CT Angiography in Extremity Acute Vascular Trauma

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Learning Objectives

• Name main indications for performing CT angiography in suspected vascular trauma.
• Describe CT angiography findings of vascular trauma.
• Describe potential pitfalls of CTA
• Demonstrate ability to proceed with therapy without time delay.
Introduction

• Prompt diagnosis of vascular injury is imperative
  – Injuries can be associated with considerable morbidity and mortality

• CT is the preferred imaging modality in patients with significant trauma
  – Adding CTA to the trauma protocol when indicated should not cause a significant delay

• CTA is usually sufficient to determine the need for and type of treatment in patients with vascular trauma.
Advantages of CTA

• Short acquisition time
• Simultaneous visualization of adjacent structures
  – Bones, muscles, etc.
• 3D visualization of anatomic relationships of vasculature and bones beneficial for surgical planning
• With MDCT - ability to evaluate small arteries
Efficacy of CTA

• Evaluation of arterial injury in proximal extremities (Single detector CTA)\(^1\)
  – Sensitivity 95%
  – Specificity 99%

• Evaluation of arterial injury in proximal and distal extremities\(^2\)
  – Sensitivity 95%
  – Specificity 87%

Potential Pitfalls of CTA

• False positive – vasospasm
• Lack of opacification of distal vessels due to CTA bolus timing
• Venous injuries may be missed
  – single phase protocol
• Use of MIP images alone – failure to detect subtle injury
  – Must review axial thin cuts – time intensive
• Surgical hardware/foreign bodies artifact
Artifact – Metallic Foreign Body

- Limited Evaluation at level of foreign body
Clinical Findings

• Hard findings of vascular injury
  – Pulsatile bleeding
  – Loss of distal pulses
  – Expanding or pulsatile hematoma
  – Pallor, cyanosis, decreased temperature
  – Audible bruit or palpable thrill (AVF)
  – Massive distention of superficial veins (AVF)

• More than 90% of patients with hard findings have arterial injury at time of surgery
  – Immediate surgical intervention or DSA
Clinical Findings

• Soft Findings of Vascular Injury
  – Palpable but diminished pulse
  – Isolated peripheral nerve injury
  – History of severe hemorrhage in the field
  – Unexplained hypotension
  – Large non-pulsatile hematoma
  – Prolonged capillary refill (controversial)

• Up to 35% of patients with soft findings have positive angiographic studies
  – A portion of these require emergency repair
Clinical Findings

• High Risk Injuries
  – Proximity of penetrating wound to vascular structure
  – Trajectory crosses vascular bundle
  – Examples
    • Bites from large dogs
    • Shotgun wounds
    • Severely displaced fractures
    • Crush injury
    • Major joint dislocation (especially knee)
  – Missed occult vascular injury in 6-hour “warm ischemia” window = delayed complications
Self-inflicted stab wound to thigh

PFA pseudoaneurysm
Profunda Femoris Artery Pseudoaneurysm and AV Fistula

Sequential DSA of RLE:
- PFA pseudoaneurysm
- Simultaneous arterial and venous opacification
- Enlarged draining vein

AFV suspected:
- Palpable thrill or audible bruit
- Distention of superficial draining veins
- Early venous enhancement during arterial phase

DSA of RLE:
- Status post coil embolization – 3 coils
Pedestrian struck by motor vehicle

Peroneal artery pseudoaneurysm

CTA, axial

Left peroneal artery pseudoaneurysm was identified on CTA
Peroneal Artery Pseudoaneurysm

- Left peroneal artery pseudoaneurysm was confirmed on DSA
- Successfully treated with coil embolization

- Pseudoaneurysm can present as a pulsatile mass
Peroneal Artery Pseudoaneurysm

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- Pseudoaneurysm can present as a pulsatile mass
- On CTA it is an organized, localized extravascular contrast filled sac connected to the artery in question
The patient presented for suture removal s/p laceration of the volar aspect of the hand. Suture removal was complicated by pulsatile bleeding.

CTA demonstrated a large pseudoaneurysm of the distal ulnar artery.
Filling Defect of Radial Artery

- Patient presented with a stab wound to the arm.
- A non-occlusive dissection of the right radial artery was suspected on CTA.
- Patient was taken to the OR due to compartment syndrome.
Narrowing of Radial Artery

- Radial artery was normal at surgery
  - Possibly spasm
  - Pitfall of CTA
- Reduction of vessel caliber:
  - Traumatic dissection
  - Spasm
  - External compression
  - Thrombus
MVA – Ejected with amnesia
Occlusion of the Subclavian Artery

• Comminuted fracture of the scapula with short segment occlusion of the subclavian artery, likely secondary to dissection
MVA – Ejected with amnesia

Occlusion of the Subclavian Artery

- DSA demonstrated reconstitution however attempts to cross the occluded segment failed.
- Collaterals are sometimes difficult to identify given their small caliber in the acute setting.
- In the chronic setting, the collaterals are more established.
Patient punches window

Occlusion – Transected Radial Artery

• Occlusion of radial artery identified on CTA

• Vessel disruption
  – Diminished peripheral pulses
  – Pale, cold extremity

• Arterial spasm - may prevent visualization of active contrast extravasation in the setting of artery transection.

• Transection necessitates surgical repair.
Pt fell in the woods – piece of wood embedded in medial thigh
Active Contrast Extravasation

- Hematoma with active contrast extravasation
- Small superficial artery ligated in OR
Pt fell in the woods – piece of wood embedded in medial thigh
Active Contrast Extravasation

Ongoing hemorrhage - blush of extraluminal contrast material in the region of vascular disruption.
Cut forearm with circular saw
Active contrast extravasation

- Contrast Extravasation from distal ulnar artery and possible pseudoaneurysm
- Transected ulnar artery identified in Operating Room
Conclusion

• Indications for CTA in vascular trauma
  – Soft findings of vascular injury
• Describe CT angiography findings of vascular trauma.
  – Pseudoaneurysm, AVF, Interruption, Contrast Extravasation
• Potential pitfalls of CTA
  – Artifacts, Technique/contrast timing, vasospasm
• Demonstrate ability to proceed with therapy without time delay
  – Avoid missing injury in 6-hour “warm ischemia” window, therefore decreasing morbidity
References

• Gakhal & Sartip. *AJR.* 2009, 193, W49.