

Algorithm for Managing Acute Lower Extremity Ischemia

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Disclosure

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I have the following potential conflicts of interest to report:

Consulting: Silk Road, Surmodics, Profusa, CSI, Cardinal, Terumo

Chief Medical Officer: Intact Vascular, Cagent, Vesper

Scientific Advisory Board: Abbott, Medtronic, Boston Scientific

Slides courtesy of Jim McKinsey

Acute Limb Ischemia: Overview

- Lower Extremity Arterial ischemia:
 - Acute-Embolus, thrombosis
 - Acute on Chronic
 - Bypass graft that occludes
 - High grade stenosis that thromboses
- Acute arterial lower extremity ischemia is characterized by lack of blood flow leading to severe ischemia, cell death, loss of limb or life. (muscle death occurs within 6-8 hours of occlusion)
- Outcomes are poor, 30% amputation at 30 days
- In-hospital mortality rates as high as 20%



Acute Limb Ischemia: Etiology

Embolus:

- Cardiac
- Atrial fibrillation 60-75%
- Aneurysms (blue toe syndrome)
- Atherosclerosis
 - Emboli typically lodge where there is an narrowing (at bifurcation's) of the artery:
 - » Femoral – 28 %
 - » Upper extremity – 20 %
 - » Aortoiliac – 18 %
 - » Popliteal – 17 %
 - » Visceral and other – 9 % each

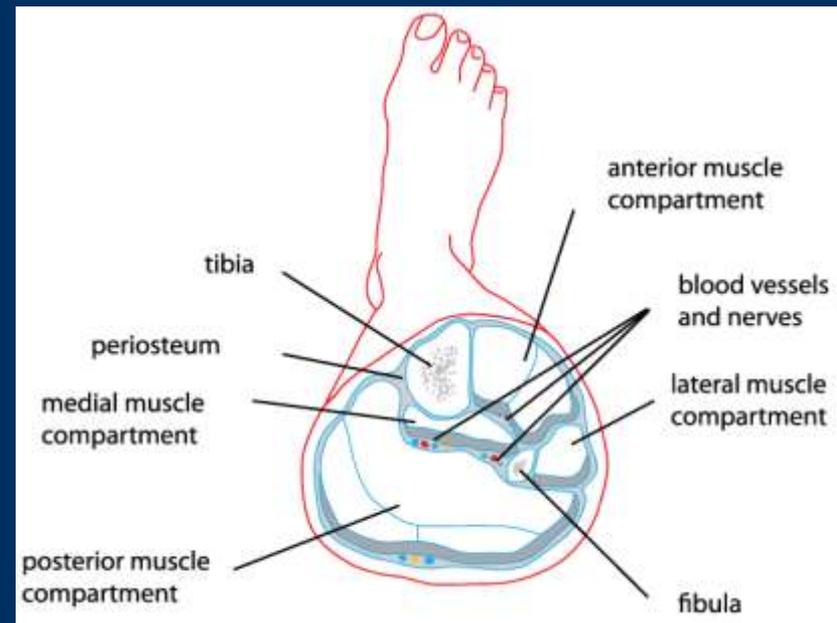
Thrombosis:

- Atherosclerosis
- Hypercoaguable states
- Hypovolemia
- Polycythemia
- Trauma
- Previous bypass surgery
- Iatrogenic

Acute Limb Ischemia: Diagnosis (The P's)

- **Pulseless:**
 - Pulse deficit
- **Paresthesias:** the first sign of arterial ischemia.
 - Most sensitive nerves are in the anterior compartment of the leg, and innervate the dorsum of the foot
- **Paresis:** Motor weakness is the next sign of arterial ischemia
 - Motor nerves are denervated after sensory nerves
- **Pain:**
 - Muscle tenderness is typically a late sign of muscle necrosis/ irreversible ischemia
- **Pallor:**
 - Good sign of distal perfusion

Severity of symptoms influences strategy.



Acute Limb Ischemia: SVS Classification

Category	Description/Prognosis	Findings		Doppler Signals	
		Sensory Loss	Muscle Weakness	Arterial	Venous
I. Viable	Not immediately threatened	None	None	Audible	Audible
II. Threatened					
a. Marginally	Salvageable if promptly treated	Minimal (toes) or none	None	Inaudible	Audible
b. Immediately	Salvageable with immediate revascularization	More than toes, associated with rest pain	Mild, moderate	Inaudible	Audible
III. Irreversible	Major tissue loss or permanent nerve damage inevitable	Profound, anesthetic	Profound, paralysis (rigor)	Inaudible	Inaudible

-Evaluation. TASC classification: determining viability (which will guide therapy)

Acute Limb Ischemia: Treatment

Once diagnosis has been made in absence of absolute contraindication:

- Start IV Heparin with Bolus
- O2 even in absence of pulmonary disease
- Analgesia
- Foley catheter
- IV hydration
- Plan for Intervention:
Imaging (CTA or duplex)

Acute Limb Ischemia: Endovascular Treatment

Endovascular Techniques

- Angiographic evaluation of inflow and outflow

- Percutaneous aspiration thrombectomy (PAT)

- Rapid technique which is applicable with the use of a large lumen catheter (6–8F), Penumbra Cat 8 or Cat 6.

- Percutaneous mechanical thrombectomy

- Mechanical clot dissolution catheters, hydrodynamic/rheolytic catheters, mixed type, and ultrasonic catheters
- AngioJet
- Excimer laser
 - Percutaneous mechanical thrombectomy is recommended in cases of stage Rutherford IIb ischemia and high surgical risk, because thrombolysis is time-consuming and could result in clinical deterioration and/or compartment syndrome.

- Pharmacological recanalization technique

- Operator crosses the occlusion with a guidewire and a multi-side-hole catheter, which allows direct delivery of the thrombolytic agent into the thrombus
- Can unmask arterial stenosis once thrombus is dissolved

Best in patients with moderate ischemia or prohibitive open surgical risk.

Acute Lower Extremity Ischemia: Catheter-Directed Thrombolysis

- tPA (Alteplase)
- Reduced endothelial damage
- Reduction in magnitude of surgical intervention required
 - Underlying lesion exposed
 - Improved outflow through lysis of distal vessels
- May require extended treatment times
- Higher bleeding risk
- May require secondary intervention-surgery, endovascular
- Mechanical thrombectomy devices (combination therapy)

Acute Limb Ischemia: Potential Contraindications to Thrombolysis

- Active bleeding disorder
- GI bleed
- CVA
- Intracranial /spinal surgery
- Head injury
- HTN SBP > 180mm Hg/ DBP > 110mm Hg/Older patients
- CPR – 10 days
- Intracranial tumor
- Pregnancy
- Diabetic hemorrhagic retinopathy
- Recent eye surgery
- Hepatic failure
- Bacterial endocarditis
- Major surgery/trauma

Acute Limb Ischemia: Surgical Treatment

Surgical approaches to the treatment of ALI

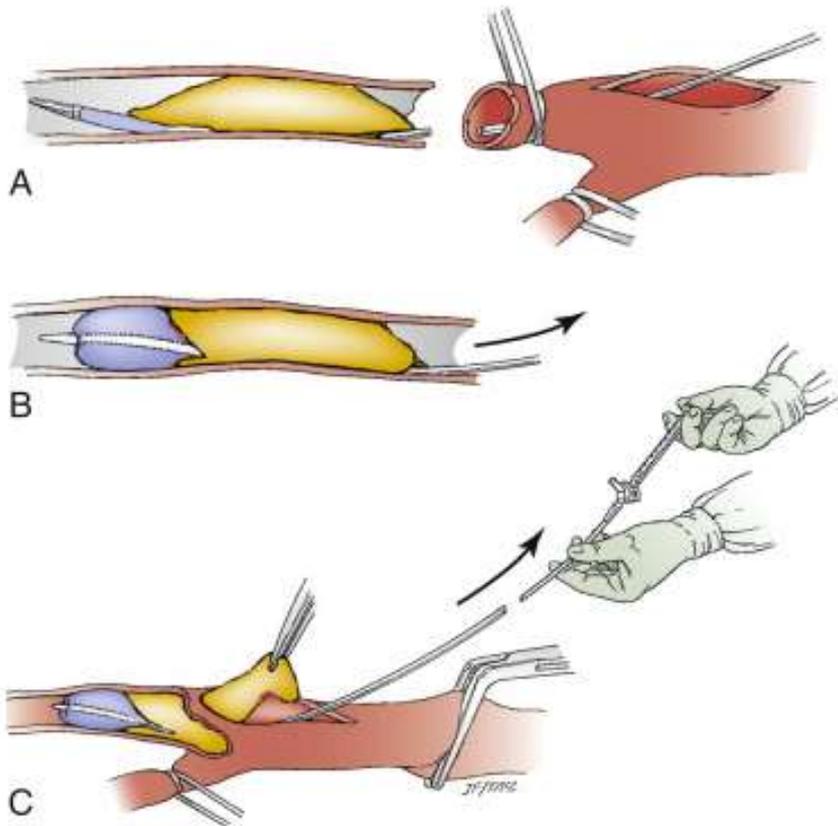
- Thromboembolectomy with a balloon catheter
 - Profound ischemia in the setting of focal embolus
- Bypass surgery, Endarterectomy and patch angioplasty
 - Acute ischemia superimposed upon chronic

Acute Limb Ischemia: Open Surgical Treatment

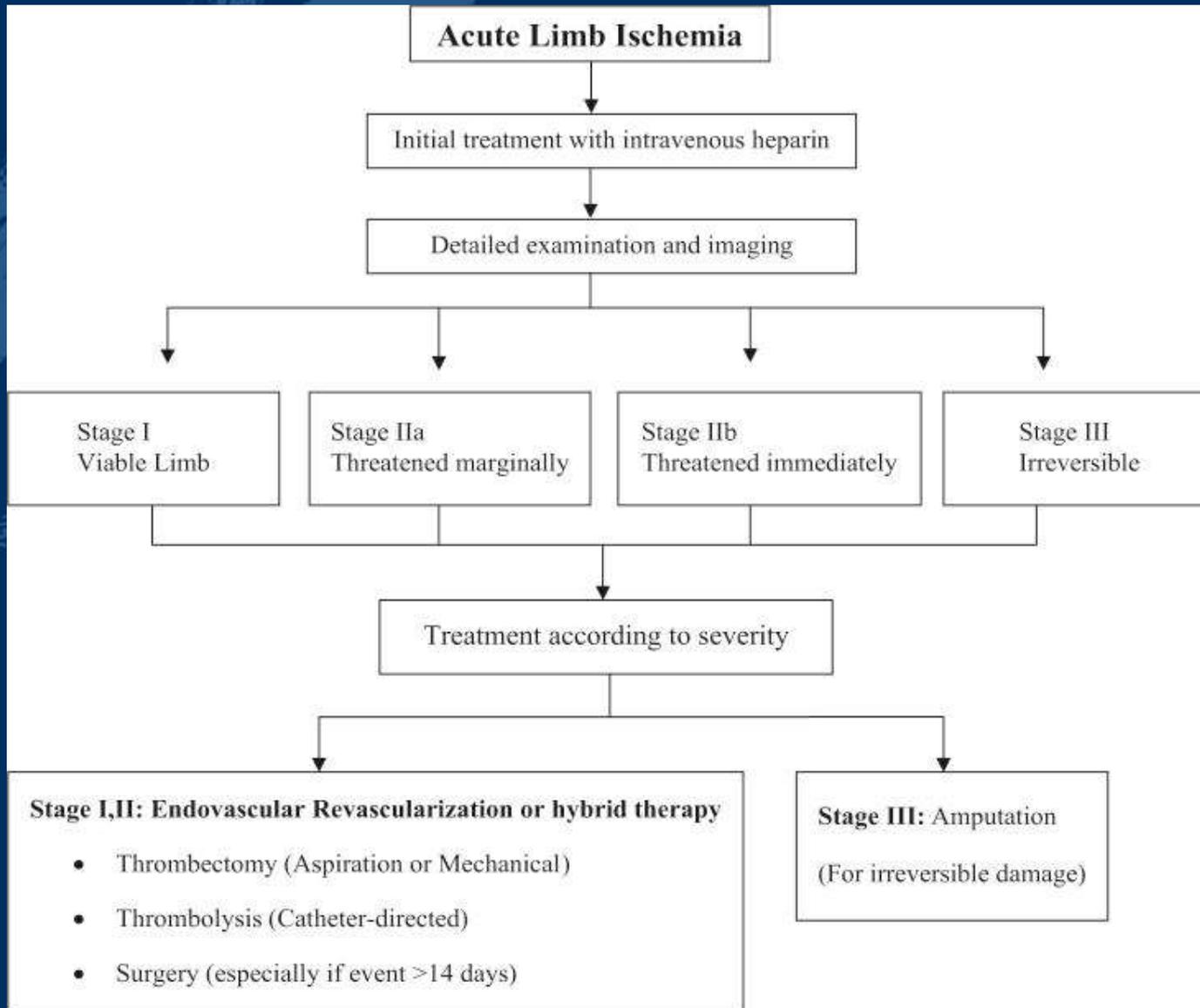
Classic Thromboembolectomy:

- Proximal and distal control
- Catheter passage beyond thrombus
- Withdraw inflated balloon
- Repeat until no residual thrombus

- Can be replaced by:
 - FATE – fluoro-assisted thromboembolectomy



Acute Limb Ischemia: Treatment



Complications After Treatment of Acute Arterial Ischemia

- Reperfusion acidotic washout
- Peripheral muscle edema and swelling
- Compartment syndrome
 - Numbness in distal extremity, tenderness to palpation
 - “Soft calf” on physical exam does not exclude compartment syndrome
 - Measure compartment pressure if in doubt.
 - Elevation of CPK can be caused by Compartment Syndrome

Acute Lower Extremity Ischemia

Conclusion

- Early recognition and treatment is critical for best outcomes for cases of acute limb ischemia
- Consider endovascular treatment first for cases of non-severe acute ischemia
 - Thrombectomy: Mechanical, aspiration, laser
 - Thrombolysis
 - Combined mechanical and pharmaceutical
- Surgical Intervention
 - Severe Ischemia especially with neurologic symptoms and if fasciotomies are required
 - More Chronic Ischemia (14 days)

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