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Case report

Bilateral popliteal entrapment syndrome in a young athlete diagnosed with ultrasound ☆

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ABSTRACT

Popliteal artery entrapment syndrome (PAES) occurs when the popliteal artery is compressed by abnormally developed or hypertrophied muscles adjacent to the popliteal fossa. When symptomatic, it most frequently presents with leg cramping while walking or running. We describe the case of an 18-year-old female runner presenting with claudication and exercise intolerance. After MRI was non-diagnostic, diagnostic ultrasound demonstrated that she had functional (Type VI) PAES. She subsequently underwent popliteal artery release surgery. Type VI PAES should be considered in young, healthy patients who present with claudication, particularly athletes.

Case report

An 18-year-old female with no significant medical history presented with increasing calf pain during exercise after beginning the fall training of her college freshman year. She consistently experienced pain less than a mile into her runs, slowing her times significantly and preventing her from finishing runs. As a Division I cross country athlete, this was especially bothersome.

Popliteal artery entrapment syndrome (PAES) was suspected due to her age and presentation. MRI and CTA studies of the patient's knees demonstrated hypertrophy of the medial gastrocnemius muscle (Figs. 1 and2). However, the results were nondiagnostic of PAES due to failure to perform the imaging with plantar flexion in addition to the standard neutral position. Both popliteal arteries demonstrated mild narrowing and medial displacement; however, blood flow was still visualized bilaterally (Fig.3).

A popliteal artery ultrasound study was then performed. In the neutral position, blood flow through both popliteal arteries was normal (Fig. 4A). However, when she plantar flexed her feet, both arteries neared total occlusion (Fig. 4B). As a result of this study, the patient was diagnosed with functional PAES and referred for surgical popliteal artery release.

☆ Competing Interests: The authors have no declarations of interests relevant to this case report.

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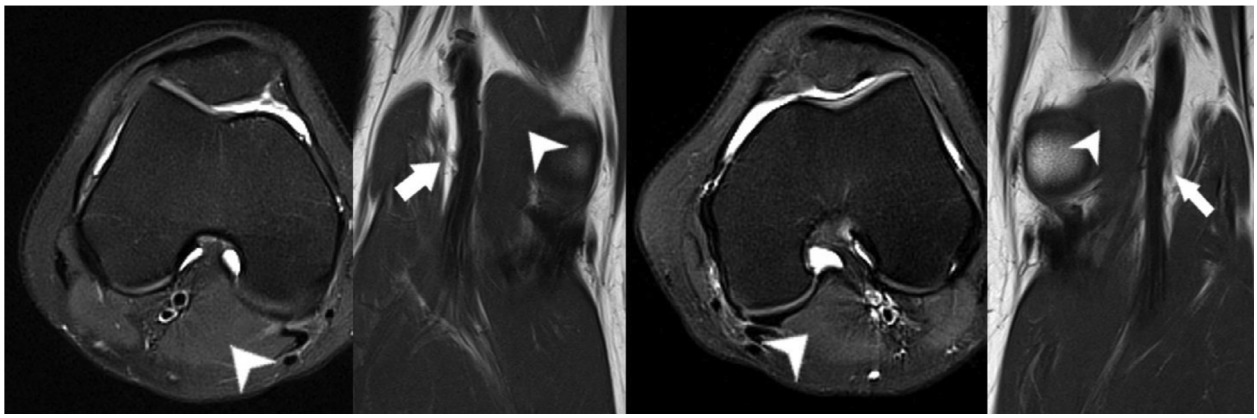

Fig. 1 – Routine bilateral knee MRI. Axial PD FAT Sat and Coronal T1 images of the bilateral knees demonstrate an hypertrophy of an otherwise normal medial gastrocnemius muscle bilaterally (arrowheads) which leads to mild narrowing and medial displacement of the popliteal artery bilaterally (arrows).
1A Right Axial PD Fat Sat 1B Right Coronal T1 1C Left Axial PD Fat Sat 1D Left Coronal T1

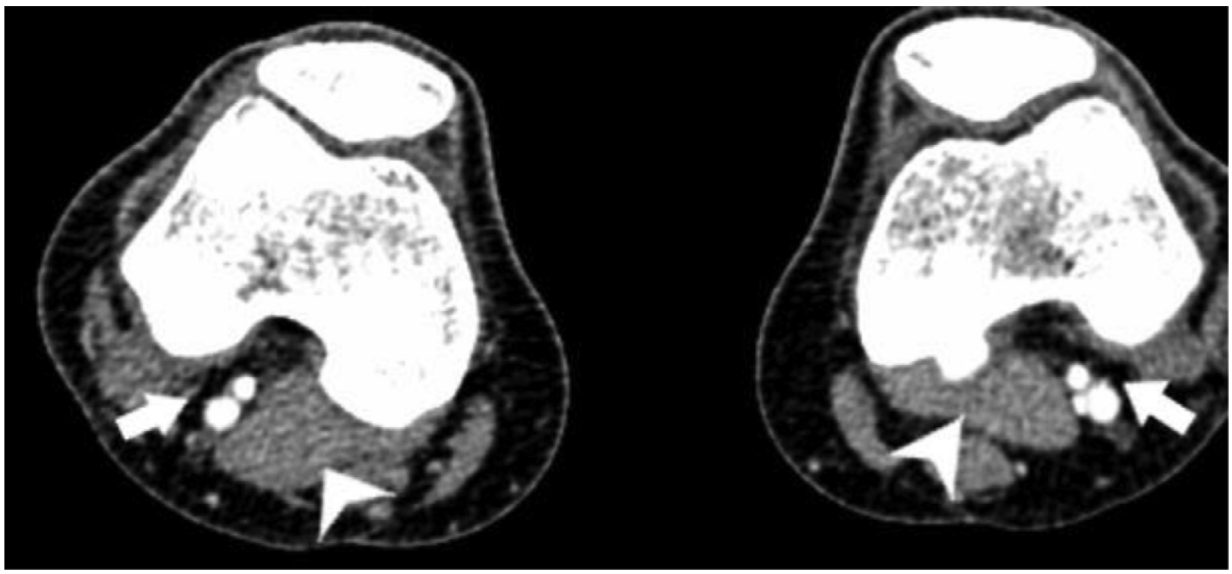

Fig.2 – Bilateral Lower Extremity CTA image demonstrating hypertrophy of the medial gastrocnemius muscle bilaterally (arrowheads) leading to mild medial displacement and narrowing of the popliteal arteries bilaterally (arrows)

Discussion

PAES presents with cramping pain in one or both legs induced by exertion. Claudication almost always occurs after a specific duration of exercise and in the same location [1]. Up to 15% of patients also report foot coldness [2].

Six variations of PAES have been described. In Type I or classical PAES, the popliteal artery lies medial to the medial head of the gastrocnemius muscle. While the popliteal artery still runs the same path in relation to the gastrocnemius, Type II PAES represents a slighter medial deviation of the popliteal artery. If abnormal bands of gastrocnemius muscle or fibrotic tissue arise during embryonic development, the developing popliteal artery can become trapped, resulting in Type III PAES. If the primitive axial artery of the limb bud persists, the popliteal artery will run beneath the popliteal muscles in type IV PAES [A]. Type V PAES involves compression of the popliteal vein in addition to the artery. Patients with Type VI or functional PAES have normal anatomy with hypertrophic muscles that compress the vasculature [3]. Bilateral involvement – as seen in this patient – has been reported in up to two-thirds of those diagnosed with PAES [4].

The classic patient with an anatomic abnormality (Types I-IV PAES) is an older (mean age of 43) male (72%) who leads a sedentary lifestyle (86%) and experiences symptoms after light exertion. By contrast, the typical patient with functional PAES (Type VI) is a younger (mean age of 24 years) female (66%) who leads a highly active lifestyle (90%) [5].

Fig. 3 – Bilateral Lower Extremity MRA Coronal Subtracted Images demonstrates narrowing of the popliteal artery bilaterally (arrowheads).
3A Right and 3B Left Coronal MRA Contrast Subtracted Image

PAES has been historically considered a rare condition; in one study of 1200 patients presenting with claudication, only 5 were diagnosed with PAES [6]. However, another review of cadaveric dissections found PAES incidence was 3.5% [7], leading the authors to conclude that it is often asymptomatic.

Radiography is recommended to eliminate bone or cartilage irregularities as symptom etiology [8]. The first step in diagnosing PAES usually involves the positional stress test (PST). While plantar flexing against resistance, the dorsalis pedis or posterior tibial pulse is taken. Pulse absence indicates a positive test for PAES [2]. Next, imaging studies may be performed to confirm the diagnosis and identify the etiology. Popliteal artery diameter and blood flow are compared between images taken at rest and during plantar flexion. CT angiography is most commonly used, followed by MRI. These modalities help visualize muscle to vessel relationships, facilitating surgical planning [9]. Doppler ultrasound (DU) is less frequently utilized. In 1 study, DU was able to detect PAES 74.4% of the time [2]. DU was necessary to diagnose PAES in this case, as it was the only imaging modality to demonstrate complete compression of the popliteal arteries resulting in the absence of blood flow.

If PAES is left undiagnosed and untreated, the popliteal artery can degenerate. The successive microtraumas from occlusion can manifest as vessel fibrosis, aneurysms, and thrombosis. Once this has occurred, a saphenous vein graft is needed to restore normal blood flow to the lower leg [9], instead of the simpler popliteal artery release surgery.

PAES should be considered whenever a patient presents with claudication, especially when he or she is young, highly active, and lacks risk factors for atherosclerosis. Prompt diagnosis is crucial to avoid potential complications. DU represents a valuable tool for PAES screening, offering the benefits of low cost, wide availability, and the absence of radiation.

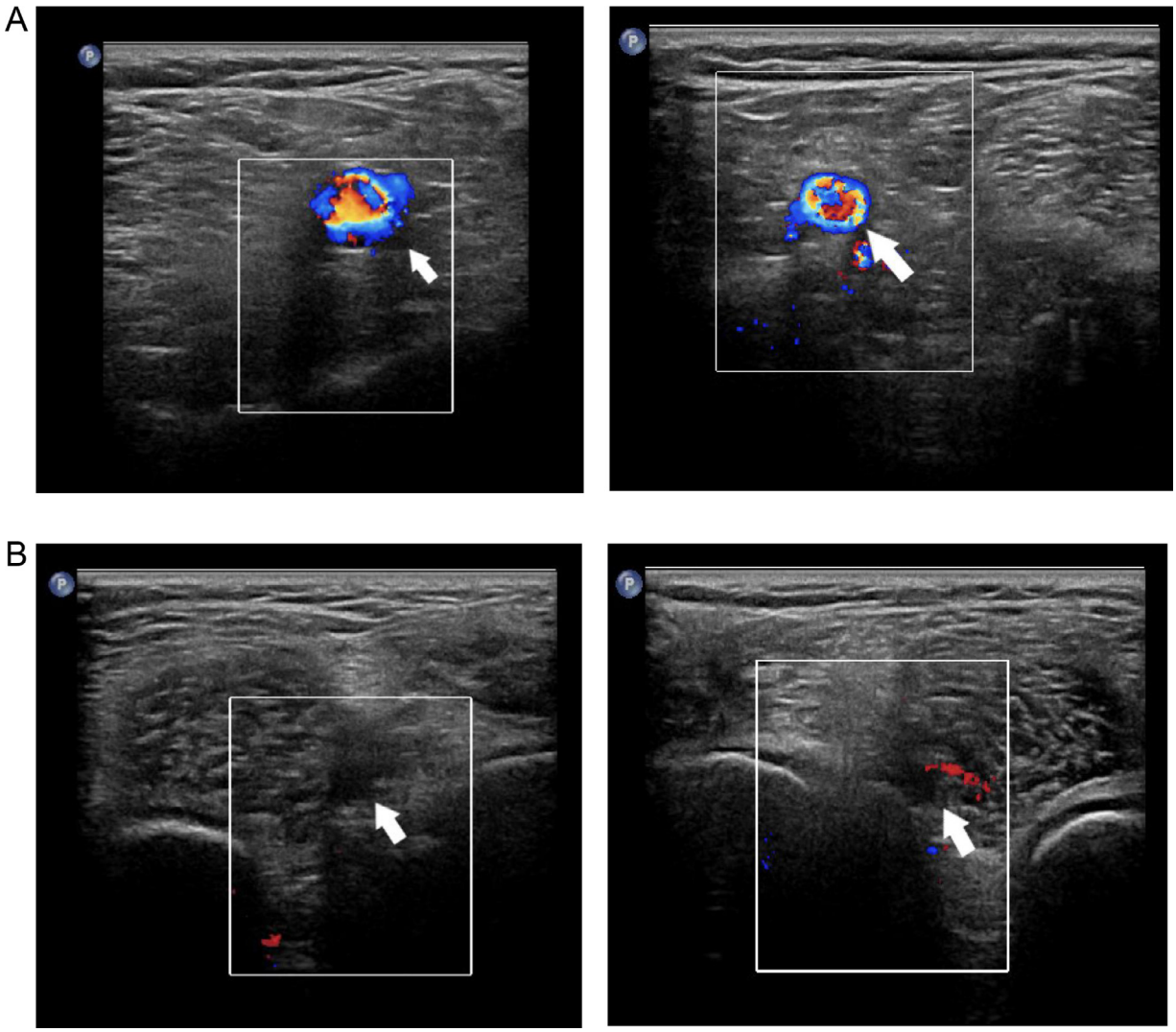

Fig. 4 – (A) Bilateral popliteal artery color images demonstrate flow within the bilateral popliteal arteries during neutral positioning.
(B) - Bilateral popliteal artery color images demonstrate absence of flow within the popliteal arteries during plantar flexion, consistent with popliteal artery entrapment syndrome

Patient Consent

Written, informed consent was obtained from the patient featured in this case report.

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