POPLITEAL ARTERY ENTRAPMENT SYNDROME

Background
1. Definition: Rare cause of exertional leg pain
   o Due to an abnormal relationship between popliteal artery and surrounding myofascial structures in popliteal fossa.

Pathophysiology
1. Pathology of Disease
   o Structural—multiple variations. May be most important to describe the arterial path.
     ▪ Classification 1
       • Type I
         o Popliteal artery loops medially then deep to normal positioned medial gastrocnemius.
       • Type II
         o Artery lies in normal position but is compressed by laterally displaced edge of gastrocnemius.
       • Type III
         o Medial gastrocnemius has additional musculotendinous slip on lateral side, compressing artery as it runs into muscle bulk.
       • Type IV
         o Artery loops medially and then deep to medial gastrocnemius
         o Is compressed by fibrous bands tethered to artery.
       • Type V
         o Artery and vein loop medially then deep to normal positioned medial gastrocnemius.
       • Type VI
         o Normal anatomy with compression of vasculature during exercise by muscle and tendon structures
     o Functional 2
       ▪ Anatomically normal
       ▪ Muscle hypertrophy constricts artery with contraction.
       ▪ Theoretical compression between medial gastrocnemius and lateral condyle of femur.

2. Incidence, Prevalence
   o Absolute rates of occurrence cannot fully be described due to previously under recognized pathology.
   o Reports of 0.165%-3.5% of general population 3,4
   o Bilateral entrapment common: 27-67% of presenting patients 5,6

3. Risk Factors
   o Young Athletes
   o Male > Female—may be over-representation due to historic predominance of male athletes and military based studies 7
4. Morbidity / Mortality
   o Progressive condition
   o Symptoms correlate with degree of entrapment.
     § Repetitive trauma to arterial intima leads to intrinsic atherosclerosis and/or thrombus.
     § Intraluminal stenosis can lead to poststenotic dilation and aneurysm formation.
     § Distal embolic disease can lead to ischemia.

Diagnostics
1. History
   o Population:
     § Young, active, fit individuals often involved in military or athletics.
     § Higher muscle development may unmask occult pathology.
   o Presentation:
     § 90% with claudication - lower extremity pain at a reproducible duration and intensity of exercise, which resolves with rest.
     § 10% with acute or chronic ischemia signs and/or symptoms
     § Often free of atherosclerotic risk factors due to younger age at onset.
2. Physical Examination
   o Normal at rest
   o Pulses:
     § Decreased dorsalis pedis and posterior tibial pulse in plantar flexion compared to dorsiflexion considered highly sensitive.
     o If aneurismal formation: pulsatile mass in popliteal fossa
     o Venous involvement may occur and lead to exertional leg swelling.
3. Diagnostic Testing
   o Ankle/Brachial Index: ratio of blood pressure in ankle to arm. Calculated by dividing systolic blood pressure at ankle by systolic blood pressure in arm
     § Rest: Normal ABI > 1
     § Stressed (either plantar flexion or treadmill stress test):
       o ABI < 1 suggestive of exercise induced arterial insufficiency
       • Indicates need for further diagnostic testing.
   o Diagnostic imaging
     § All modalities:
       • Test or image bilateral popliteal artery due to common bilateral disease.
       • Bilateral exam of lower extremity in neutral, active plantar flexion, and passive dorsiflexion.
     § Digital Subtraction Angiography (DSA): Historically considered as reference standard.
     § Advantages:
       o Clearly shows anatomic features of arterial lesions
       o Typical popliteal artery findings:
         • Medial deviation of proximal portion
Segmental occlusion in mid-portion
- Post-stenotic dilation in distal portion
  - Suggestive finding: artery patent in neutral but absent in active plantarflexion or passive dorsiflexion.

- Limitations:
  - Invasive
  - Unable to show soft-tissue structures leading to entrapment
  - Unable to differentiate entrapment vs. arteriosclerosis or degenerative causes.

- Doppler Sonography\textsuperscript{11,12}
- Advantages:
  - Quick, inexpensive, non-invasive
- Limitations:
  - False-positive possible
    - Common in athletes with developed musculature\textsuperscript{13}
  - Poor identification of soft-tissue structures

- CT Angiogram (CTA)\textsuperscript{6,11}
- Advantages:
  - Rapid high spatial-resolution images
  - Delineates muscle, vessel, fat tissue, and bone
  - Positional relationship of muscle to artery
  - Provides axial images.
  - Allows grading of stenosis/occlusion
  - 3-D reconstruction aids surgical planning.
  - Better than DSA at evaluating etiology of occlusion from arteriosclerosis and/or thrombus.
- Limitations:
  - Radiation exposure
  - Contrast dye
  - Less specificity in soft tissues than MRI

- Magnetic Resonance Imaging (MRI) & Magnetic Resonance Angiography (MRA)\textsuperscript{11}
- Advantages:
  - Noninvasive, no radiation.
  - Best soft-tissue resolution, superior to CTA.
  - Provides surgically relevant anatomy
  - Able to investigate adventitia of artery.
- Limitations:
  - Expensive
  - Motion artifact common, especially with provocative, active plantarflexion.

**Differential Diagnosis**
1. Key Differential Diagnoses
   - Medial Tibial Stress Syndrome
o Stress Fracture of tibia or fibula
o Muscle Strain
o Tendinopathy
o Peripheral nerve entrapment, superficial peroneal or saphenous nerve
o Chronic exertional compartment syndrome
o Endofibrosis (external iliac artery)

**Therapeutics**

1. **Acute Treatment**
   - Avoid exacerbating activity

2. **Definitive Treatment**
   - Refer to Vascular surgery for surgical treatment.
     - **Structural Entrapment:**
       - Bypass graft or Vascular repair
       - Repair of musculotendinous anomaly
     - **Functional Entrapment:**
       - Musculotendinous resection
   - **Prognosis:**
     - Good to excellent surgical response.
     - Progressive disease without surgical correction.

**References**


Author: Robert Amrine, MD, FMR of Idaho

Editor: Carol Scott, MD, University of Nevada Reno FPRP