Iatrogenic Vascular Injuries

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Injury/Disease/Demographics

- Most iatrogenic vascular injuries are caused by interventional procedures, abdominopelvic oncologic resection or orthopedic joint and spine operations.
- Although not infrequent, nearly half of iatrogenic injuries are considered preventable and delays in treatment can result in significant morbidity.
- The incidence of inadvertent arterial puncture and intravascular foreign bodies are rising with increasing endovascular therapies.

Clinical Presentation

- The following scenarios are manifestations of iatrogenic vascular injuries:
    - Arterial puncture during central venous catheter insertion with expanding hematoma.
    - Laceration during surgical procedures with overt external hemorrhage and shock.
    - Rupture during endovascular procedure with abrupt hemodynamic instability.
    - Thrombosis with acute onset of pulselessness, pallor, paralysis or end organ failure following intervention.
    - Occult injury such as fistula, intimal flap or pseudoaneurysm with delayed presentation following intervention.
    - Malfunction of vascular closure device with above conditions.

Evaluation/Diagnostics/Imaging

- Assess for hard signs of vascular injury that suggest thrombosis or active hemorrhage.
- Assess for bruit, thrill or pulsatile mass that suggest occult vascular injury.
- Ankle-Brachial Index <0.9 requires imaging.
- Non-Invasive (Ultrasound) assessment can detect thrombosis and occult injuries; although it can be operator dependent, large intimal flaps, pseudoaneurysms and arteriovenous fistulas are easily diagnosed.
- Multi-planer computed tomographic angiography is helpful to evaluate for an injury or plan endovascular therapies in anatomic regions that are difficult to expose.
- Catheter based angiography is relatively safe and allows for simultaneous diagnosis and endovascular treatment.

Role of Nonoperative Management

- Rapid decision making is crucial to avoid immediate consequences.
- Antiplatelet therapy is suggested for all iatrogenic arterial injuries for at least 90 days.
- Repeat imaging in 1-2 weeks for occult injuries (flaps, dissections) and 3 months for stented or repaired vessels.
- Small fistulas and pseudoaneurysms may expand over time and therefore conservative management is guided by location and ease of repair:

- Carotid, femoral, and popliteal arteries are repaired on diagnosis.
- Vertebral, profunda femoral and tibial arteries can be observed.

Indications for Operative Intervention

- Hemorrhage or expanding hematoma.
- Bruits and thrills associated with an accessible arteriovenous fistula; otherwise, should consider an endovascular option or conservative management.
- Pulsatile mass associated with a pseudoaneurysm.
- Thrombosis with ischemic changes.

Pre-operative Preparation

- Anticipate a saphenous harvest from the contralateral limb.
- Apply pneumatic tourniquet for iatrogenic extremity injury.
- Request vascular instruments, loupe magnification, and headlamps.
- Review the endovascular options, and ensure the c-arm has digital subtraction capability and a fluoroscopic compatible operating room table.

Operative Techniques/Intraoperative Considerations

- Ensure exposure is adequate and minimize forceful clamp placements.
- Additional iatrogenic injuries often occur in the context of taking shortcuts or hurried steps.
- Call for surgical assistance early and use sponge sticks or carefully placed clamps until help arrives.
- Vascular closure devices are well suited for stable patients with inadvertent arterial punctures from central venous catheter insertion. A suture-mediated closure system like the Perclose Proglide, (Abbott Vascular, Santa Clara, CA) is passed over the wire, the suture needles are deployed and the arteriotomy is closed when the wire and device are removed and knot pushed down to the artery.
- Transarterial embolization using coils, gelfoam, or alcohol particles are useful for treating solid organ hemorrhage or deep pelvic bleeding.
- Covered stents can resolve arteriovenous fistulas and arterial injuries in surgically inaccessible regions (Carotid, Subclavian, Vertebral, and Retrohepatic IVC).
- Bovine thrombin injections are very effective for narrow necked pseudoaneurysms. Open repair requires proximal and distal control and patch or suture repair depending on the size of the injury. Patch >1/3 circumferential injury.
- Vessel transections during abdominopelvic or orthopedic operations should have meticulous control of hemorrhage to avoid hemodynamic instability and perform a direct open repair by lateral suture, patch, end anastomosis or interposition grafting.

Postoperative Management/Complications

- Antiplatelet therapy can be started in the immediate post-operative period.
- After stenting, give Plavix 300 mg (loading dose) then 75 mg daily for three months.
- Aspirin either 81 mg or 325 mg orally following arterial repairs is suggested.
- Systemic anticoagulation is controversial and reserved for extremity bypass at high risk for failure.
- Vein graft surveillance with duplex ultrasound is indicated once postoperatively and then at least biannually for five years.
- Lack of soft tissue coverage over vein grafts increases the risk for anastomotic dehiscence.
- Always consider fasciotomy when there is prolonged ischemic time (>3-4 hrs.)

Considerations for Special Populations

- Pediatric thrombotic extremity vascular injuries with ischemia from inadvertent arterial puncture respond well to systemic anticoagulation.
- The saphenous vein remains an excellent conduit in both pediatric and adult patients.
- Elderly patients may have medial calcinosis and an artificially elevated ankle-brachial index.

Suggested Readings

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