

Emergency Radiology Case: 30M with a blunt traumatic aortic injury

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February 5th, 2020

RAD 4001

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Clinical History

- 30M presented to the ED after MVC single vehicle rollover, non-restraint, unknown LOC at scene, CPR x2 min
- GCS 13 – patient combative and intoxicated
- Pt intubated due to hypertension 2/2 agitation
- Pt found to have aortic pseudoaneurysm with extravasation on CT w/contrast

Vitals

- On presentation to the ED

- HR: 118 bpm

- RR: 28 breaths/min

- SpO₂: 100% (15L NRB mask)

- BP: 183/82

- After intubation in the ED

- HR: 101 bpm

- RR: 20 breaths/min

- SpO₂: 100%

- BP: 99/59

Physical Exam

- General: **intubated and sedated**
- GCS: 6T
- Eyes: PERRLA
- Neck: Cervical collar
- CV: RRR
- Pulm: Mechanical vent
- Abdomen: soft, non-tender, non-distended, **R flank abrasions**
- Extremities: no edema, motor sensation grossly intact, R elbow laceration
- Skin: normal temperature; abrasions R hip
- Vascular: **palpable distal pulses in all extremities**

Initial Management

- Pt had many potentially injuries due to major MVC so the team started broad
- Initial imaging was a Chest/Abdomen/pelvis CT w/ contrast
- Followed by CT Head w/o contrast, CT Face w/o contrast, CT C-Spine w/o contrast

ACR Appropriateness Criteria

- Major Blunt Trauma

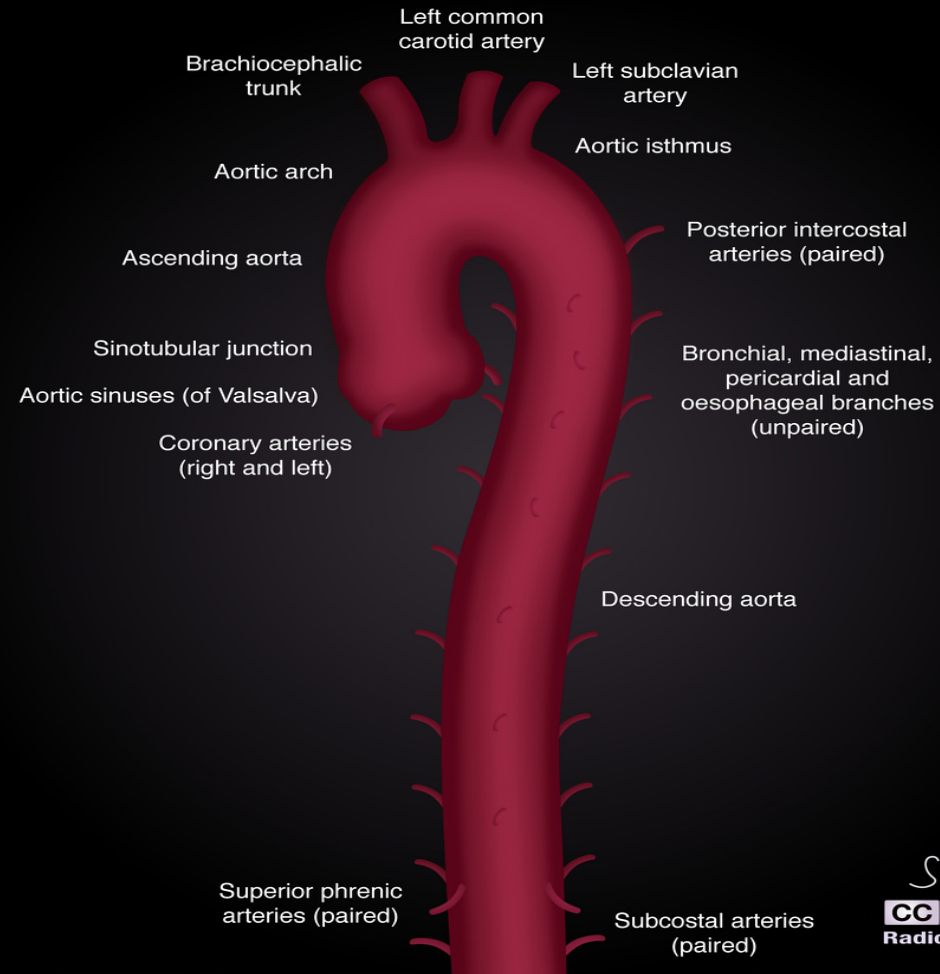
Variant 7: Major blunt trauma. Hemodynamically stable. Suspected chest trauma. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
CT chest with IV contrast	Usually Appropriate	☼☼☼
CT whole body with IV contrast	Usually Appropriate	☼☼☼☼
CTA chest with IV contrast	Usually Appropriate	☼☼☼
Radiography trauma series	Usually Appropriate	☼☼☼
CT chest without IV contrast	May Be Appropriate	☼☼☼
CT whole body without IV contrast	May Be Appropriate	☼☼☼☼
US FAST scan chest abdomen pelvis	May Be Appropriate (Disagreement)	○
CT chest without and with IV contrast	Usually Not Appropriate	☼☼☼
US chest	Usually Not Appropriate	○
MRI chest without and with IV contrast	Usually Not Appropriate	○
MRI chest without IV contrast	Usually Not Appropriate	○

Mechanism of Injury

- Blunt Traumatic Aortic Injury normally results in injuries at sites where the aorta is relatively **fixed** compared to other structures
 - Aortic root
 - Aortic isthmus (most common) – branch point between mobile ascending aorta and relatively fixed descending aorta
- Various mechanisms
 - Osseous pinch – compression of aorta between spine and manubrium
 - Rapid deceleration – in the lateral or antero-posterior direction
 - Shearing forces – tethered sites of the aorta are relatively immobile
 - Water-hammer effect – sudden increase in intrathoracic pressure

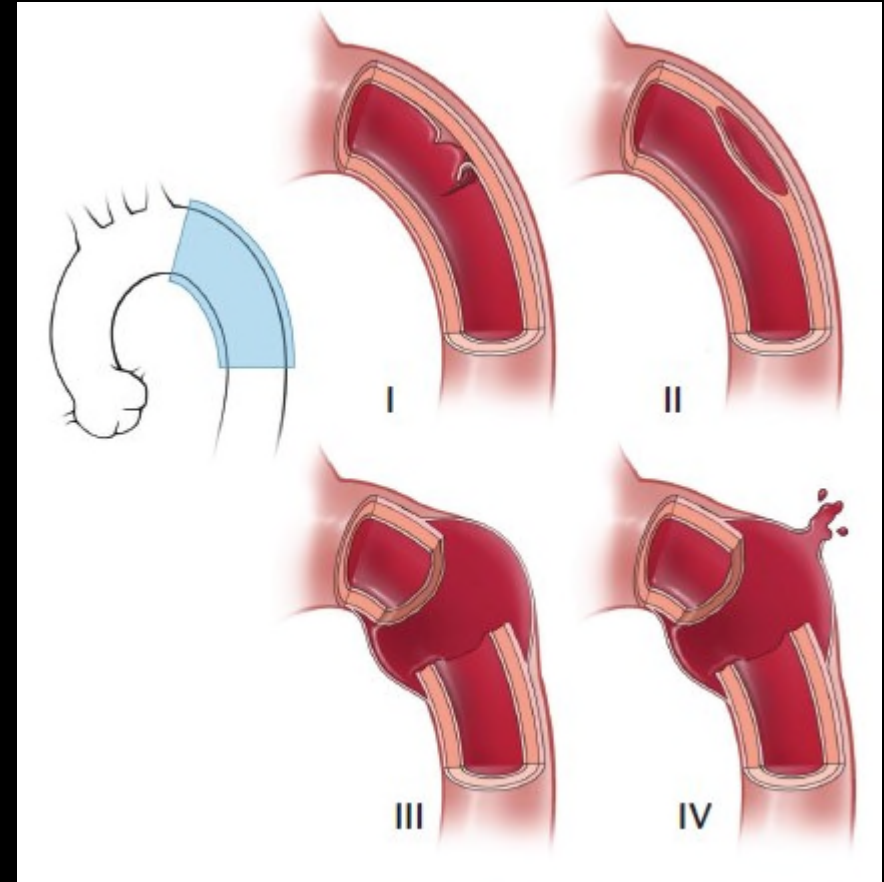
Normal Aortic Anatomy



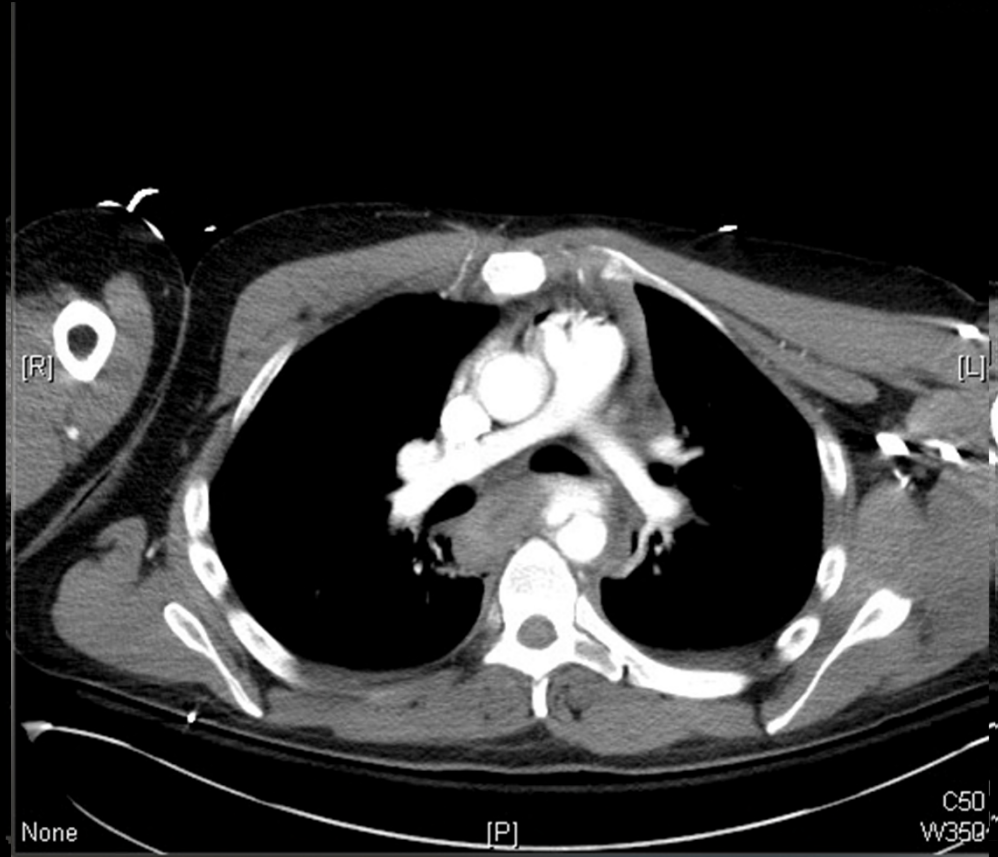
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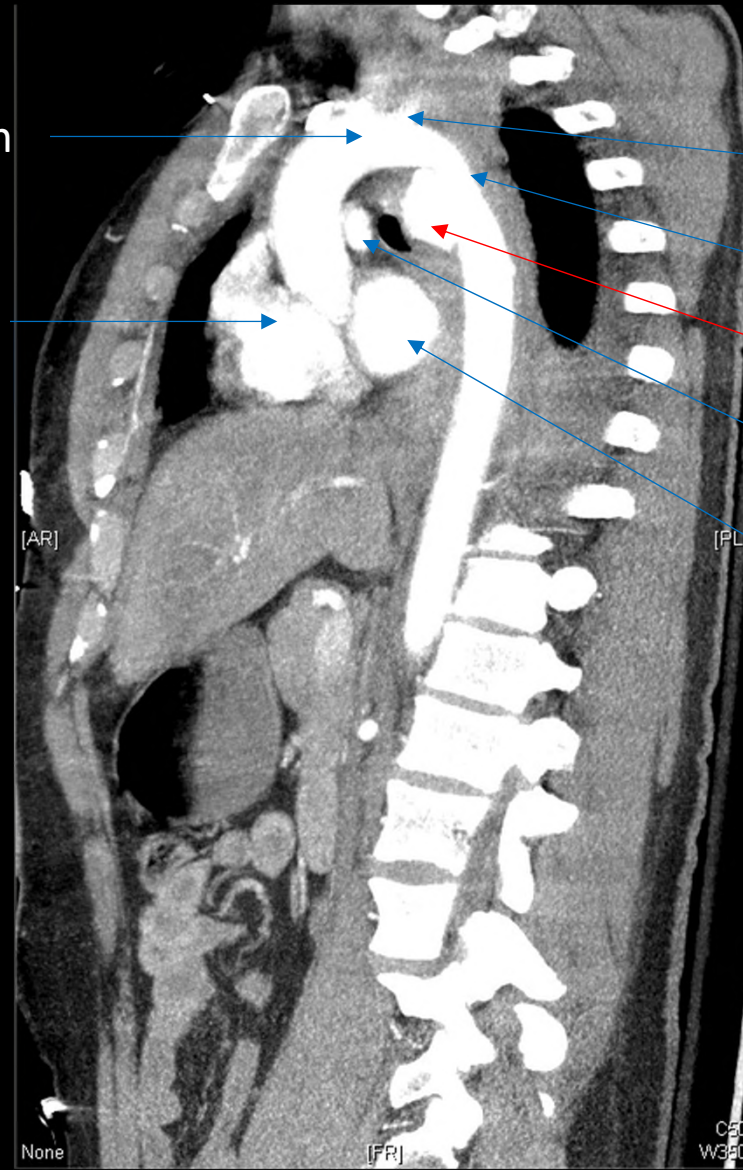
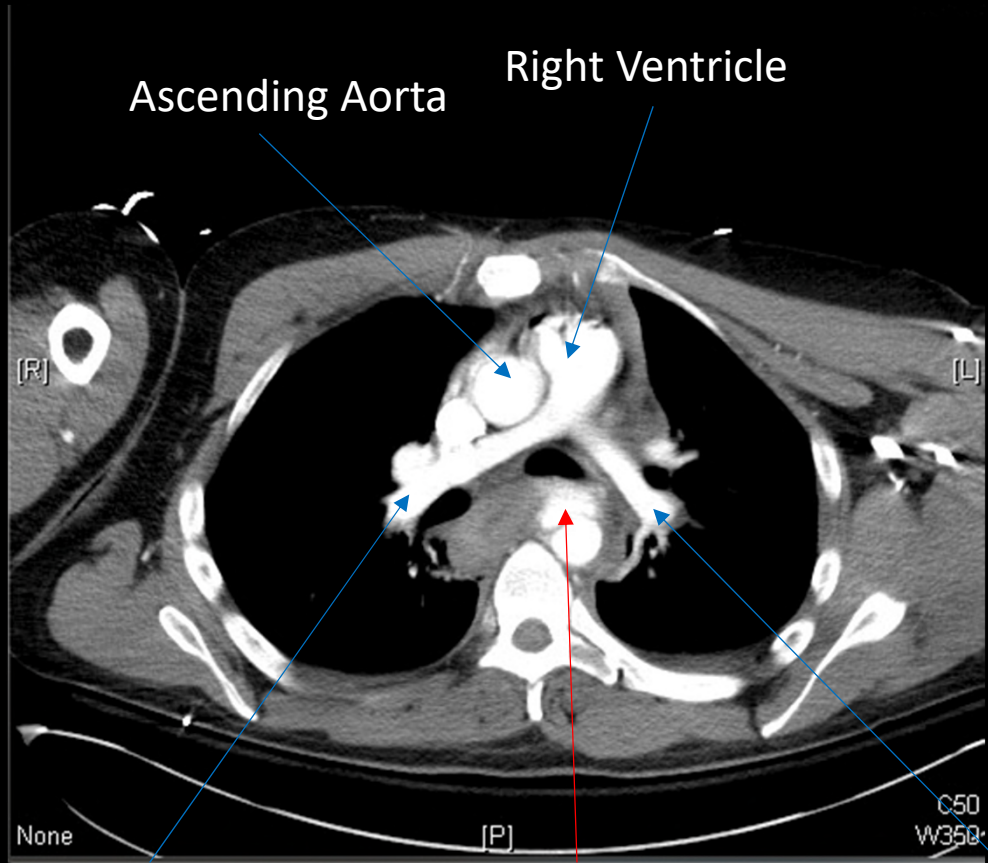
Blunt Aortic Trauma Injury – Grading

- Grading is determined by CT or TEE
 - Type I: Intimal Tear
 - Type II: Intramural hematoma
 - **Type III: Pseudoaneurysm**
 - Type IV: Rupture (eg, periaortic hematoma, free rupture)
- Grading is based on degree of vascular injury in the vessel wall



CT Chest w/ contrast





R Pulmonary Artery Pseudoaneurysm L Pulmonary Artery

Initial Management – Grade 3 BTAI

- Manage stress on vessel wall with antihypertensive agents
 - SBP <100mmHg
 - HR <100bpm
- Hemodynamically stable
 - Grade I – nonoperative management with aggressive BP and HR management
 - Grade II, III, IV – **operative repair with aggressive BP/HR management**
- Hemodynamically unstable
 - Urgent operative repair

Open vs Endovascular Repair

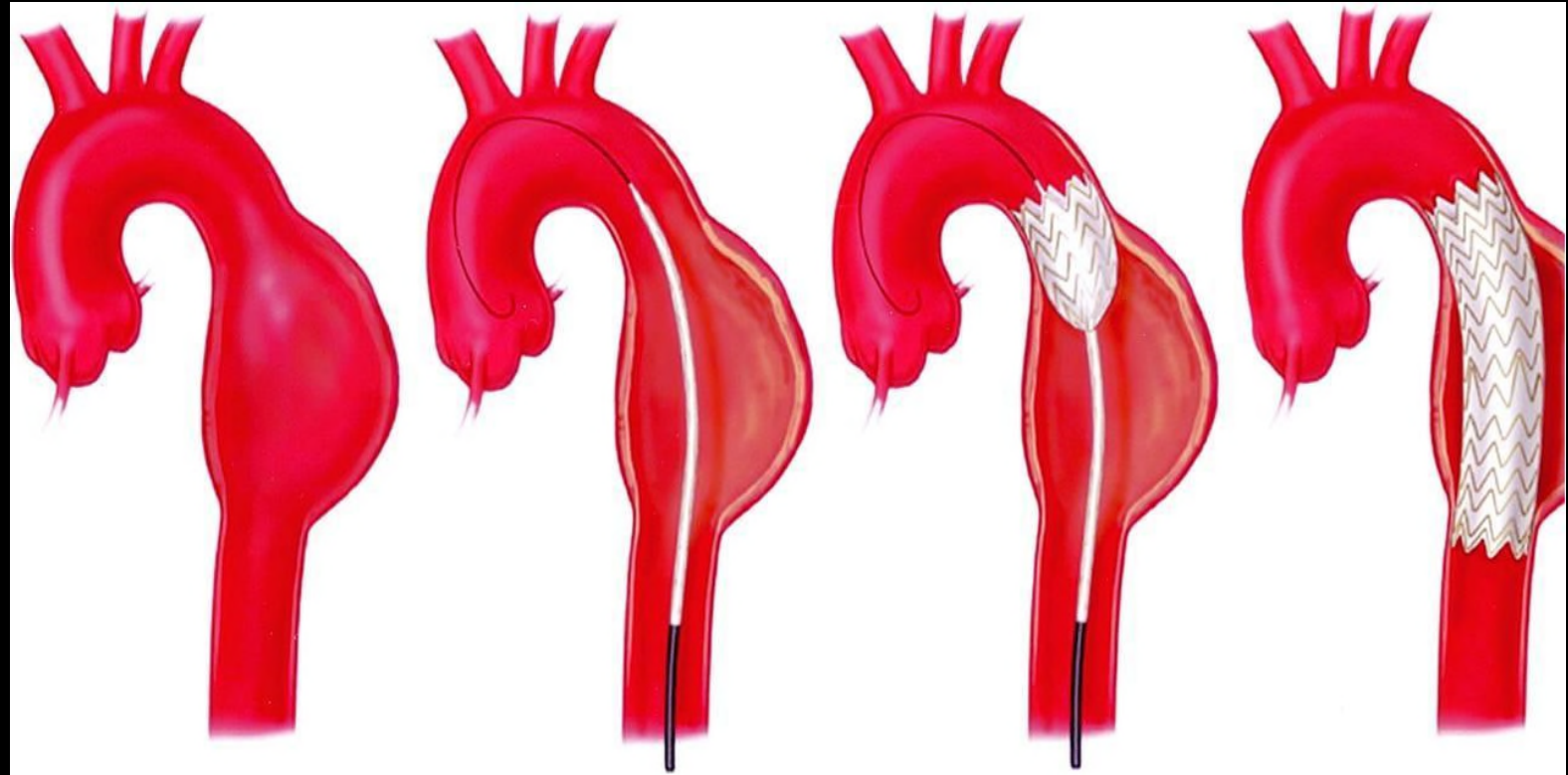
- **Open** – thoracotomy incision to gain access to the diseased portion of the aorta and replacement with a prosthetic tube graft
 - Open is preferred when endovascular is contraindicated
- **Endovascular** – modular graft placement delivered via femoral artery catheter
 - 20-30% of thoracic stent-graft devices are not suited for narrow aortas or the acute angle of the aortic arch, so their use depends on the age of the patient and location of injury
 - TEE or IVUS may help guide endovascular stent sizing and placement

Anatomic criteria for endograft repair — The following criteria are mandatory for thoracic endograft placement:

- Aortic diameter at proximal landing zone ≥ 17.5 mm
- Adequate proximal and distal landing zones (≥ 2 cm in length)
- Minimal calcification at the fixation sites
- Focal aortic lesion
- Location in the descending thoracic aorta
- No significant tortuosity of the thoracic aorta
- Minimal intraluminal thrombus
- Adequate diameter and quality of access vessels (sheath size depends upon the graft chosen)

Thoracic Endovascular Thoracic Aortic Repair - TEVAR

- A catheter with a graft attached is threaded up the descending aorta and deployed once correct position is identified
- Mean BP is reduced to 60s which helps prevent graft from prematurely deploying and moving distally

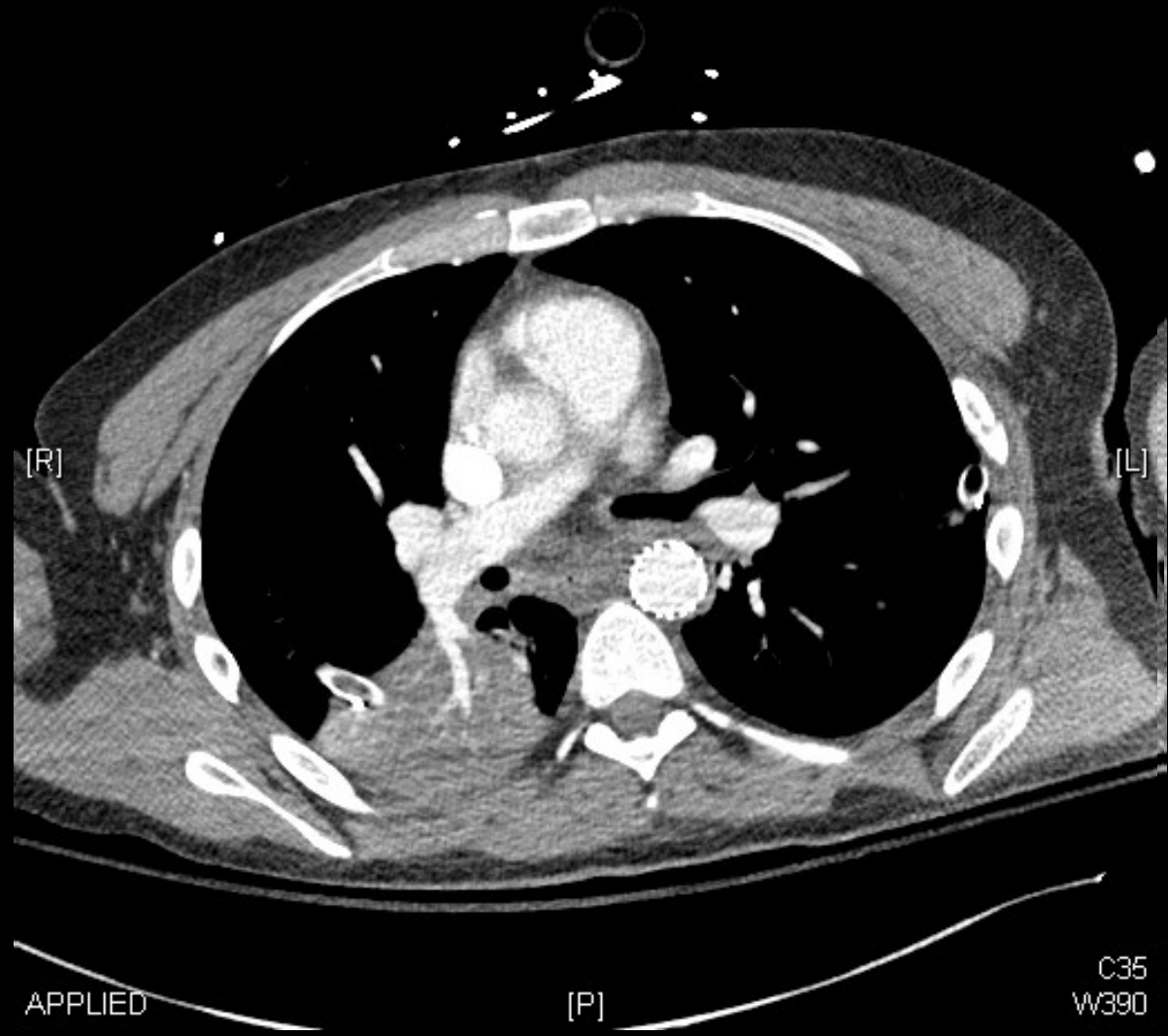


Potential Complication of TEVAR

- Perioperative mortality – 1.9-3.1%
- Spinal cord ischemia – 3-11% (comparable to open)
 - Extent of thoracic aortic coverage is greatest risk factor for spinal cord ischemia
- Cerebrovascular ischemia – 4-8%
 - Proximity of graft to carotid increase risk for embolic complications
- Migration of the graft caudally can occur – 1-2.8%
 - Device infolding/collapse can occur – especially in young trauma pts

Se:4
Im:89

[A]



APPLIED

[P]

C35
W390

Imaging Cost at Memorial Hermann

- Chest Xray 1View - \$683.00
- CT Chest w/ contrast - \$3936.25
- CT Pelvis/Abdomen w/ contrast - \$7998.00
- CT Head, Maxillofacial, Cervical Spine w/o contrast – \$11,623.00
(3157 + 4409 + 4057)
- **Total Imaging Cost = \$24,240.25**
(Excluding fees for EMS, medications, medical equipment, nursing, physicians, surgical interventions, etc.)

Current status of patient

- Pt moved to STICU after emergent TEVAR
- Pt was extubated and subsequently developed quadriplegia due to worsening epidural hemorrhage → underwent emergent C2-C7 laminectomy with evacuation of epidural hematoma with neurosurgery
- Remains in the STICU in critical condition (multiple fractures, AKI, ARDS, quadriplegia, etc.)
- Follow-up CT w/ contrast one month post-op to evaluate stability at the graft site

Take Home Points – Case Summary

- If there is blunt trauma, suspect damage to the aorta at the isthmus
- The best way to evaluate for a BTAI is with a CT Chest w/ contrast
- Surgical repair for Grade II, III, IV or with hemodynamic instability
 - Endovascular preferred if the patient's anatomy and type of injury is appropriate

References

<https://www.ncbi.nlm.nih.gov/books/NBK459337/>

https://www.uptodate.com/contents/management-of-blunt-thoracic-aortic-injury?topicRef=15185&source=see_link

https://www.uptodate.com/contents/surgical-and-endovascular-repair-of-blunt-thoracic-aortic-injury?sectionName=ENDOVASCULAR%20REPAIR&topicRef=117119&anchor=H1081750615&source=see_link#H1081750615

<https://www.uptodate.com/contents/endovascular-repair-of-the-thoracic-aorta#H144779840>



Questions?