THORACIC AND ABDOMINOPELVIC VASCULAR INJURIES IN TRAUMA
An Overview of Anatomy, Classification and Management

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LEARNING OBJECTIVES

1) To explore clinically relevant anatomy involved in thoracic and abdominopelvic vascular injuries in trauma
2) To identify the typical radiologic manifestations and classification of thoracic and abdominopelvic vascular injuries in trauma
3) To recognize the importance of imaging protocol parameters in detection of vascular injuries
4) To discuss various management options, namely surgical versus interventional radiologic approaches

DISCLOSURE OF CONFLICT OF INTEREST

Authors do not have a relationship with a for-profit and/or a not-for-profit organization to disclose
CLASSIFICATION OF VESSEL INJURY
Based on Society for Vascular Surgery (SVS) Guidelines

Grade I: Intimal tear
    Separation of intima from adjacent media

Grade II: Intramural hematoma / Large Intimal Flap
    Blood collects between vessel wall layers

Grade III: Pseudoaneurysm
    Injury to intima and media resulting in flowing blood contained by adventitia

Grade IV: Rupture
    Injury to all layers of a vessel wall resulting in extravasation of blood

INJURY MECHANISMS

Thoracic Aorta

- **Rapid deceleration**: Shifting of structures results in shear stress on tethered portions
- **Osseous pinch**: Compression of aorta between structures
- **Hydrostatic forces**: Tears at aortic root and isthmus caused by sudden rise in intrathoracic pressure

A) Mediastinal widening is demonstrated on radiograph (arrows). B) and C) CTA showing aortic injury involving the undersurface of the transverse aorta, with opacification along the ligament arteriosum, also nicely demonstrated on the 3D volume rendering image (arrows).

Abdominal Aorta

- **Crush injury**: Compression of internal organs may occur between abdominal wall, posterior thoracic cage and spine
- **Shear injury**: Rapid deceleration causes force vectors in areas where vessels are fixed (tears, dissection, laceration)
- **Burst injury**: Sudden rise in intraluminal pressure of hollow viscus organs
A) to D) A large pseudoaneurysm of the transverse aorta is seen (arrows) in addition to a large area of active contrast extravasation within the mediastinum (arrows), in keeping with a grade 4 (severe) aortic injury.

**MANAGEMENT**

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<th>MINIMAL</th>
<th>MODERATE</th>
<th>SEVERE</th>
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| • No external contour abnormality  
• Intimal tear and/or thrombus <10mm | • External contour abnormality or intimal tear >10mm | • Active extravasation  
• Left subclavian artery hematoma >15mm |

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<th>NO INTERVENTION</th>
<th>SEMI-ELECTIVE REPAIR</th>
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| • Optional follow-up imaging | • Stabilization of concomitant injuries  
• Impulse control | • BAI takes first priority |
TRAUMA PROTOCOL AT VANCOUVER GENERAL HOSPITAL

CT RIPIT (Rapid Imaging Protocol In Trauma)
- CT Head, CTA Arch-to-vertex + C-Spine MPR
- CTA Chest, abdomen and pelvis
- CT Abdomen and pelvis venous phase 70 sec + L-Spine MPR
- CT Abdomen and pelvis delayed phase (5-10 min) if suspected vascular or ureteral injury

Blunt Abdominopelvic Trauma
- CT abdomen and pelvis from dome of diaphragm to greater trochanters in portal venous phase – 70 second delay following contrast injection
- CTA with 23 second delay added if vascular injury or fracture suspected

Blunt Chest Trauma
- CTA from thoracic inlet to level of SMA – 30 second delay following contrast injection
- Allows for visualization of upper abdominal arteries, liver and spleen
REFERENCES


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