

Role of angiography in popliteal artery entrapment syndrome

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ABSTRACT

Popliteal artery entrapment syndrome (PAES) is a rare but potentially limb-threatening disease seen predominantly in young athletes. We present an 18-year-old female avid soccer player, who complained of severe pain in both calves for over a year. Clinical examination and laboratory data were not helpful for diagnosis. Magnetic resonance imaging of both knees was inconclusive. Diagnostic angiography demonstrated bilateral, smooth and focal narrowing of both popliteal arteries only on active flexion and extension. PAES was confirmed by surgery. Our case is unique because of female gender and functional PAES. A review of the literature regarding PAES and its clinical relevance is presented.

Key words: • angiography • popliteal artery

Popliteal artery entrapment syndrome (PAES) is an uncommon clinical entity that occurs due to compression of the popliteal artery by adjacent muscle and tendinous structures (1). Extrinsic arterial compression causes chronic vascular microtrauma, early arteriosclerosis, and thrombus formation that, in turn, cause distal ischemia (1).

Case report

An 18-year-old female soccer player presented with severe cramping pain in both calves for over a year. The pain was increased on exertion and relieved by rest. Past medical and family history were non-contributory, and were negative for diabetes mellitus, hypertension, or smoking. Clinical examination was essentially normal except for difficulty in palpating popliteal arteries, enlarged calf muscles bilaterally and ankle brachial indices (ABI) dropping from 1 to 0.5 on exertion. A complete laboratory analysis was normal.

Magnetic resonance imaging (MRI) of both knees was inconclusive, and did not reveal any pathology to explain the clinical symptoms (Fig. 1). Diagnostic angiography via right femoral artery approach of both lower extremities revealed bilateral (right > left), smooth narrowing of popliteal arteries seen only on active plantar flexion and extension (Fig. 2). Surgical exploration of both popliteal fossae demonstrated a fibrous band compressing the popliteal artery. Slight discoloration of both popliteal arteries was also noted, suggesting early arteriosclerosis. Despite the findings in surgery, the clinical presentation was more severe than expected from a fibrous band compressing the popliteal artery. Hence, a strong functional component rather than an anatomic abnormality of PAES was considered to be the etiology of the symptoms.

This is an unusual case of functional PAES in a woman. Also, the role of diagnostic angiography makes this case important for clinicians and radiologists.

Discussion

The popliteal fossa is a diamond-shaped depression at the posterior aspect of the knee that is bordered by the biceps femoris tendon superolaterally, the semimembranosus muscle superomedially, and the medial and lateral heads of the gastrocnemius muscle inferiorly. The popliteal artery normally courses between the medial and lateral heads of the gastrocnemius muscle. The popliteal artery can be entrapped by neighboring muscles and tendons due to variations that occur during embryologic development of the muscles and arteries (2).

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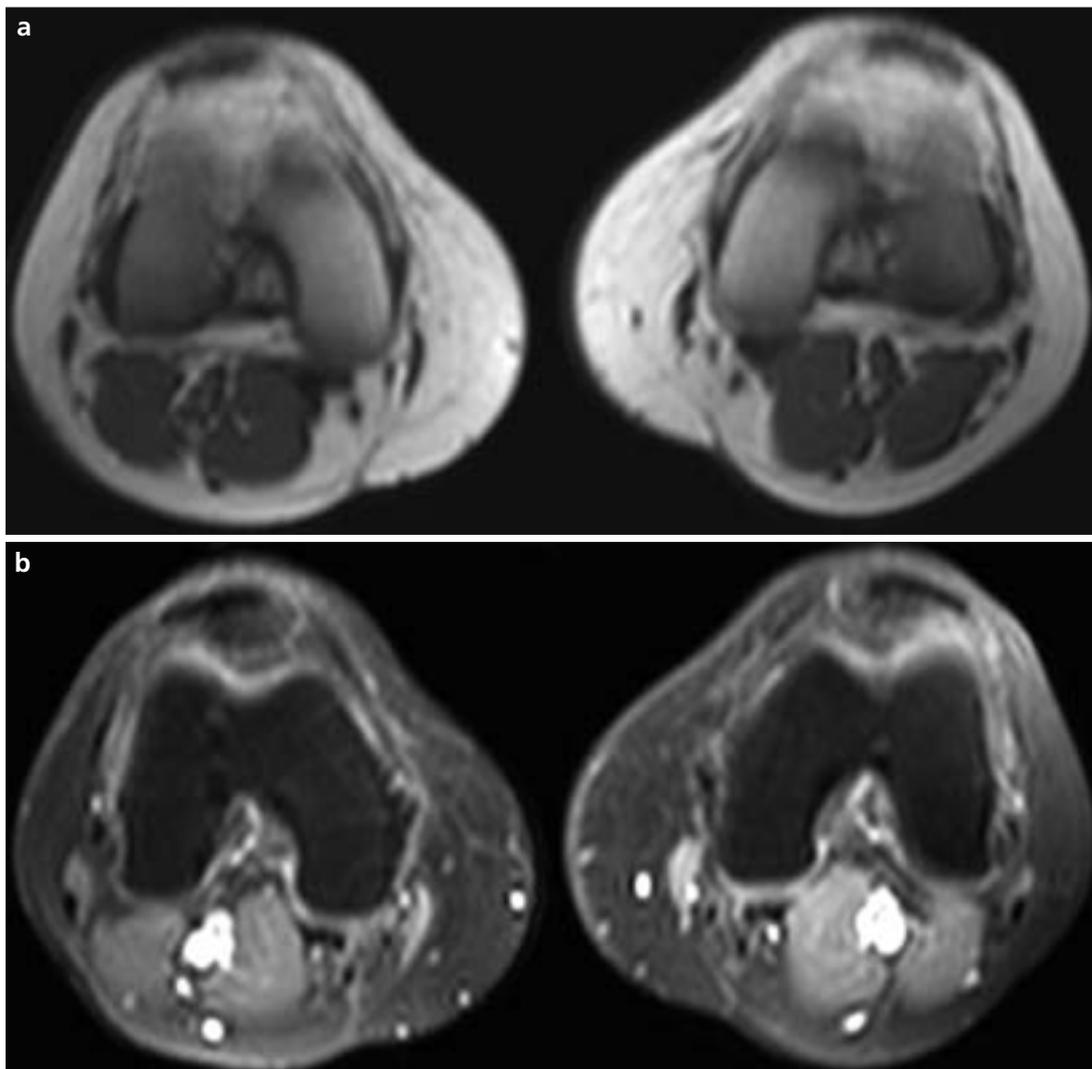


Figure 1. a, b. Axial plane non-enhanced T1-weighted (a) and gadolinium-enhanced fat-suppressed T1-weighted MR images (b) do not reveal any pathology.

There are essentially four anatomic variants of PAES (Fig. 3). Type V is any of the four anatomic variants that include the popliteal vein (3). Recently, a “functional” PAES has been described in patients with normal anatomy (type VI). In such cases, compression of the popliteal artery may be due to an anatomically normal but hypertrophic muscle. This entity is usually seen in well-conditioned athletes (4).

Patients with PAES are typically young (60% <30 years old), healthy males (15:1 male predilection) (3). In young athletes with calf claudication, 60% of cases may be due to PAES (5).

Bilateral popliteal artery involvement has been reported in 22–67% of patients presenting with PAES (6).

Turnipseed (7) found that patients with functional PAES are younger than those with the anatomic types (mean age, 24 vs. 43 years) and are more commonly female (60% vs. 28% of cases), as was our patient.

Patients with PAES usually present with calf claudication and, rarely, with ischemia due to thrombosis. On physical examination, the pulses may be normal, but may disappear or decrease with plantar flexion or dorsiflexion of the foot. Resting ABIs will usually be normal in patients with PAES, but ankle pressures will decrease with exercise. Duplex ultrasonography may demonstrate stenosis on color imaging, and increased velocities with flexion maneuvers. MRI and MR angiography are important noninvasive

modalities that can demonstrate the vessel lumen as well as the surrounding anatomy to help determine if the artery-muscle relationship is normal. Stress angiography (i.e., angiography performed in the neutral position, as well as with the foot in either dorsiflexion or plantar flexion to elicit compression) is usually performed to confirm the diagnosis prior to surgery. Imaging commonly shows a normal arterial lumen when the foot is in the relaxed position, and a narrowing of the arterial lumen during stress maneuvers (4).

Untreated PAES almost invariably progresses to permanent narrowing of the popliteal artery due to repeated microtrauma to the vessel, with subsequent fibrosis making the vessel

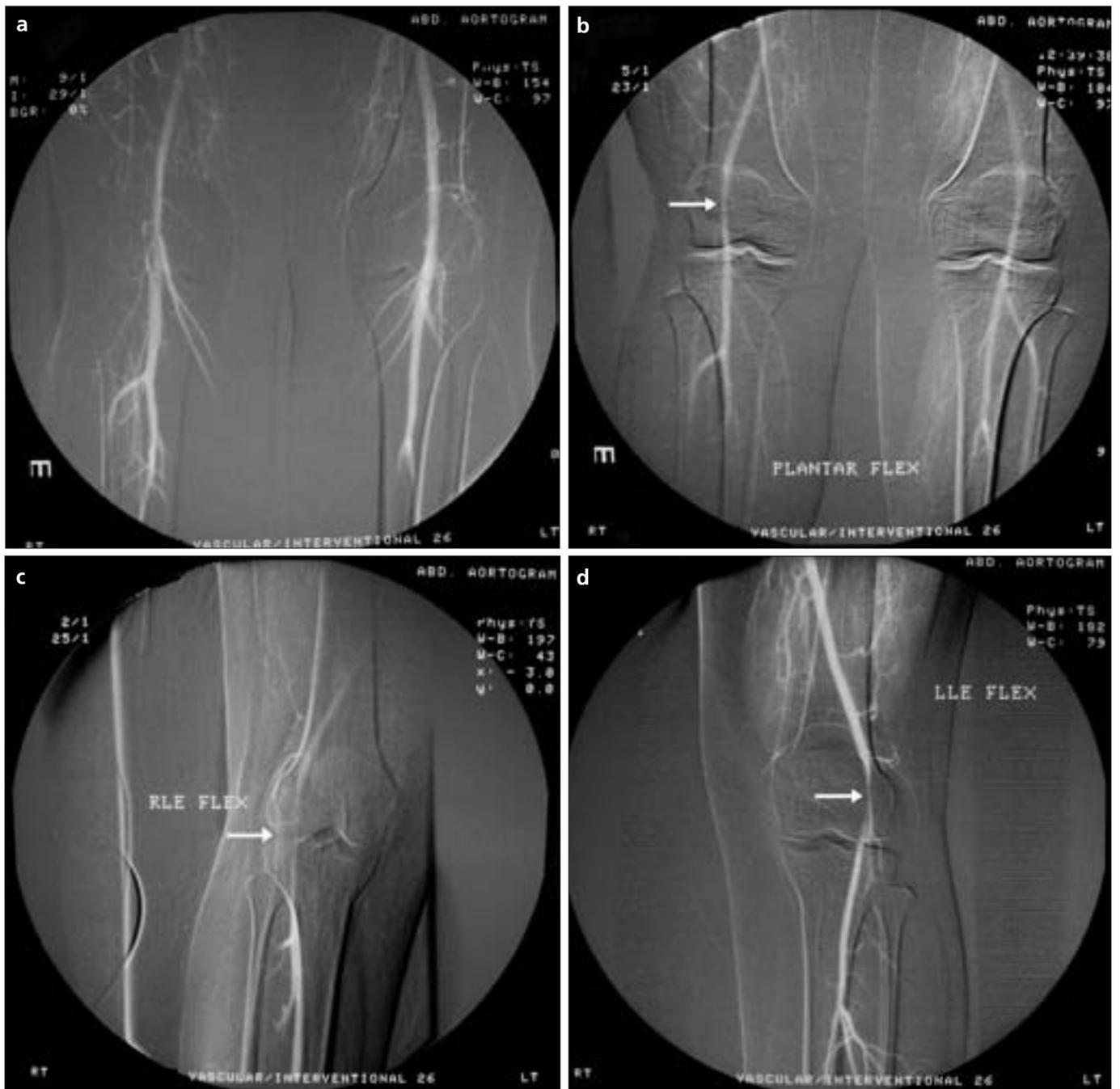


Figure 2. a–d. Bilateral lower extremity angiogram (a) demonstrates no obvious abnormality of the popliteal arteries in neutral position of the knees. On plantar flexion of the feet (b), there is bilateral narrowing of popliteal arteries, right > left. Selective angiograms of bilateral extremities (c, d) demonstrate narrowing of the popliteal arteries (arrows), seen only on plantar flexion, and more significant on the right (c) than on the left (d).

susceptible to thrombosis (5). Surgical release of the muscle or tendon is the treatment in PAES types I–V (5). PAES alone is not an indication for angioplasty or stent placement; however, interventional thrombolysis would be appropriate therapy for patients who present with occlusion due to PAES. Thrombolysis of the distal popliteal

and runoff vessels can be very important prior to surgical correction. The affected segment of the popliteal artery is usually bypassed or replaced if thrombosis has developed due to fibrosis. In patients with functional PAES, myomectomy of the medial head of the gastrocnemius muscle can result in complete relief of symptoms,

but is recommended only for patients with discrete and typical symptoms because narrowing of the popliteal artery with plantar flexion or dorsiflexion may occur in up to 50% of the general population (8).

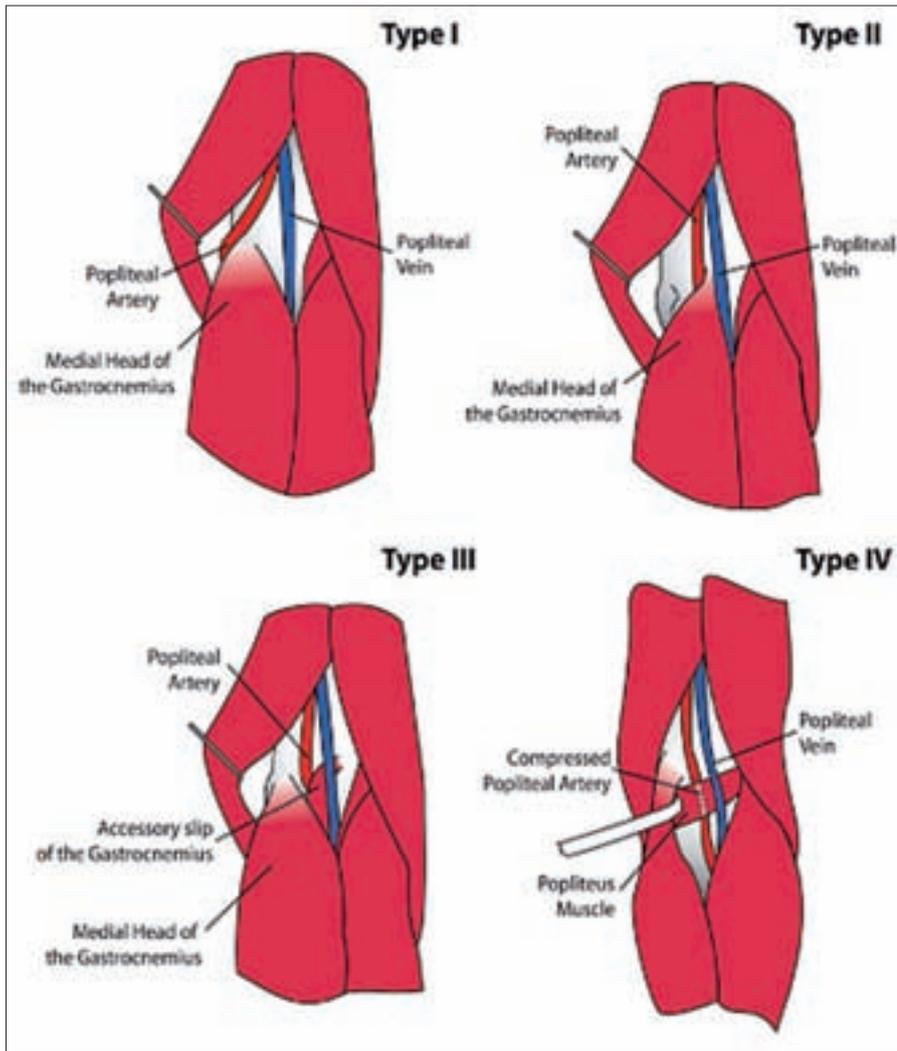


Figure 3. Drawings illustrate the classification scheme for popliteal artery entrapment syndrome (PAES). In type I, the medial head of the gastrocnemius muscle is normal, and the popliteal artery is displaced medially around and deep to the muscle. In type II, the medial head of the gastrocnemius muscle arises from an abnormal lateral position. The popliteal artery descends normally but passes medial to and deep to the muscle. In type III, the popliteal artery is compressed by an abnormal slip of gastrocnemius muscle. In type IV, the popliteal artery is entrapped by a fibrous band or by the popliteus muscle. Type V is any of the four preceding types that includes the popliteal vein. Type VI is functional PAES (normal anatomy).

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