Management of Popliteal Aneurysms

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Case Presentation

- 98M presented with
  - R foot pain that had worsened over several weeks
  - Darkening of R 1\textsuperscript{st}/2\textsuperscript{nd} toes x several wks (per daughter)
  - **Known history of R popliteal aneurysm**
  - Recent fall
  - No history of claudication
Case Presentation

• **PMH**
  - HTN
  - CHF
  - Afib on Coumadin
  - CKD
  - DJD
  - SCC/actinic keratosis s/p excisions
  - Parkinson Disease, Dementia
  - Prostate cancer
Case Presentation

• Physical exam pertinent for
  ▫ Non palpable R fem/pop pulses
  ▫ Easily palpable L fem/pop pulses
  ▫ Acute ischemic changes to the R forefoot with cyanosis of the R 1/2 toes
  ▫ Rubrous skin changes on the dorsum of the R foot
  ▫ Non palpable B/L pedal pulses
Pertinent Labs

- INR 2.8

- CTA aorta with LE runoffs performed
CTA Interpretation

- Occlusion of the R external iliac and R common femoral arteries
- R pop artery aneurysm
- Occlusion of the distal R pop artery
- Multifocal stenoses of the R SFA and R profunda femoral artery
Hospital Course

- Coumadin held; given 2 units FFP for OR
- HD #2: Iliac angiogram, balloon angioplasty and stenting of the R external iliac artery
  - successful re-establishment of flow
- Complicated by a short run of ventricular tachycardia
  - responded to lidocaine
  - hemodynamically stable throughout
Postoperative Course

- Lost palpable femoral pulses in OR
- Maintained weakly dopplerable femoral pulse
  - strengthened over next several days
- Coumadin restarted
- R 1st/2nd toes mummified but foot remained warm with sharp demarcation
- Discharged home with home PT/VNS POD #7
Management of Popliteal Artery Aneurysms
Definition

- Normal popliteal artery diameter = 0.7-1.1 cm
  - Aneurysm = 1.5x normal diameter
- True aneurysms
  - Saccular vs fusiform
- Risk factors: HTN, smoking, male, arteriomegaly
- 2nd most common aneurysm, 70% of all LE aneurysms (but incidence is <0.1%)
  - 95-100% male (20:1 M:F)
  - Bilateral in 50%
  - 40-60% have aortoiliac aneurysms
Diagnosis

- Up to 80% asymptomatic at diagnosis
- 30% cause complications
  - Compression (especially when diameter=3cm)
    - Tibial, peroneal, sciatic nerve pain, ipsilateral edema, phlebitis, varicosities
  - Thromboembolism
  - Acute limb threat
  - Intermittent claudication
  - Ischemic rest pain
  - Rupture (4%)
Diagnosis

- Physical exam: unreliable

- Duplex US: more reliable, shows thrombus, patency of outflow vessels, size of aneurysm

- Angiography, CTA, MRA used in operative planning
Operative Indications

- **Thrombosis** (complete thrombosis a CI)
- **Symptoms**
- **Size >2 cm (esp. with wall thrombus)**
  - <2cm: surveillance sonography
    - <1.7cm: 12 mo interval
    - >1.7cm: 6 mo interval
- **Goal:** prevent limb loss by distal embolization or thrombosis of aneurysm
- **Present with acute ischemia?** → 1/3 will need amputation
History

- Aneurysms first described >4000 years ago
  - Ebers Papyrus (2000 BC) described features and treatment of peripheral arterial aneurysms
- Galen (AD 131-200) defined aneurysms as “a localised pulsatile swelling which disappeared on pressure”
- Etymology: Latin “poples” the ham of the leg
History (continued)

- Antyllus (3rd century AD) first described an elective operation + differentiated true from false aneurysms
  - Wilmer (1779): “There is not, that I know, a single case upon record where that operation has succeeded”
- Percival Pott (1714-1788) advocated amputation as the best treatment once symptomatic
  - “I have never seen any other operation than that of amputation which has preserved the life of the patient”
Endoaneurysmorrhaphy

• 1888: Matas described obliterative endoaneurysmorrhaphy
  ▫ Involved tying off all entering vessels, leaving the sac, and obliterating the sac by successive layers of sutures within it
History (continued)

• Up until 20th century, popliteal aneurysms were treated by inducing thrombosis
  ▫ Indications for operating: pain, swelling, rupture
• 1953: Popliteal aneurysms graphically described as “a sinister harbinger of sudden catastrophe”
Compression

• Goal was to thrombose the popliteal aneurysm
  ▫ Either compression of SFA, directly on aneurysm, or a combination
• Failure of compression therapy was treated with proximal ligation
More History

- Enderlen (1863-1963) described excision and re-anastomosis with end to end technique
  - Still used for small, localized aneurysms
- Lexer, Pringle, Bernheim 1912-1915: Reversed saphenous vein graft by posterior approach
  - Direct in-line repair
  - Now largely superseded by ligation and bypass from medial approach
Posterior Approach

- Advantageous for large saccular aneurysms
- Prone position
- Lazy S-curve incision
  - Allows ligation of geniculate vessels and other tributaries

- **Downsides:**
  - *Places tibial/peroneal nerves at risk*
  - May be more difficult to clear thrombus
  - Vein harvest more challenging
History: Medial Approach

- **Edwards (1969):** Exclusion by ligation and revascularization with venous bypass via the medial approach
  - Removal of aneurysm unnecessary to avoid damage to vein
  - 5 year graft patency 70-94% (for elective repair)
  - Significantly higher risk of expansion seen in medial bypass and ligation method compared with posterior approach
    - arterial flow within aneurysm described in up to 1/3 of cases
Medial Approach

- Use for small fusiform aneurysms
- Exposes above and below knee popliteal
- Easy to harvest saphenous vein for harvest
- Conventional bypass/ligation
- Aneurysm should be opened and back-bleeding branches ligated - difficult with medial approach
- **Downside:** genicular braches can lead to endotension
Thrombolysis

- Low dose intra-arterial thrombolysis described in early 1980s
- Complications of bleeding in 5%, ICH in 1%
- Trend is away from use pre-operatively, used perioperatively to clear runoff
Endovascular Popliteal Aneurysm Repair (EPAR)

- First described by Marin in 1994
  - PTFE graft
  - Used in high risk patients with comorbidities
  - Requires favorable anatomy
    - Proximal and distal landing zones >10mm
    - Caliber difference between 2 segments <= 2mm
    - Distal landing zone in infrageniculate popliteal artery
    - Angulation <45°
    - Access artery of large enough caliber
Contraindications:

- Thrombosed aneurysms/ occluded SFA
- Distal embolization
  - Deployment of stent may worsen
- Diffuse aneurysms either:
  - extending above the adductor hiatus involving the entire BK popliteal
  - involving the SFA
EPAR

- Increased rate of thrombosis, repeated interventions
- May have as good medium-long term patency as open (Antonello et al.)
- Meta-analysis (Lovegrove et al.)
  - Short-term graft thrombosis and reintervention rates significantly greater
  - Hospital stay is much shorter
  - Difficult to argue for EPAR as gold standard
EPAR

• 1 year primary patency rates 93%, secondary patency rates 100% (Rajasinghe et. al)
• 5 year primary patency rate 70%, secondary patency rate 76% (Tielliu et. al)
Comparison of PAA Therapies

- Retrospective review of 171 PAA treated 1993-2013
  - 53% asymptomatic
  - 19% presented with acute ischemia
  - 49% had bilateral PAA
    - Mostly small, only 20% required b/l treatment
  - 32% had associated AAA
• Saphenous vein bypass used in 58%
  ▫ 37% popliteal to popliteal
  ▫ 14% popliteal to tibial vessel
• ePTFE bypass used in 23%
• Stent graft used in 19%
• 30 day mortality 1.8%
• 3% underwent reoperation
• 3% required amputation
• popliteal-popliteal bypass with better patency at 24 months using saphenous vein (95%) vs ePTFE (79%)
• Short ePTFE bypasses and stent grafts with similar patency (79%)
Repair Techniques

- Open
  - Medial approach
  - Posterior approach
  - Saphenous vein vs prosthetic
- Endovascular stenting
Outcomes of Open Repair

- Similar results between medial and posterior approach (no randomized trials)
- Patency of saphenous vein superior to graft
- Limb salvage rates following repair directly correlate with number of patent tibial outflow vessels
Question #1

Which of the following is true regarding femoral and popliteal aneurysms?

A. Rupture and approximately 50% mortality are common outcomes of these aneurysms
B. When symptomatic, the aneurysm manifests as lower extremity ischemia caused by thrombosis or distal embolization
C. Femoral and popliteal aneurysms are approximately equal in propensity for complications
D. These lesions are always symptomatic when identified
Question #2

A 75-year-old man with known bilateral popliteal aneurysms presents with acute pain in his right foot. On examination, there are punctate blue lesions on his first 3 toes, no palpable pulses in his foot and a weak popliteal artery pulse. When considering his treatment options, which of the following statements is TRUE?

A. Endovascular stenting should be considered first-line therapy
B. Thrombolysis before operation will improve his outcome
C. 30-day thrombosis rates are equivalent for primary bypass and endovascular stent grafts
D. Future aneurysmal dilation can be prevented by endovascular stenting
E. Antiplatelet therapy is not necessary
Question #3

• An asymptomatic aneurysm requiring early operation is a:
  A. 2-cm iliac artery aneurysm
  B. 2-cm popliteal artery aneurysm
  C. 4-cm thoracic aortic aneurysm
  D. 4-cm abdominal aortic aneurysm
  E. 1-cm splenic artery aneurysm
References


• Rajasinghe HA, Tzillinis A, Keller T, Schafer J, Urrea S. Endovascular exclusion of popliteal artery aneurysms with expanded polytetrafluoroethylene stent-graft: early results. *Vasc Endovasc Surg* 2006;40:460-6

• Tielliu IF, Verhoeven EL, Prins TR, Post WJ, Hulsebos RG, van den Dungen JJ. Treatment of popliteal artery aneurysms with the Hemobahn stent-graft. *J Endovasc Ther* 2003;10:111-6

PREOPERATIVE DIAGNOSES:
1. Critical limb ischemia of right forefoot, with ischemic rest pain.
2. Occlusion of right external iliac artery.
3. Chronic atrial fibrillation.

POSTOPERATIVE DIAGNOSES:
1. Critical limb ischemia of right forefoot, with ischemic rest pain.
2. Occlusion of right external iliac artery.
3. Chronic atrial fibrillation.

PROCEDURE PERFORMED: Right retrograde iliac arteriogram, balloon angioplasty and stenting of occluded right external iliac artery.

ATTENDING SURGEON: Vittorio Rotella, M.D.
RESIDENT SURGEON: Kristen Bridges, M.D.
ANESTHESIA: Local with sedation.
ANESTHESIOLOGIST: Maryam Nia, M.D.

IV FLUIDS:

ESTIMATED BLOOD LOSS: Minimal, 20 mL.

CONTRAST MEDIA: 80 mL Visipaque 320.

IMPLANTS: Gore Viabahn stent graft 13-mm diameter x 10-cm length.

IV MEDICATIONS: Ancef 1 gram periprocedurally, 5000 units intravenous heparin during the procedure.

OPERATIVE FINDINGS: Successful crossing and recanalization of occluded right external iliac artery with balloon angioplasty and stent graft. The patient regained strong palpable right femoral pulse.

COMPLICATIONS: The patient had a short run of ventricular tachycardia at the end of the case which responded to lidocaine. The patient maintained hemodynamic stability throughout the procedure.

INDICATIONS FOR PROCEDURE: This is a 98-year-old male with multiple medical problems including dementia and atrial fibrillation on anticoagulation, who is known to me from the wound care clinic here at the Brooklyn VA, who was seen in consultation early this week on Monday for worsening ischemia of the right forefoot. Daughter was present and relates that the patient has been experiencing worsening pain and cyanotic changes to the right great toe and second toe for the past several weeks beginning on Palm Sunday. Pain and symptoms have progressed over the past several weeks. Apparently the patient had a fall in the recent past. The patient was seen in the podiatry clinic where examination revealed acute ischemic changes to the right forefoot with cyanosis of the right great toe and wound too with
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</tr>
</tbody>
</table>
Primary DX: Peripheral vascular disease s/p Rt external iliac angioplasty and stenting
Onset Date:
Prognosis: Guarded

Secondary: AF, Parkinson's HTN, prostate ca, CKD, DJD
Date:
Prognosis: Guarded

Surgical Procedure: angioplasty and stenting of rt ext iliac artery
Date: Apr 15, 2015
Diagnosis known by: Patient, Family

Medications (name, dose, frequency & route of administration):
Counadin 3mg, diltiazem, tamsulosin 0.4mg,
carbodopa, levodopa (50/100)

Diet/Fluids: low salt

Allergies: SIMVASTATIN yes

DME/Supplies on discharge (specify):

VISITING NURSE ORDERS:
-------------------------
[ ] Hospice Home Care

[ ] Registered Nurse
[ ] Wound Care: Specify: freq:
[ ] Instruct with medications
[ ] Decubitus Care: Specify: freq:
[ ] IV Therapy: Specify:
    [ ] Venous Access
[ ] PEG feedings: Specify:
[ ] Instruct in O2 therapy: specify orders:
[ ] Foley care: specify size & care needed:
[ ] Injections: Specify:
[ ] Trach Care: Specify:
[ ] Diabetic Teaching:
    [ ] IDDM?
    [ ] NIDDM?
### Vitals:

<table>
<thead>
<tr>
<th>DATE/TIME</th>
<th>TEMP</th>
<th>PULSE</th>
<th>RESP</th>
<th>BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/17/15 @ 1730</td>
<td>98.5</td>
<td>76</td>
<td>18</td>
<td>155/75</td>
</tr>
<tr>
<td>PAIN</td>
<td>WEIGHT</td>
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</tbody>
</table>

### PE:
- **Gen:** NAD, resting comfortably
- **CVS:** normal S1, S2, irregular
- **Resp:** b/l CTA
- **Abdomen:** soft, NT, ND, BS+
- **Ext:** Right groin dressing c/d/i, no swelling or hematoma. Leg warm, doppler ++.
- **Foley in place, clear amber urine**
- **Skin:** no erythema, rash

### Labs:

- **PROTHROMBIN TIME:** 30.3 H
- **PARTIAL THROMBOPLASTIN TIME:** 70.9 H
- **INTERNATIONAL NORMALIZED RATIO:** 2.62
- **WBC:** 11.27 H
- **RBC:** 3.57 L