Case presentation

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HPI

- xx y/o M referred to the vascular clinic by his PMD for cyanotic changes to LLE
- pt also c/o worsening rest pain in LLE for 2 weeks
PMH / PSH

- htn
- CAD s/p CABG 15 years ago
- PVD s/p L femoral – popliteal artery bypass 1995, 05/ 2006
- + tobacco use
Physical Exam

- AVSS
- S1, S2; CTA b/ l
- Abd S/ NT/ ND
- Ext: LLE cyanotic, cold to touch
- Vascular: diminished L femoral pulse, dopplerable L popliteal pulse
Labs

- WBC = 7.12; H/H = 14/42; Plt = 243
- Na/K = 135/4.6;
  Cl/CO2 = 100/25;
  Gluc = 101;
  BUN/Cr 28/1.3
- LFT's wnl
- cardiac enz -ve
Studies

- EKG: NSR
- CXR: wnl
- arterial duplex: occluded bypass graft
Hospital course

- pt admitted
- anticoagulation started
- LE angiography: extensive plaques b/l iliacs; occlusion of the LLE bypass graft distal to L CFA, w/ excellent reconstitution of flow in the popliteal a.; 2-vessel runoff with a good supply of the dorsal arc via AT that had reconstituted from the peroneal
Hospital course (cont.)

- OR 7/31/06
- L axillo → deep femoral, deep femoral → popliteal bypass w/ 8-mm ringed PTFE graft
- pt tolerated procedure
- POD#7, hematoma noted on the L axillary incision site
- pt taken back to OR for wound exploration / evacuation of hematoma; repair of bypass graft
Hospital course (cont.)

- no complication post-op
- pt discharged home POD #13
Extra-anatomic bypass
History

- **Freeman & Leeds (1952)**
  - used an endarterectomized SFA to perform a L femoral -> R femoral artery bypass

- **McCaughan & Kahn (1960)**
  - used Dacron graft to perform external iliac -> contralateral popliteal artery bypass in 2 pts

- **Lewis (1960)**
  - first described the use of upper extremity artery for inflow of a graft to a lower extremity artery
History

- **Blaisdell & Hall as well as Loew (1962)**
  - reported axillofemoral extra-anatomic bypass

- **Vetto (1962)**
  - popularized the usage of a subcutaneous femoral femoral artery bypass

- **Shaw & Baue (1962)**
  - reported the usage of obturator foramen bypass for bypassing an infected groin wound
Indications

- **Absolute indications**
  - aortic sepsis
    - mycotic aneurysm
    - aortoenteric fistula
    - infection of previously placed aortofemoral bypass grafts
  - groin sepsis involving prosthetic graft

- **Relative indications**
  - pts with poor risk (e.g. significant cardiac or pulmonary dz)
  - pts unsuited for intra-abdominal procedure
    - hostile anatomic regions
    - extensive aortic calcification
    - multiple previous vascular procedures
    - peritoneal dialysis
Hemodynamic considerations

- Basic principle of vascular bypass: to divert blood from an adequate inflow source to underperfused recipient vascular bed

- Primary concerns for extra-anatomic bypasses are:
  1. the potential of "stealing" blood flow from the distal regions of the donor limb, and
  2. decreased long-term patency in low-flow situations, especially marginal outflow circumstances
Hemodynamic considerations (cont.)

Shin & Chaudhry (1979)

- R -> L external iliac artery bypass w/ occlusion of the L EIA proximal to the distal anastomosis
  - no significant change in flow within the AA before or after the cross-over bypass
  - no evidence of decreased distal flow in the R femoral (donor) a. distal to the cross-over graft
  - no reduction in blood flow in the R distal iliac (donor) a. even with a low-resistance bed of AVFs in the outflow limb of the L EIA (except in profound hypotension)
Hemodynamic considerations (cont.)

Rutherford et al (1987)

- If the outflow distal SFA is occluded, patency of
  - axillofemoral artery bypass decreases from 90% → 40%;
  - femoral - femoral artery bypass decreases from 80% → 50%

- Conclusion: the status of the outflow bed is the most significant predictor of graft patency
Pre-op evaluation

- standard cardiac & pulmonary evaluation
- usually performed under general anesthesia, but can be performed under local anesthesia w/ sedation for pts w/ poor cardiopulmonary reserve
- non-invasive testing to evaluate quality of inflow if necessary
- angiography of infrainguinal vessels
Axillofemoral artery bypass

- pt placed supine w/ the donor arm extended
- incision for axillary a. → transverse incision one finger-breath inferior of the middle & lateral thirds of the clavicle
- SCV → retracted inferiorly
- pectoralis minor muscle → lateral aspect
- s. thoracic a. → divided to allow a more proximal exposure and mobilization of proximal SCA
minor pectoral muscle
minor pectoral muscle retracted laterally

artery

vein
side branches and veins receive loops
Axillofemoral artery bypass (cont.)

- Femoral arteries are exposed via incisions directly over the vessels
- Alternative approach (in groin sepsis or hostile anatomy)
  - lateral approach: profunda femoris artery
  - more distal approach: SFA or popliteal artery
- Tunnel creation
  - posterior to the pectoralis minor → along lateral chest wall → groin
artery emerges dorsally from Poupart
superficial and deep branch are encircled with loops
cutaneous branches of femoral nerve may cross, but must be saved to prevent burning pain postoperatively
Axillofemoral artery bypass (cont.)

- **Proximal anastomosis:**
  - axillary a. mobilized ~ 5 – 6 cm
  - anteroinferior arteriotomy & anastomosis placed medial to the tendon of pectoralis minor
    - minimize the amount of tension on the anastomosis w/ movement of the upper extremity

- **Distal anastomosis:**
  - end-to-side to femoral a.
15 mm arteriotomy following heparin and clamping
dorsal portion of e-t-s anastomosis between artery and 8 mm dacron graft is completed
proximal anastomosis of ax-fem graft is dry
e-to-s anastomosis with common femoral artery using standard 'parachute technique' (see: 'femoral artery dissection' for details)
Axillofemoral artery bypass (cont.)

- **Graft material**
  - Polytetrafluoroethylene (PTFE) usually preferred, but Dacron grafts have been shown to have equal patency.
  - Use of externally supported bypass graft recommended to decrease the potential kinking or compression with movement of the upper torso.

- **Size of conduit**
  - Depends on the caliber of the inflow & outflow vessels.
  - Generally, 8- to 10-mm graft is most appropriate.
**Femoral – femoral artery bypass**

**Indications:**
- Limb salvage in poor-risk patients with unilateral iliac occlusive disease
- Occlusion of one limb of an aortobifemoral artery bypass
- Aortic dissection with compromise of one of the iliac arteries
- Focal CFA sepsis
- Limb ischemia 2° to placement of IABP
Femoral – femoral artery bypass (cont.)

- vertical groin incisions unless groin sepsis
- donor anastomosis is positioned at the medial aspect of the proximal CFA & allow a gentle sweep to the recipient femoral a.
- subcutaneous tunnel created w/ blunt finger dissection in a suprapubic region anterior to the rectus sheath
- distal anastomosis → CFA (or SFA or PFA)
sterile exposure, antibiotics, general or regional anesthesia
tunnelling just ventral of abdominal muscles
hep 5000 prior to clamping, use prolene 5.0, parachute technique, 8 mm dacron vascutek graft
End-to-side anastomosis is completed.
Flush both arteries and graft prior to restoration of circulation
Obturator bypass

- **Indications:**
  - localized groin infection
  - mycotic aneurysms of the femoral a.
  - suppurative groin lymphadenopathy
  - radiation necrosis

- **inflow:** abd aorta, CIA, EIA

- **outflow:** SFA, PFA, popliteal a. (above or below knee)

- **Exposure of recipient vessel is performed first**
Obturator bypass (cont.)

- retroperitoneal approach or a lower midline transabdominal incision approach used to expose the aorta or iliac vessels
- obturator foramen can be palpated posterior to the sup. ramus of the pubis
- obturator vessels & obturator n. lie in the superior lateral position of the obturator canal
- bypass tunnel should be positioned through the medial portion of the obturator membrane
Obturator bypass (cont.)

- medial incision made through the obturator membrane & tunneling device
  passed through the obturator canal →
  medial thigh → recipient vessel
- tunnel should be posterior to the pectineus & adductor magnus muscle
- end-to-side anastomosis to recipient vessel

Complications
- obturator n. or vessel injury
- bladder injury
Post-op care

- most surgeons advocate use of antiplatelet therapy alone post-op
- no data available to support the use of coumadin
- regular post-op surveillance of graft w/ duplex ultrasound
  - peak systolic velocities of <80 cm/s in the midportion of the axillofemoral graft are predictive of graft thrombosis
Results & complications

- Extra-anatomic bypasses are associated with the same if not greater risk of complications than any other arterial prosthetic bypasses.

- Pre-op condition of pts, such as abdominal sepsis and severe debilitation, predispose them to complications, such as hematoma, graft infection, graft disruption, and graft thrombosis due to low cardiac output.
Results & complications (cont.)

- **graft infection**
  - 4% → 8% for axillofemoral artery bypass
  - 3% → 5% for femoral-femoral artery bypass

- **exertional disruption of the proximal anastomosis**

- **primary graft disruption (5%)**

- **operative mortality 5% - 10% in most series**

- **death usually related to cardiac dz or sepsis**
Graft patency

- If there is NO significant arterial inflow stenosis of the donor artery, the femoral – femoral artery bypass has the highest patency of the extra-anatomic bypasses.
# Graft patency in femoral - femoral artery bypass

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>N</th>
<th>1° patency (years)</th>
<th>Operative mortality</th>
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<tr>
<td>Crawford <em>et al</em></td>
<td>1975</td>
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<td>Eugene <em>et al</em></td>
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<td>1988</td>
<td>26</td>
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<td>Francois <em>et al</em></td>
<td>1991</td>
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<td>68%</td>
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<tr>
<td>Self <em>et al</em></td>
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<td>Ricco</td>
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# Graft patency in axillo - unilateral femoral artery bypass

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<th>Year</th>
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<th>4 - 5</th>
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<td>1976</td>
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<td>LoGerfo <em>et al</em></td>
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<td>Ascer <em>et al</em></td>
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## Graft patency in axillo-bifemoral artery bypass

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Summary

- Extra-anatomic bypass grafts have proven to be effective in bypassing infected regions, in avoiding hostile abdomens, and in pts w/ poor risks.

- Antiplatelet therapy is advocated in post-op treatment, and there is no data to support the use of coumadin.


