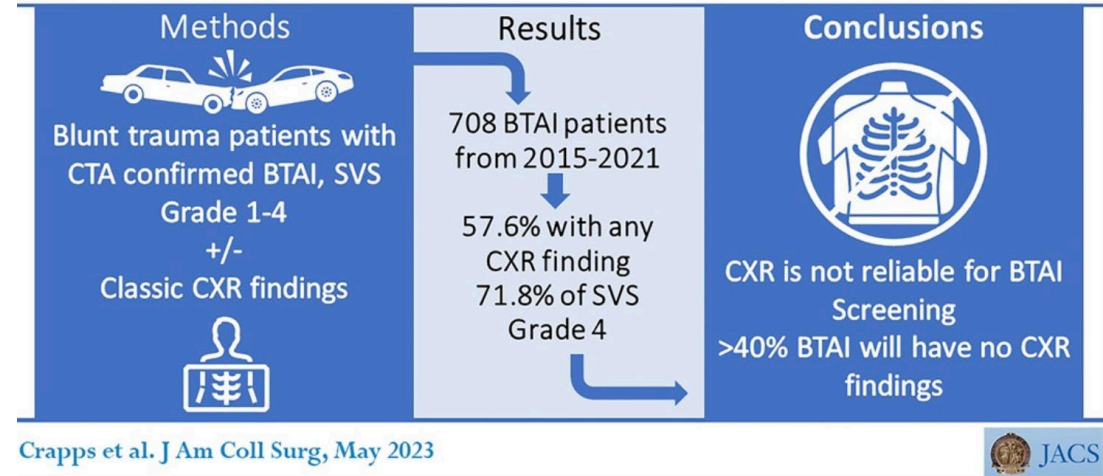
Initial Trauma Assessment

- Primary & secondary survey
 - ABCs
 - CXR, Pelvic XR, FAST
- Instability due to abdominal and/or pelvic hemorrhage managed first
- Hemorrhagic shock
 - Transfusion

Diagnosis- CXR

- Use to be used as a screening tool
- CXR readings reviewed for mediastinal abnormalities
 - Widened mediastinum
 - Mediastinal to chest width ratio
 - Irregular aortic arch
 - Blurred aortic contour
 - Opacification of aortopulmonary window
 - Apical pleural hematoma

Is Chest X-Ray (CXR) a Reliable Screening Tool for Blunt Thoracic Aortic Injury (BTAI)? Results from the American Association for the Surgery of Trauma/Aortic Trauma Foundation Prospective Blunt Thoracic Aortic Injury Registry



	All injuries (N = 708)	Grade 1 (N = 192)	Grade 2 (N = 90)	Grade 3 (N = 348)	Grade 4 (N = 78)
Any CXR finding	57.6%	39.1%	55.6%	65.2%	71.8%
Multiple left-sided rib fractures	35.2%	31.8%	32.2%	38.2%	33.3%
Widened mediastinum	27.7%	7.8%	23.3%	35.3%	47.4%
Left hemothorax	12.4%	2.6%	14.4%	14.7%	24.4%
Clavicular fracture	7.3%	5.2%	6.7%	8.9%	6.4%
Scapular fracture	4.5%	6.3%	1.1%	4.3%	5.1%
Deviated trachea or NG tube	3.4%	0.5%	1.1%	4.9%	6.4%
Sternal fracture	2.3%	2.1%	1.1%	2.0%	5.1%
Apical cap	1.4%	0%	2.2%	2.0%	1.3%
Loss of AP window	0.6%	0.5%	0%	0.9%	0%

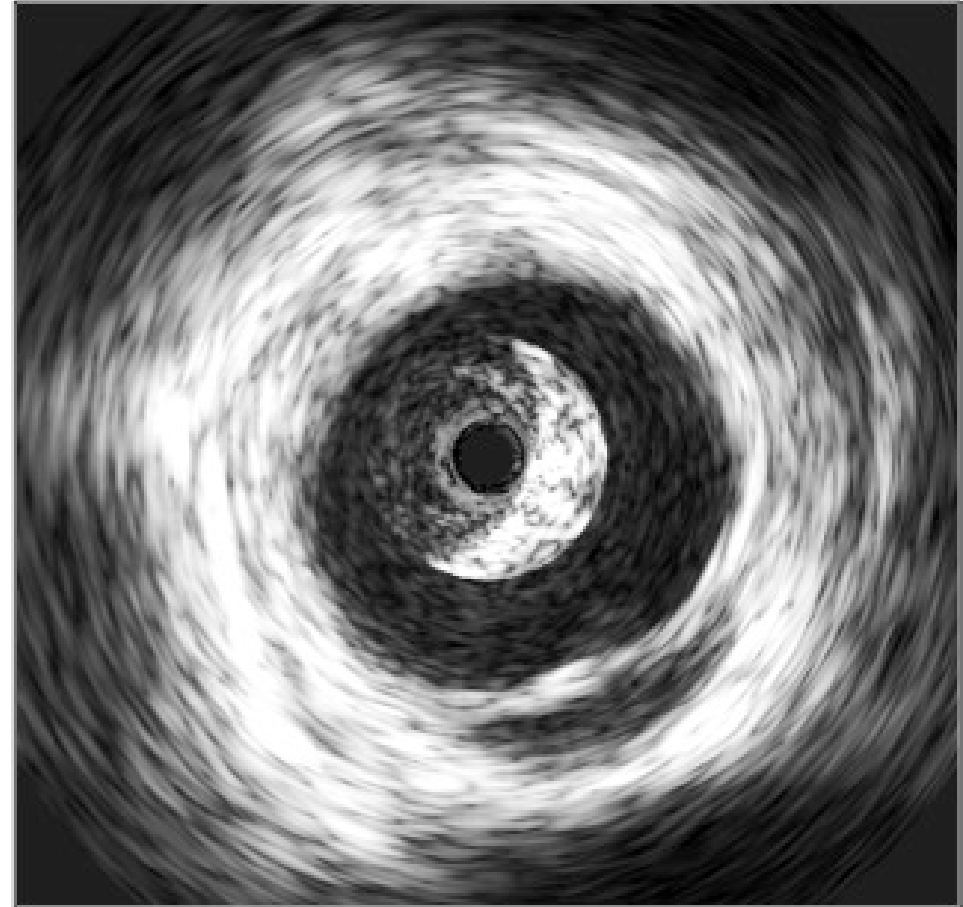
CT/ CT Angiography

- Gold standard for initial diagnosis and characterization
- IV Contrast enhancement paramount
 - Modern “trauma pan scan”



IVUS

- Mitigates contrast risk
- Rarely used as sole modality to facilitate TEVAR
- Good means to assess / confirm diameter after resuscitation for TEVAR device selection



GRADING

SOCIETY FOR VASCULAR SURGERY® DOCUMENTS

Endovascular repair of traumatic thoracic aortic injury: Clinical practice guidelines of the Society for Vascular Surgery

W. Anthony Lee, MD,^a Jon S. Matsumura, MD,^b R. Scott Mitchell, MD,^c Mark A. Farber, MD,^d Roy K. Greenberg, MD,^e Ali Azizzadeh, MD,^f Mohammad Hassan Murad, MD, MPH,^g and Ronald M. Fairman, MD,^h Boca Raton, Fla; Madison, Wisc; Palo Alto, Calif; Chapel Hill, NC; Cleveland, Ohio; Houston, Tex; Rochester, Minn; and Philadelphia, Pa

Initially published in 2011

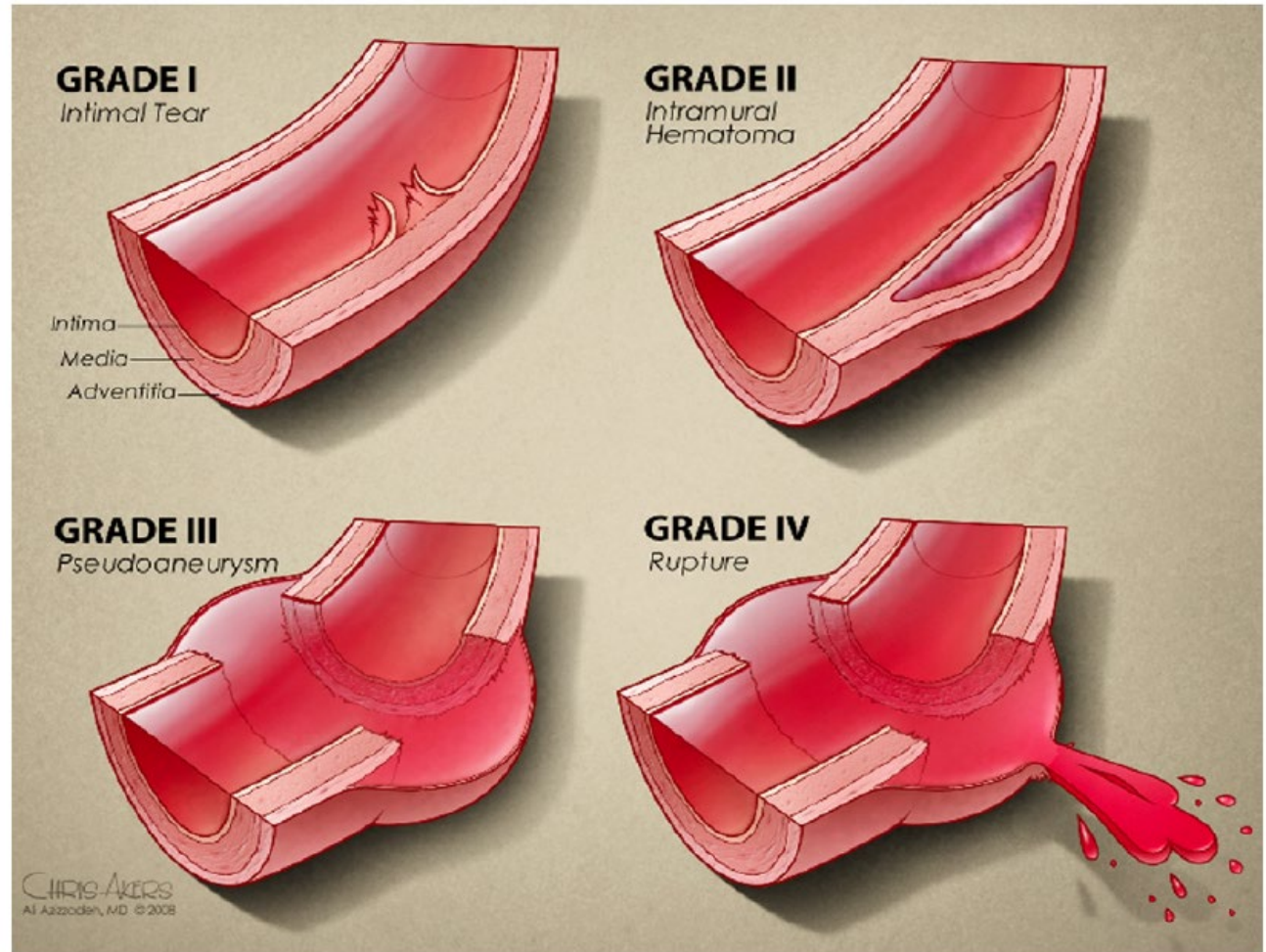
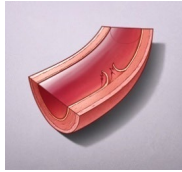


Fig. Classifications of traumatic aortic injury.¹²

Treatment

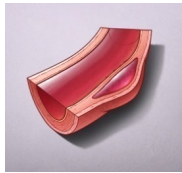
- Medical / Non-Operative Management
- TEVAR
 - Has almost completely replaced open repair



GRADE I



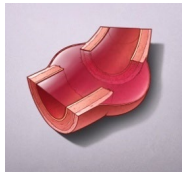
Medical TX



GRADE II
Intramural Hematoma



Medical TX/ TEVAR



GRADE III



TEVAR / OR
Urgent repair



GRADE IV



TEVAR / OR
(Emergent)

Medical Treatment

- Strict BP control with beta blockade and afterload reduction (SBP<120, MAP<80)
 - Esmolol
- Pain management
- Management of associated injuries
 - TBI
 - SCI
 - Injuries affected by heparin administration
- Repeat imaging- monitoring for progression
 - No hard guidelines
 - Based on patient stability
 - 24 hrs - prior to discharge

Medical Management – JVS 2022

- AAST / ATF Registry, 2016-2020
- 432 BTAI patients
- Medical Management in initial period = 57% (245)
- MM as definitive planned therapy = 26% (114)
 - GR1 59.6%; GR2 23.7%; GR3 15.8%; GR4 0.9%

Medical Management – JVS 2022

- Continuous titratable infusion = 49.1%
 - Intermittent bolus = 29.8%
- Beta-blockers most common agents (74.6%)
- Systolic BP goal most common (83.3%)
 - Most often to target of < 120 mm Hg (66.3%)
- Stated goals attained in just 64.0%

Medical Management – JVS 2022

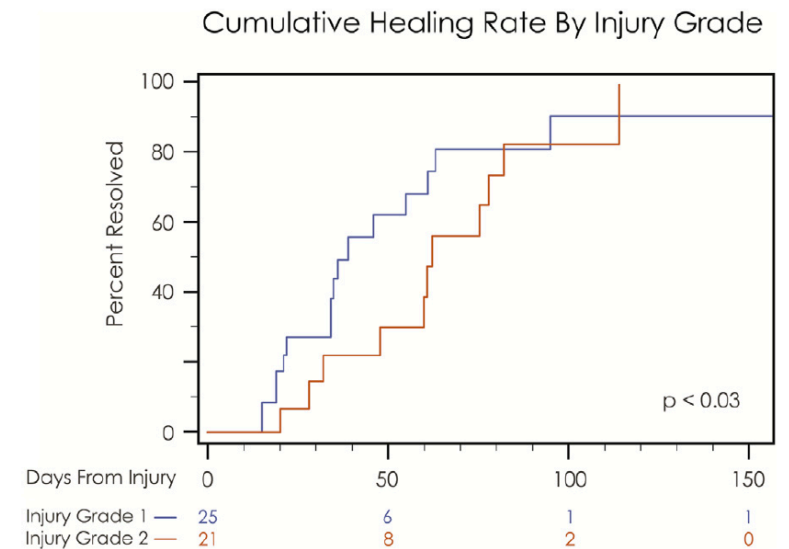
- Patients requiring intervention after selection for definitive medical management = 10.5% (12)
 - TEVAR = 11; Open = 1
- NO aortic-related deaths among patients receiving definitive MM

Determinants and outcomes of nonoperative management for blunt traumatic aortic injuries



Harleen K. Sandhu, MD, MPH,^a Samuel D. Leonard, MS,^a Alexa Perlick, BS,^a Naveed U. Saqib, MD, FACS,^{a,b} Charles C. Miller III, PhD,^a Kristofer M. Charlton-Ouw, MD, FACS,^{a,b} Hazim J. Safi, MD, FACS,^{a,b} and Ali Azizzadeh, MD, FACS,^{a,b} *Houston, Tex*

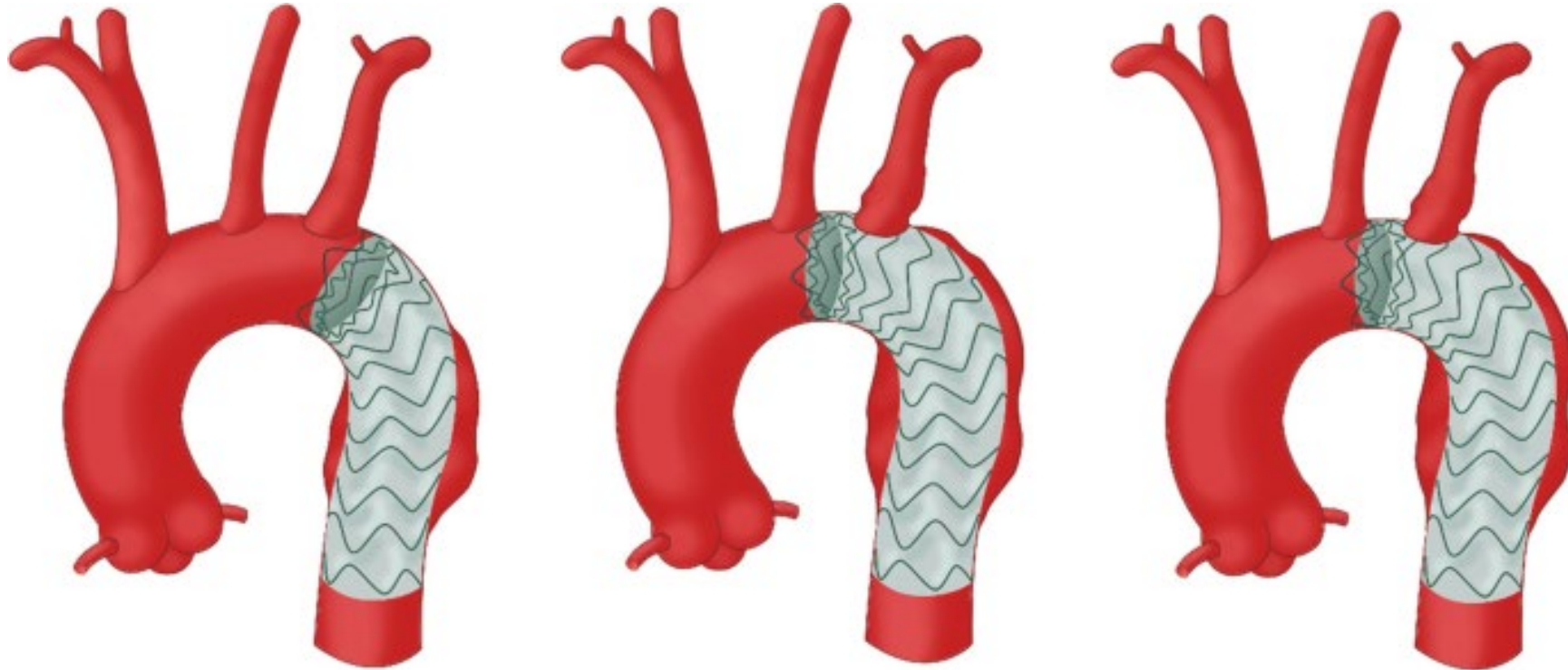
- 48 MAI (SVS G1+G2)
- Resolution of injury (median)
 - Grade 1 = 39 days
 - Grade 2 = 62 days
- Conclusion: Minimal Aortic Injuries may be safely managed medically, with the majority resolving within 8 weeks



Summary - Medical Management

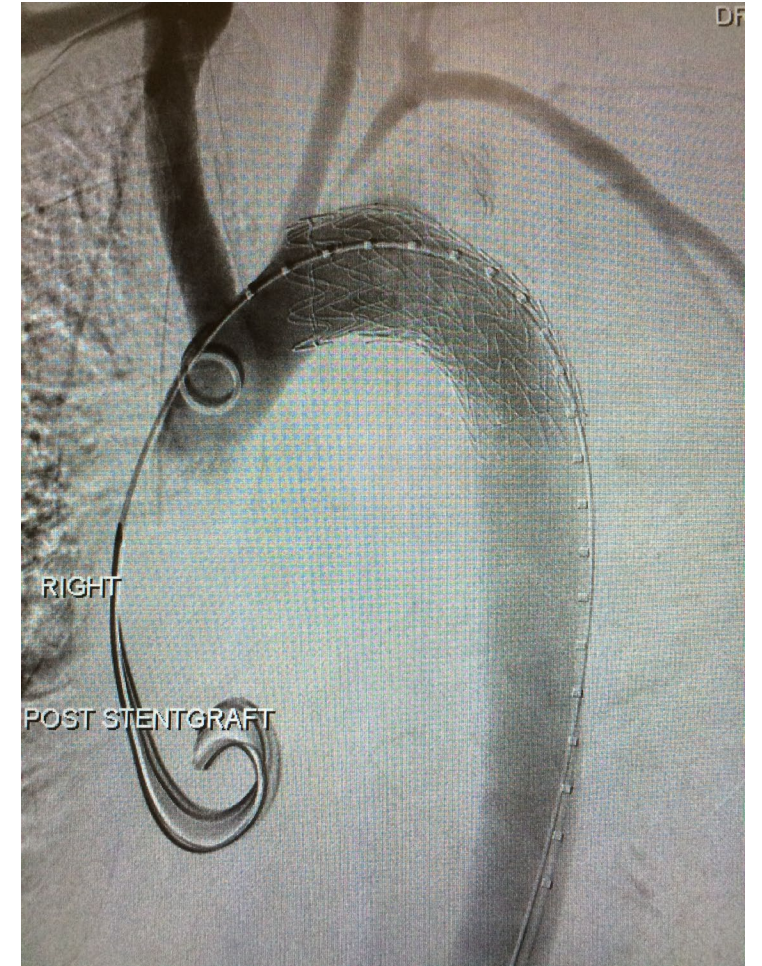
- Probably ideal for all BTAI patients
 - Definitive therapy vs. en route to TEVAR
- Continuous infusion short acting beta blockers most commonly employed in practice
- Most common goal = SBP < 120 mm Hg

Thoracic Endovascular Aortic Repair (TEVAR)



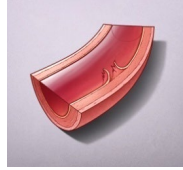
Thoracic Endovascular Aortic Repair (TEVAR)

- FDA approved devices for trauma indications in 2005
- Has now completely replaced open repair



TEVAR Questions?

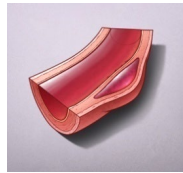
- Timing?
- Minimal aortic injury?
- Associated injuries
 - TBI
 - Solid organ injury
 - SCI



GRADE I



Medical TX

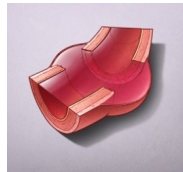


GRADE II

Intramural Hematoma



Medical TX/ TEVAR



GRADE III



TEVAR / OR
Urgent repair



GRADE IV



TEVAR / OR
(Emergent)

Post-Operative Complications in Emergent vs. Non-Emergent Thoracic Endovascular Aortic Repair in Blunt Thoracic Aortic Injuries from the Aortic Trauma Foundation Global Registry

Michelle S. Bach, B.S.,¹ Joseph DuBose, M.D.,² Jessica L. Efird, M.D.,² Lucas M. Ferrer Cardona, M.D.,² Sadia Ali, M.D.,² Simin Golestani, M.D.,² Joshua Crapps, M.D.,² Bonnie Du, M.D.,² James Bradford, B.S.,¹ Carlos V.R. Brown, M.D.,² Jayson Aydelotte, M.D.,² Tatiana Cardenas, M.D.,² Marc Trust, M.D.,² Michelle Robert, M.D.,² Pedro G.R. Teixeira, M.D.²

The University of Texas at Austin Dell Medical School¹ and The University of Texas at Austin Dell Medical School Department of Surgery and Perioperative Care²

- AAST / ATF Registry 2015-2022
- Emergent (< 5hours; N = 203) vs. Non-Emergent (> 5 hours; N = 248)
- Emergent TEVAR associated with:
 - Increased need for post-operative pressors
 - Aortic Re-intervention need after TEVAR
 - Unanticipated return to the OR for BTAI treatment complications
- No other differences in outcomes
 - Suggests that emergent TEVAR is associated with increased adverse outcomes, and non-emergent TEVAR may be more appropriate for most patients

TEVAR Considerations Unique to Trauma

- Trauma patients often present in hemodynamic shock
 - Aorta may be measured smaller than it's true size
 - May lead to under-sizing of the endograft
 - IVUS
- Need adequate landing zone proximal and distal to injury
 - Need adequate vessel access (>7mm diameter iliacs, 18-24Fr sheath)
- L subclavian artery coverage is often needed (40%)
 - Carotid-subclavian bypass may be required
 - CS bypass should always be performed if:
 - LIMA bypass to coronary arteries
 - Dominant left vertebral artery
 - Certain cerebrovascular anatomic variants

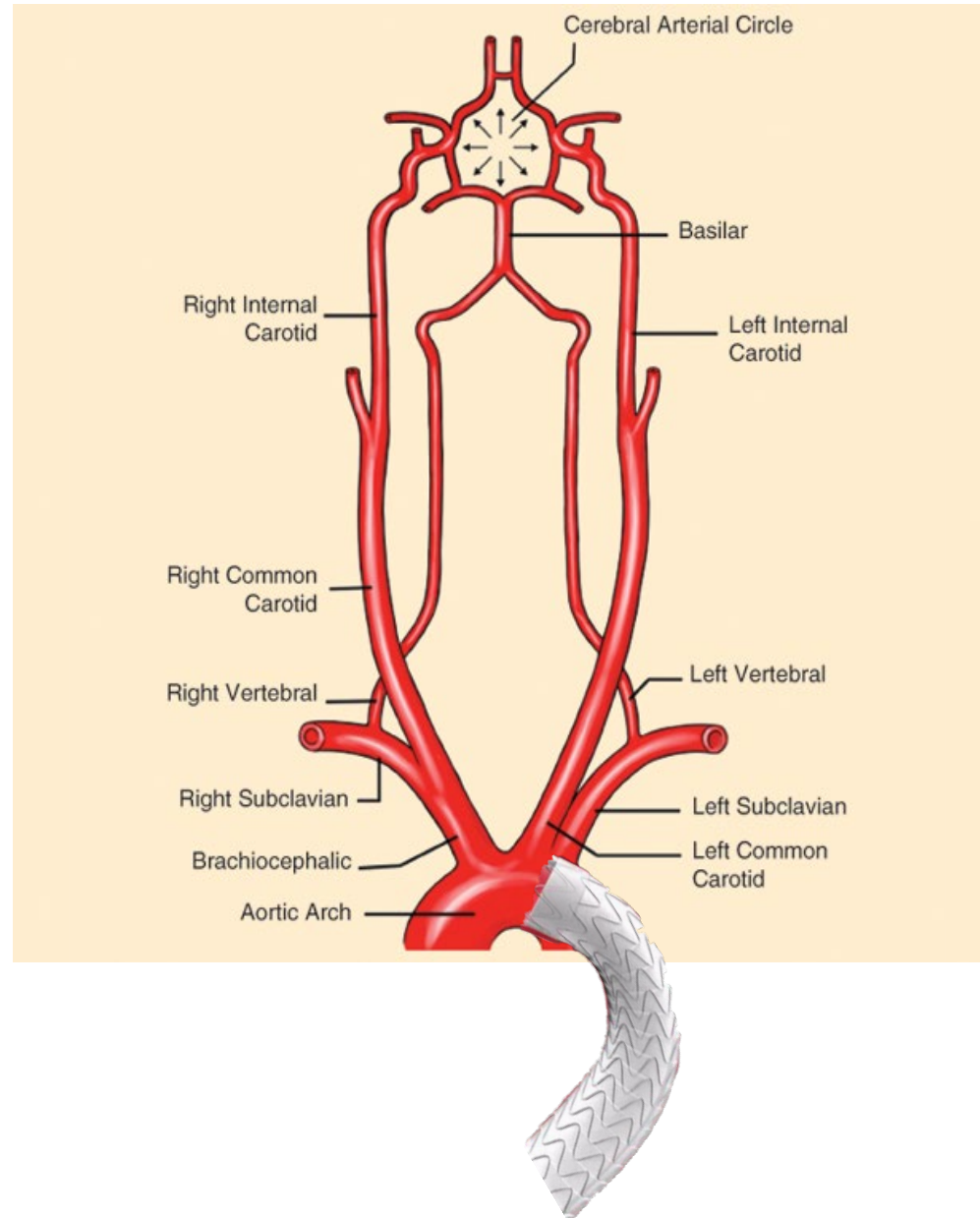
Left subclavian artery coverage

Traditionally required in about 40% of cases



Potential Symptoms after L Subclavian Artery Coverage

- Arm ischemia- rare
- Subclavian Steal Syndrome
 - Retrograde flow into L vert artery



TEVAR treatment - Summary

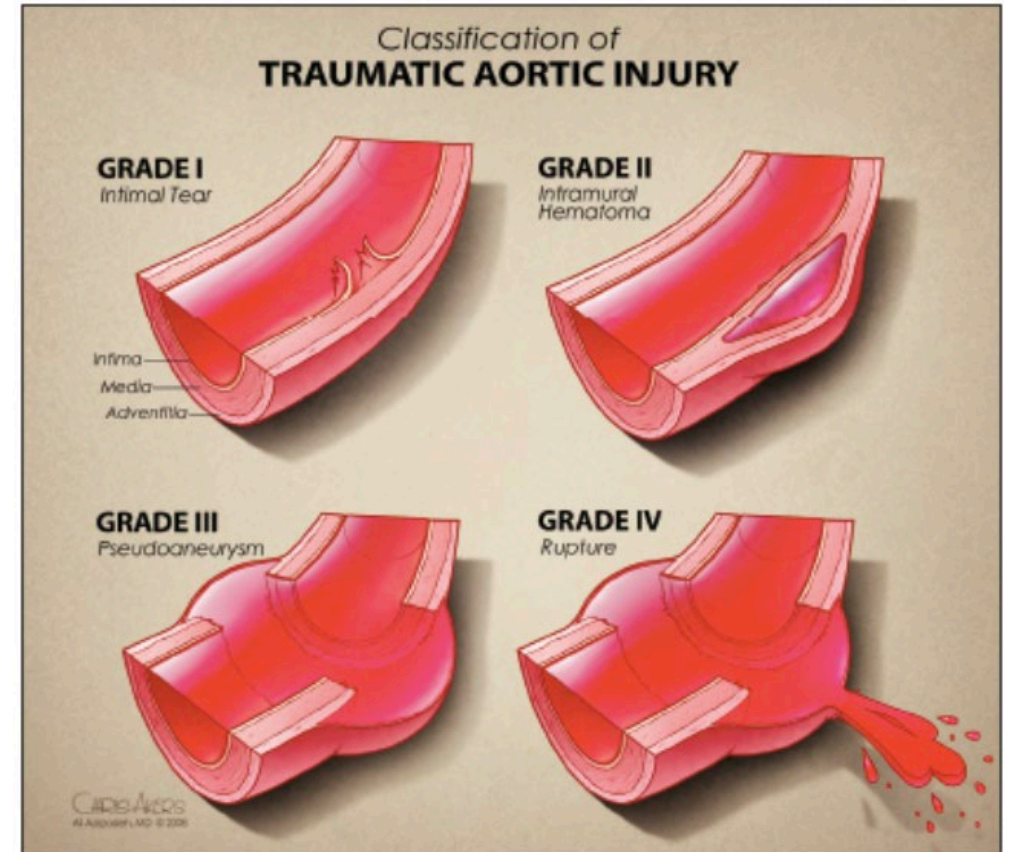
- TEVAR is the treatment of choice for BTAI injuries requiring repair
- Emergent timing should be reserved for Grade 4 ruptures with active bleeding
- L SCA coverage should likely be paired with revascularization of the subclavian
 - Traditionally bypass vs.
 - Branched endovascular device

Post-op Management (Post TEVAR)

- ICU for at least 24 hrs
- Q1-2 neurovascular checks
- Aspirin?
- Monitor for paraplegia
 - May treat with lumbar drain + MAP drive
- +/- CS bypass if indicated
- Repeat CTA 4-6 weeks post-op
- CTA at 1 year

Summary:

- CTA gold standard for diagnosis
- SVS Grading
 - Helps determine medical management vs urgent/emergent TEVAR
- Medical Management
 - Grade I and Grade II?
 - New guidelines
- TEVAR has almost completely replaced open repair
- Consider associated injuries



Thank You!



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