Complications of Lower Extremity Procedures

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Disclosure

• I have no relationships to disclose.

• I have no unlabeled or unapproved uses of drugs or devices in my presentation.

Acute limb ischemia

• Common and potentially devastating problems in vascular surgery
  – Native Vessel
  – Vascular Graft occlusion

• Dependent factors for outcomes in ALI
  – Speed and accuracy of diagnosis and treatment

• 2 distinct phases in physiology of acute vascular and graft occlusion
  – Ischemia
  – Reperfusion

Complications

• Acute limb ischemia
• Graft occlusion
  – Early
  – Mid
  – Late

• Operative management of graft occlusion
• Interventional Management of graft
• Graft infection
• Wound infection

Presentation of Vascular graft Occlusion

• Bypass for severe claudication – if occlude:
  – 50% will present with recurrent claudication
  – 50% will present with severe limb-threatening ischemia

• Better to detect “failing” rather than “failed” graft
  – Diminished pulses
  – Recurrent symptoms of claudication
  – Failure of tissue to heal completely
  – No clinical sign -> ABI not sensitive enough -> Duplex scanning is most important mode of identification

• 300 cm/s and peak systolic velocity ratio across the stenosis > 3.5->correlating with >70% diameter-reducing stenosis

Graft Surveillance

Zierler, R.E., Strandness’s Duplex Scanning in Vascular Disorders. 2009: Lippincott Williams & Wilkins.
Causes of Graft occlusion

- Embolism
  - Atherosclerotic heart disease
  - Coronary artery disease
  - Acute myocardial infarction
  - Arrhythmia
- Vascular Heart Disease
  - Rheumatic
  - Degenerative
  - Congenital
  - Bacterial
  - Prosthetic
    - Artery to Artery
    - Anerysma
    - Atherosclerotic Plaque
  - Idiopathic
  - Paradoxical Embolus

- Thrombosis
  - Atherosclerosis
  - Low-flow states
    - Congestive Heart failure
  - Hypovolemia
  - Hypertension
  - Hypercoagulable states
  - Vascular Grafts
    - Progression of disease
    - Intimal Hyperplasia
    - Mechanical

Causes of Graft occlusion cont

- Trauma
  - Penetrating
    - Direct vessel injury
    - Indirect injury
      - Muscle emboli
    - Proximity
  - Blunt
    - Intimal flap
    - Spasm
    - Iatrogenic
      - Intimal flap
      - Dissection
      - Presence of mechanical device
      - Presence of distal venous thrombosis
      - Venous propagation
      - External compression

Factors contributing to graft occlusion with time

Early causes of Autologous graft failure

- #1 reason for vein failure is technical
  - Avoid by liberal use of angiography or duplex scanning
- Defect in graft
  - H/o superficial phlebitis -> sclerotic changes in segments of vein
  - Injury at harvest or preparation
  - Kinking
    - Be sure to mark vein to avoid kink

Early causes of prosthetic graft failure

- External compression
  - #1 source of prosthetic stenosis
  - Minimized with external support
- Defect in graft
  - Not a typical concern with prosthetic
  - Hypercoagulable state
    - More common in younger pt’s
Other causes of early causes of graft failure

- Hypercoagulable state
  - Suggested by history of thrombophlebitis, prior bypass failure or other thrombotic event
- Heparin induced thrombocytopenia (HIT)
- Extensive DVT
- Thrombocytosis

Mid-term causes of prosthetic graft failure

- #1 cause within 2 years
  - Progression of distal disease
    - More significant with prosthetic conduit
- Infection
  - Rare
  - Requires prompt treatment
- Hypercoagulable state (more common in early period)

Late causes of autologous graft failure

- Most common within 2 years of procedure: Intimal hyperplasia
  - Proximal or distal anastomosis
  - Vein graft
- Most common after 2 years: progression of distal disease
- Rare causes
  - Aneurysmal dilatation
  - Stenotic lesion at inflow or outflow
  - Rupture (rare) (wound infection)

Outcome after arterial occlusion

- 3 determining factors
  - Overall medical condition
  - Degree of ischemia
  - Promptness of management

- Work-up
  - Identify concomitant medical problems
    - MI
    - Unstable hemodynamics

Treatment

- Goals:
  - Relieve ischemia
  - Elucidate cause of thrombosis or embolism
- Techniques
  - Pharmaco/mechanical thrombolysis
  - Operative revascularization

Catheter based thrombolysis and mechanical thrombectomy

- Best for early ischemia
- May assist in identifying causative lesion
- Can be used in tandem with additional endoluminal therapy
- Should not be used for acute severe ischemia (symptomatic, neuro deficit)
- Delay in identifying “non-thrombus” (i.e., aortic atherosclerosis, atrial myxoma, or other tumor embolism)
Mechanical Thrombectomy

Catheter Infusion

• Catheters can be placed within the clotted or thrombosed graft and infusion of TPA over nite or for several hours to reduce clot burden and to return patency of graft

• This is a common approach to graft occlusion

Complications of endovascular repair

• Complications of endovascular revascularization is less frequent.

• Incidence of acute ischemic event is less with an endovascular approach to limb salvage.

• Many of these patients represent with their chronic ischemia

Complications of Endovascular Repair

• Often the approach to these patients is repeat arteriogram

Local TPA or mechanical thrombectomy may be useful

Attempted revascularization with SIA approach but many of these patients may require surgical options

Acute Operative management

• 2 Options: approach at distal or proximal anastomosis
  – Proximal - More common
    • Allows endo approach to distal portion
    • Avoid scarred distal operative site
  – Distal: Allows evaluation of outflow system
    • Correct most common site of intimal hyperplasia
    • Graft thrombectomy with patch angioplasty of distal anastomosis to correct pathology
    • Vein graft thrombectomy is much more technically demanding than prosthetic

Acute Operative management

• If flow limiting stenosis distal to anastomosis
  – Extension with prosthetic or autologous has patency of 30-40% at 3 yrs
  – Preferred to perform entirely new jump graft
Graft revision

- Stenotic lesion in vein graft
  - Short (<5cm) – balloon angioplasty
  - May require use of cutting balloon
  - Long or recurrent stenoses – surgical vein patch
  angioplasty or interposition graft replacement
- Incompletely lysed valve
  - Lyse valve
  - Patch angioplasty
- Lesions at proximal or distal anastomosis
  - Patch angioplasty (most effective when performed prior to thrombosis of graft)

What to do with the thrombosed ePTFE graft?

- Attempted thrombectomy
- Reangio if possible
- Revision and replacement with Vein graft
- Jump graft to lower vessel
- Replacement of entire graft with new graft material

Graft infection

- Relatively uncommon problem
  - 1.5-5% incidence
  - Increased in fem-tib bypass
- Can manifest months to years after implantation
- Organism
  - S. aureus (most prevalent - 25-50%)
  - More common <4 months after implantation
  - S. epidermidis increasing in proportion
  - >4 months
  - Others – Pseudomonas, E. coli, Enterobacter, Proteus
  - Dramatic clinical manifestations – anastomatic disruption

Graft infections - causes

- 3 main causes
  - Intraoperative contamination
  - Hematogenous spread of bacteria
  - Direct contamination of graft by infection emanating from the skin, soft tissue, GI tract or GU tract

Diagnosis of graft infection

- Clinical presentation
  - Cellulitis
  - Soft tissue infection
  - Drainage tract
  - Pseudoaneurysm
  - Septic emboli to foot
- Clinical Findings
  - Fever
  - Leukocytosis with left shift
  and elevated ESR
  - Poor sensitivity
  - Purulent drainage from graft site
  - Splinter hemorrhages
  - Positive blood cultures
  (best taken distal to graft)

- Late infections can appear as healing complication
  - Seroma
  - Pseudoaneurysm
  - Late graft thrombosis with no anatomic reason
  - Systemic signs usually not present

Imaging for graft infection

- Duplex Ultrasound
  - Quick, portable, non-invasive
  - Excellent initial test for interrogation of infrainguinal grafts
  - Good to identify peri-graft fluid collection
- Indium 111-labeled WBC scan
  - Positive predictive approaches 80% to 90% in detecting graft infection
- CT – most sensitive
  - Perigraft fluid or gas collections (greater than 6-8 weeks after implantation)
  - Anastomatic aneurysms
  - Distortion of tissue planes
Management of graft infection

- Indications for removal of entire graft
  - Suture line involvement
  - Suspected suture line involvement
  - Pseudomonas, or gram negative infection
  - Femoropopliteal bypass grafts should be excised in entirety
- Graft preservation can be achieved in some circumstances
  - Debridement
  - Drainage
  - Systemic antibiotics
  - +/- Coverage with a muscle flap

Management of graft infection

- Revascularization
  - Remove graft first
  - Then revascuialization
  - Conduit
    - 1. Autogenous vein or endarterectomy treated artery
    - 2. CryoVein
    - 3. Prosthetic – PTFE preferred to dacron
      - PTFE more resistant to bacterial colonization

Management of graft infection

- Alternatives
  - Remote endarterectomy for SFA
  - Attempt SIA of SFA
  - Cryopreserved cadaver vein or cadaver arterial graft or use of deep femoral vein
    - Best indication for use, other situations show poor patency
    - Advantages: Ease of handling, resistant to infection, appropriate size match
    - Disadvantages: Significant cost, poor medium and long-term patency rates

Wound complications after bypass

- Reported to occur up to 40%
- More from non-healing wounds vs. wound infection
- High risk patients
  - White diabetic female
  - Large skin flaps
- Treatment
  - Hematoma evacuation
  - Non-vital tissue debridement
  - +/- Muscle flap coverage

Summary

- Multi-factorial causes of graft thrombosis
- Identify who is at high risk
- Provide treatment based on common causes of graft thrombosis