



AAST Acute Care Surgery Didactic Curriculum

Extremity Vascular Injury

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Highlights:

Evaluation in suspected injuries

- Goal is to evaluate the potential vascular injury given vessel proximity in the extremities.
- Measure ABI or BBI as part of physical examination and perform CT arteriogram if <0.9 .
- CTAs are readily available; accuracy is comparable to conventional arteriography.
- Hard signs of vascular injury will have therapeutic operation 95-98% of the time.

Management of Acute Hemorrhage and Shunt use

- Life-threatening injuries with concomitant vascular injury can cause revascularization delays (life over limb). Two surgical teams can assist with expedited care.
- Extremity hemorrhage control: direct digital pressure, balloon catheter, tourniquet use.
- Proximal/distal control through short incisions around a large peripheral hematoma.
- Avoid prolonged vascular repair when temporary intraluminal shunt is indicated.
 - Shunt indications: Gustilo IIIC open fracture; need distal for complex revascularization (ie, extra-anatomic bypass); 'damage control' for near-exsanguination; perfusion of an amputated part of an upper extremity prior to replantation.
 - Combined venous injury with arterial shunt and extremis, consider larger shunt for the vein injury.
 - Shunt should be 4cm longer than the vascular defect.
 - Pulsatile flow distally is verified visually, palpation and/or by Doppler.
 - Every attempt should be made to cover the injured vessel with shunt.

Peripheral Vascular repair options

- Avoid scar contractures: anterior shoulder (axillobrachial exposure), elbow (brachial exposure) and knee (medial or posterior popliteal exposure), utilize curvilinear incisions.
- General principles:
 - remove cracked intima, frayed adventitia or intramural hematoma.
 - Obvious back bleeding from distal end before vascular control may not require passage of Fogarty balloon.
- Peripheral arterial repair
 - 5-0 or 6-0 polypropylene sutures.
 - Laterally arteriorrhaphy (transversely) or venorrhaphy
 - Patch angioplasty (rare however use a vein, PTFE, bovine)
 - End-to-end anastomosis

- should not require sacrifice of excessive arterial branches.
 - Interposition graft (reverse saphenous vein or PTFE)
 - Extra-anatomic bypass graft
- Ideal sequence when choosing an interposition graft: (1) greater saphenous vein; (2) lesser saphenous vein; (3) basilic or cephalic vein and (4) plastic conduit.
- Contraindications to greater saphenous vein graft:
 - Stenotic vein, small luminal diameter, size mismatch, sole venous outflow.
- Polytetrafluoroethylene (PTFE) grafts concerns:
 - Rigidity causing kinking of native artery, infection, and long-term patency.
- Peripheral venous injury: majority diagnosed in the operating room.
 - Should be repaired when feasible and is patient hemodynamically stable.
 - 4-0 or 5-0 polypropylene suture
 - venorrhaphy: lateral repairs highest patency
 - interposition grafting:
 - Large peripheral vein: ringed PTFE grafts reasonable alternatives when the contralateral saphenous vein is too small.
 - Vein patch (vein, PTFE, bovine): rare but described.
 - End-to-end
 - Ligation
 - Morbidity: increased venous hemorrhage from soft tissues or distal fasciotomies, increases need for below knee fasciotomy if popliteal or femoral vein ligated; transient adverse effect on arterial inflow; postoperative edema of the injured extremity.

Pharmacologic adjuncts

- Early systemic heparinization may be contraindicated with TBI, solid organ injury or extensive soft tissue injury to the extremities.
- Either systemic (100 u/kg) or regional heparinization (12 500 units/250 mL normal saline or 50 units/mL with injection of 15–20 mL in proximal and distal ends).
- If distal end of the transected artery is in spasm, the topical application of papaverine.
- Continuation of systemic heparin 24-48 hours may have a role in small arterial repairs or in those repairs requiring revision after reconstruction.
- Daily Aspirin is used postoperatively to decrease platelet aggregation.
- Thrombolytic therapy: limited role with concurrent injuries
 - Catheter-directed therapy tissue plasminogen activator (tPA): only available agent
 - tPA dosing 0.25 to 1.5 mg/hr
 - fibrinogen levels trended once systemic levels fall.
 - heparin infusion continued after thrombolysis.