When is Open Surgery or Hybrid Approach Indicated for Acute Limb Ischemia & When to do a Fasciotomy

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Disclosures

• Consultant: Endologix, Shockwave, Abbott, BSC, Phillips, Medtronic, PQ Bypass

• VIVA Physicians 501c3 Board Member

• Stock Ownership: None

• Research Trials: Bolton, Gore, Medtronic, Endologix, Surmodics, Boston Scientific, NIH
Acute limb ischemia

• Sudden onset symptoms and hypoperfusion
• Symptoms largely dependent on collaterals
• Defined as ischemia < 14 days duration
Historical Surgical Treatment Algorithm

• Choices:
  • Heparin
  • Embolectomy
  • Amputation
• Mortality rate for ALI ~25%
• Presentation after 6-8h of onset with paralysis limb loss is likely

• No sensory or motor deficit and viable limb
  • Good results utilizing anticoagulation & delayed elective revascularization
• Late revasc after 10 -12 hours of severe ischemia often unsuccessful followed by either recurrent thrombosis, limb loss, or death

Blaisdell Surgery 84, 822-834. 1978
# Rutherford Category

<table>
<thead>
<tr>
<th>Category</th>
<th>Doppler Signals</th>
<th>Neurologic Exam</th>
<th>Capillary Return</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Arterial</td>
<td>Venous</td>
<td>Motor</td>
<td>Sensory Loss</td>
</tr>
<tr>
<td>I. Viable</td>
<td>Present</td>
<td>Present</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>IIa. Threatened (urgent)</td>
<td>Absent</td>
<td>Present</td>
<td>None</td>
<td>Mild</td>
</tr>
<tr>
<td>IIb. Threatened (immediate)</td>
<td>Absent</td>
<td>Weak</td>
<td>Any</td>
<td>Present</td>
</tr>
<tr>
<td>III. Irreversible</td>
<td>Absent</td>
<td>Absent</td>
<td>Paralysis</td>
<td>Anesthetic</td>
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</table>

**TABLE 1: Clinical stratification of an ischemic extremity: Rutherford classification**
When Not to Use Thrombolytic Rx

**Absolute contraindications**
- Active bleeding
- Recent GI bleed
- Intracranial or spinal surgery
- Intracranial trauma within 3 months
- CVA within 2 months

**Relative contraindications**
- Major nonvascular surgery or trauma within 10 days
- Uncontrolled HTN
- Puncture noncompressible vessels
- Intracranial tumors
- Recent eye surgery
Limitations of Thrombolytics

• Mean duration of treatment to achieve flow > 24 hours
  • STILE & TOPAS

• Dependent on plasminogen supply

• Doesn’t work well on PAI-1 rich, platelet-rich arterial clots

• Systemic “lytic state” resulting in hypofibrinogenemia
  • 5-16% incidence of major hemorrhage,
  • 1-2% incidence of intracranial hemorrhage
Surgery

• Thromboembolectomy
  • Best option for embolus without distal thrombosis
  • Rapid restoration of flow
  • Can still use imaging
  • Over the wire embolectomy balloons to guide into difficult branches
Etiologies of ALI

- Embolic
  - Cardiogenic most common
    - Atrial fibrillation
    - Wall motion abnormalities
    - Valvular
    - Cardiac Tumor
    - Paradoxic Emboli

Anatomic Location

- Upper extremity (3%)
- Visceral and renal (2%)
- Aortoiliac (36%)
- Femoral (47%)
- Popliteal (12%)
Embolectomy
### Clinical stratification of an ischemic extremity: Rutherford classification

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<td>None</td>
<td>Less than 4 sec</td>
</tr>
<tr>
<td>IIa. Threatened</td>
<td>Absent</td>
<td>Present</td>
<td>None</td>
<td>Delayed</td>
</tr>
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<td>(urgent)</td>
<td></td>
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Surgical Therapy

- Leg has motor deficit
- It will not wait long before tissue death
- Thrombo-embolectomy vs distal bypass
Hybrid Therapy

- Catheter directed thromboembolectomy
- Endarterectomy with endo distal therapy
  - Helpful when chronic disease is present with superimposed ALI
Compartment Syndrome

- Increased pressure within a fascial compartment
  - Loss of sensation to light touch as first sign
    - Web space between Great Toe and Second Toe
    - Sensory portion of Deep Peroneal N.
    - Pain on passive stretch
    - Tight compartment

- Infrageniculate Compartments:
  - Anterior: Anatomy dictates vulnerability
  - Lateral: Affected in conjunction with Anterior
  - Deep posterior and Superficial posterior
Compartment Syndrome Diagnosis

- Normal pressure 10-12 mmHg
- Compartment Perfusion Pressure
  - CPP = MAP - Compartment pressure
- Critical pressure = 30-50 mmHg
- Measure of all four calf compartments
  - Stryker needle or Aline set up
When to Do Fasciotomy

- Elevated compartment pressures >25mmHg
- Pain on passive stretch
- Pain out of proportion to exam
- Long ischemic times & profound deficit
- Tightness in compartment
- Consider if >6 hours ischemia
Fasciotomy

• Serial examination is key after deciding not to perform
• Usually will occur within 2-6 hours after reperfusion
• Skin can cause necrosis if enough swelling after fasciotomy
• If compartment syndrome diagnosis delayed or missed permanent nerve injury is common with foot drop
• Once fasciotomy is done control edema to the leg
• Vac dressing is helpful at edema reduction
• Easy to do delayed primary closure at bedside
• Split thickness skin grafting when not able
Conclusions

• Surgery is always an option
• Best for embolus without distal thrombosis
• Best when Class IIB ischemia and no time to wait for pharmacological lysis
• Hybrid approach helpful when debulking of native disease proximally and steering embolectomy catheters distally
• Fasciotomy is easy and has minimal downsides
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