



# 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

# Rutherford Category

**TABLE 1: Clinical stratification of an ischemic extremity: Rutherford classification**

| Category                    | DOPPLER SIGNALS |         | NEUROLOGIC EXAM |              | Capillary Return | Management                   |
|-----------------------------|-----------------|---------|-----------------|--------------|------------------|------------------------------|
|                             | Arterial        | Venous  | Motor           | Sensory Loss |                  |                              |
| I. Viable                   | Present         | Present | None            | None         | <4 sec           | Elective angiography         |
| IIa. Threatened (urgent)    | Absent          | Present | None            | Mild         | Delayed          | Urgent angiography           |
| IIb. Threatened (immediate) | Absent          | Weak    | Any             | Present      | Delayed          | Emergent revascularization   |
| III. Irreversible           | Absent          | Absent  | Paralysis       | Anesthetic   | None             | Amputation if duration >3 hr |

# 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

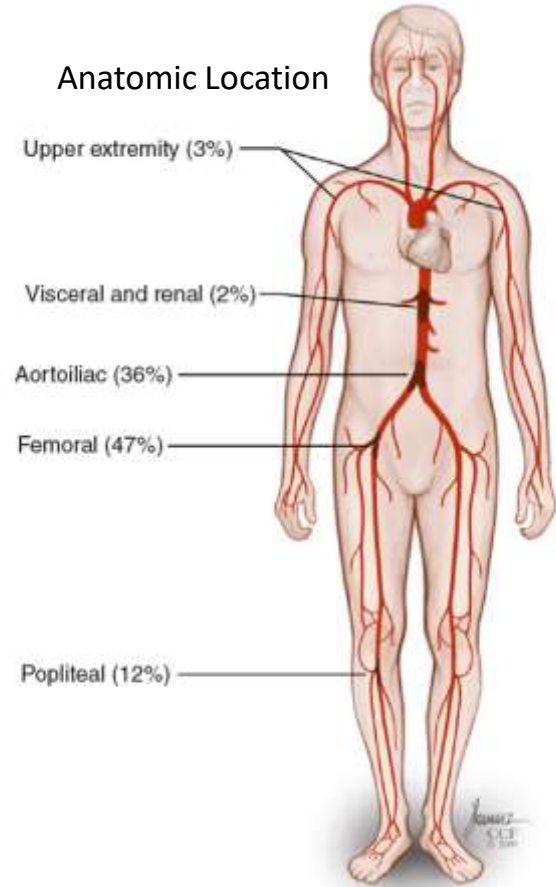
- Thromboembolectomy
  - Best option for embolus without distal thrombosis
  - Rapid restoration of flow
  - Can still use imaging
  - Over the wire embolectomy balloons to guide into difficult branches



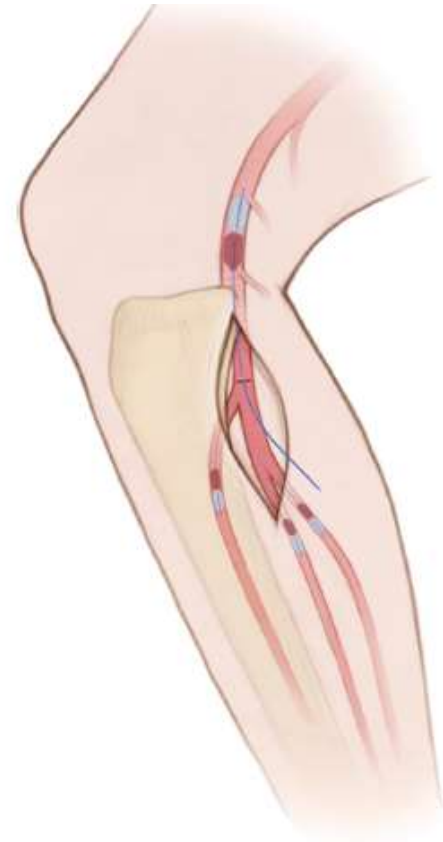
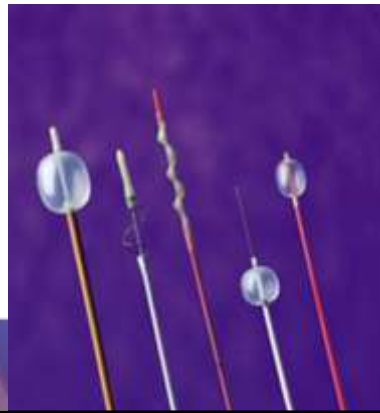
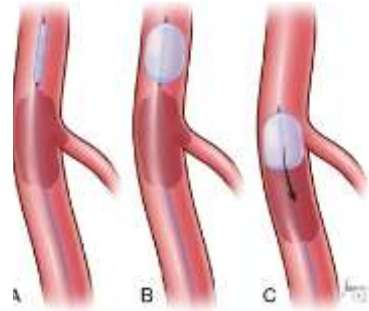
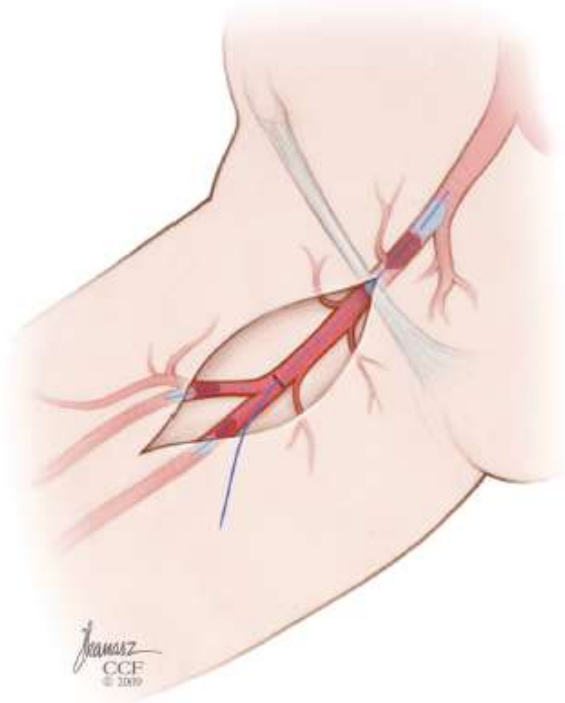


# Etiologies of ALI

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



# Embolectomy



# Rutherford Category

**TABLE I: Clinical stratification of an ischemic extremity: Rutherford classification**

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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

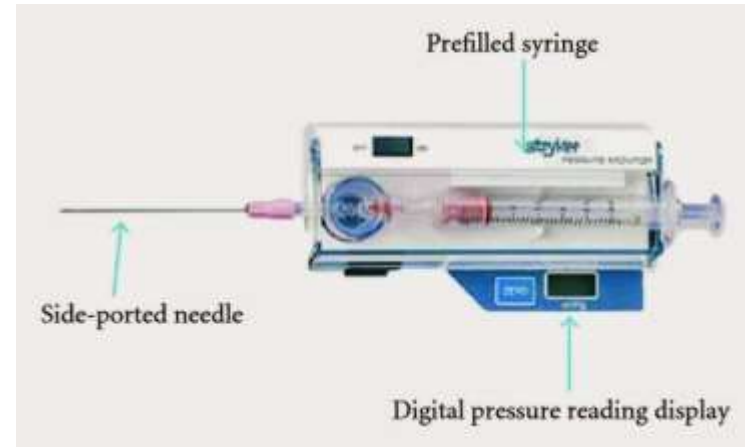
# Compartment Syndrome

- 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
  - $CPP = MAP - \text{Compartment pressure}$
- Critical pressure = 30-50 mmHg
- Measure of all four calf compartments
  - Stryker needle or Aline set up



# When to Do Fasciotomy

- Elevated compartment pressures  $>25\text{mmHg}$
- 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



(a)





# 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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