Complications of Femoral Catheterization

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Case Presentation

• xx yr old female presents with fever, chills, and painful swelling of R groin 8 days s/p diagnostic cardiac catheterization

• US showed no pseudoaneurysm

• CT showed hematoma with subcutaneous inflammatory changes
Case Presentation

- Pt taken to OR for evacuation of hematoma, but en route began to bleed profusely from puncture site

- Pt underwent R groin exploration, CFA-SFA-profunda artery ligation, and PTFE ileo-popliteal obturator bypass
Complications of Femoral Catheterization

- More than 1,000,000 femoral catheterizations done annually in USA

- Range in incidence of vascular complications reported between 0.1%\(^1\) to 6%\(^2\)

2. Waksman et al. Am J Cardiol 1995; 75:886-889
Complications of Femoral Catheterization

- Pseudoaneurysm (PSA): anterior or retroperitoneal hematomas
- Arteriovenous fistula (AVF)
- Infection: local or remote site
- Thrombosis: artery or vein
- Distal embolization
- Dissection
- Femoral nerve damage
Risk Factors for Vascular Complications

- 5,042 pts with PTCA

- Complications included groin hematoma, PSA, AVF, or need for surgical repair in 309 pts (6.1%)

- High risk with female sex, age >65, increased heparin dose during procedure, administration of heparin after procedure, intracoronary stenting

- Controversial risk factors: Systolic BP >140, catheter size

Arteriovenous Fistula
Arteriovenous Fistula
Management of AVF

• Most puncture sites resulting in AVF were found distal to the common femoral artery

• Many AVF close spontaneously, and repair is not required unless symptoms or signs of enlargement develop

• Flow velocities on US do not correlate w/ propensity for AVF thrombosis

Retroperitoneal Hematoma
Management of Retroperitoneal Hematomas

- Review of 9585 pts with femoral artery catheterizations, retroperitoneal hematoma in 45 pts (0.5%)

- 84% required transfusion therapy alone, 7 pts (16%) required operation

- Hypotension unresponsive to volume resuscitation is an indication for urgent surgical intervention

Aortic Dissection
Iliac Occlusion
Tibial Embolization
Atheroemboli
Management of Injured Vessels or Ischemic Extremity

- Surgical treatment depends on:
  - Severity of ischemia
  - Anatomical location of occlusion
  - Physiologic status
Septic Complications

- Review of 9 life-threatening septic complications, 2 deaths

- Prolonged sheath insertion (>24hrs) seen in all cases

- Diagnosis may be prolonged by confusing clinical picture

- Surgical management is complex, and may require staged procedures

Septic Complications

Percutaneous Closure Device Related Infections

- Infections characterized by clinical delay (4-28 days)
- Staph aureus is common causative agent
- Treatment entails debridement of infected materials and bypass with autogenous vein or synthetic graft

Percutaneous Closure Device Related Infections

- 30 studies involving 37,066 pts

- Meta-analysis of randomized trials only showed trend toward less complications using Angio-Seal and increased risk using VasoSeal

- Overall analysis favored mechanical compression over closure devices

**Femoral Artery PSA**

- Lacks all layers of artery wall

- Location of puncture, sheath size, anticoagulants, closure mechanism all affect prognosis

- Complications of PSA include rupture, distal embolization, local pain, neuropathy, and local skin ischemia
Femoral Artery PSA

• Incidence is 0.1-0.2% following diagnostic angiograms and 0.8-2.2% following interventional procedures

• Indications for surgical treatment:
  • Expanding PSA
  • Concomitant distal ischemia or neurological deficit
  • Compromised soft tissue viability
  • Failure of percutaneous intervention

Femoral Artery PSA

• Review of 25,273 pts from 1997 to 2002

• 28 pts with PSA (0.11%)
  • 11 closed spontaneously within 3-7 days
  • Success in 10 pts with US-guided compression
  • Remaining 7 pts operated on successfully

Femoral Artery PSA

- 240 pts with femoral PSA (n = 232) or brachial artery (n = 8) treated with 260 US-guided thrombin injections
  - 107 (44%) received anticoagulation therapy
  - 159 (66%) received antiplatelet therapy

- Primary and secondary success rates 96 and 100% for simple PSA

- Thromboembolic complications occurred in 2 pts and resolved spontaneously

Thrombin Injection of PSA

**PROTOCOL**

1. Reconstitute 1000 U Thrombin with 10 cc NS
2. Examine pedal pulses
3. Prep and drape in sterile fashion
4. Sterile US probe
5. Inject until thrombosis occurs
6. Occlude neck during injection to promote stagnation and prevent thrombin escape
7. Check artery and vein for patency and examine pedal pulses
8. Confirm PSA thrombosis
9. 24 hr bed rest and reduplex in AM
Thrombin Injection of PSA
Low-Dose Thrombin

- Thrombin escape – distal limb thrombosis and ischemia

- 23 pts with femoral PSA treated with US-guided low dose (192 U) thrombin injection

- All PSA successfully thrombosed
  - 1 pt required retreatment due to recanalization at 1 day

Contraindications to Thrombin Injection

- Hemodynamic instability
- Small PSA (<1.5 cm)
- Pressure necrosis of skin
- Vigorous bleeding or rupture of PSA
Collagen Injection

• Review of 110 pts with PSA unsuccessfully treated with US guided compression from 1993 to 2000, and treated with bovine collagen injection

• Primary closure achieved in 107 pts (97.3%)

• 1 pt required operative repair

Thrombin-Unresponsive PSA

- 54 US-guided thrombin injected PSA

- Complete thrombosis achieved in 49 pts (91%), with no significant differences in volume, or neck diameter of PSA between these pts and 5 pts with failed treatment

- Arteriotomy site laceration measured at least 8.0 mm (n = 4) and infection (n = 1) identified at surgical repair

Sheiman RG & Mastromatteo M. Am J Roentgenol 2003; 181:1301-1304
Surgical Intervention: Obturator bypass

- 34 pts, and literature review (57 cases)
  - Postop mortality 14.7%
  - 5 yr limb salvage rate 76.5%
  - 1 and 5 yr patency rates 75.3% and 54.9%

- Comparable to rates documented in the literature (70.8% and 59.7%)

Surgical Intervention: Obturator bypass

- 12 pts from 1992 to 2001

- Treatment included IV antibiotics, groin wound debridement, sartorius muscle flap, and synthetic obturator bypass via lower abdominal extraperitoneal incision

- 10 pts survived
  - Graft patency and limb salvage 80 and 60% at 60 months
  - 2 deaths (MOF at 6 and 9 days postop)

Surgical Intervention: Obturator bypass

- 2 pts with femoral graft infections
- Nonreversed translocated saphenous veins
- No deaths, limb loss, or graft occlusions
- In both cases small-caliber distal saphenous veins precluded performing reversed saphenous vein grafts

Dr. Deitch’s Personal Results

- 20 pts at NYPH, 3 pts at Jamaica Medical Center, 3 pts at Downstate (24 cardiac caths; 2 dialysis catheter related)

- Primary PSA thrombosis in 23/26 pts, 2 with reinjection, combined thrombin injection and compression in 1 pt

- No recurrences, artery or vein occlusions

- All injections well tolerated by pts