A Rare Case of Functional Popliteal Artery Entrapment Syndrome- A Potential Misdiagnosis of Chronic Exertional Compartment Syndrome

Sara Judickas DPM, Meghan Roby DPM, Nevin Joseph DPM, Alexa Bykowski DPM, David Epstein MD, FACS, FICA, RVPI

Grant Medical Center
OhioHealth

PURPOSE

Functional popliteal artery entrapment syndrome (FPAES) is a rare disorder most commonly affecting the young, athletic population. The disorder results in functional compression of the popliteal artery during exertion and presents with similar symptoms to those who suffer from chronic exertional compartment syndrome (CECS). The purpose of this case report is to shed light on this rare diagnosis and discuss diagnostic features which should be recognized to prevent misdiagnosis and unnecessary invasive intervention.

LITERATURE REVIEW

Popliteal artery entrapment syndrome (PAES) is characterized by compression of the popliteal artery due to anatomic variability of the artery course.[1] PAES is considered incredibly rare affecting only 0.6-3.5% of the population.[2] Functional popliteal artery entrapment syndrome is a subtype of PAES. Patients present with similar complaints with no anatomic abnormality present.[3] The etiology of FPAES is poorly understood. The cause of entrapment is thought to be from hypertrophied gastrocnemius musculature or soleal band compression which functionally compresses the artery during exertion.[4] Typical presentation involves calf pain, cramping and paresthesias to the extremity. The disorder can mimic other conditions of the lower extremity which can cause a delay in diagnosis.[3]

FPAES is frequently misdiagnosed as chronic exertional compartment syndrome. Both disorders affect a similar patient population and complaints are similar in quality and anatomic location. CECS can be diagnosed using compartmental pressure testing pre- and post-exercise.[5] Diagnosis of FPAES involves advanced imaging modalities including noninvasive vascular testing, magnetic resonance imaging (MRI) and dynamic conventional angiography.[3] Specific testing used to aid in diagnosis is typically completed by a vascular surgeon.[6]

CASE STUDY

A 21-year-old female college softball player presented with pain and paresthesias to her bilateral lower extremities (BLE) that resolved with rest. Physical exam was benign. Compartmental pressure testing revealed elevated pressures in her bilateral posterior compartments. She was then treated for CECS with compartmental fasciotomies at an outside institution. A few years later, the patient presented with recurrent symptoms. Bilateral knee MRI were obtained and revealed normal anatomic contents of the popliteal fossa. Arterial duplex demonstrated elevated popliteal artery velocities. Dynamic conventional angiography revealed near occlusion of bilateral popliteal arteries.

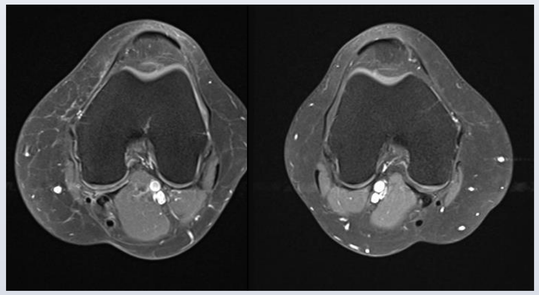

Figure 1: MRI demonstrating normal anatomic course of bilateral popliteal arteries

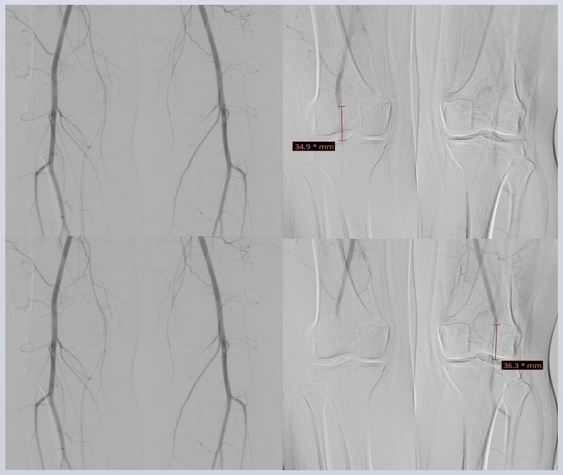

Figure 2: Conventional dynamic angiography demonstrating near complete occlusion of suprageniculate popliteal artery during plantarflexion in bilateral lower extremities

CASE STUDY CONTINUED

Findings confirmed a diagnosis of FPAES and the patient elected to proceed with bilateral medial gastrocnemius head myomectomies.

Surgical exploration confirmed hypertrophied gastrocnemius musculature which was resected. There was no evidence of anatomic abnormality or aberrant fibrous bands. Following muscle resection, intraoperative arterial duplex was used to assess patency through the artery during plantarflexion which demonstrated improved popliteal arterial flow.

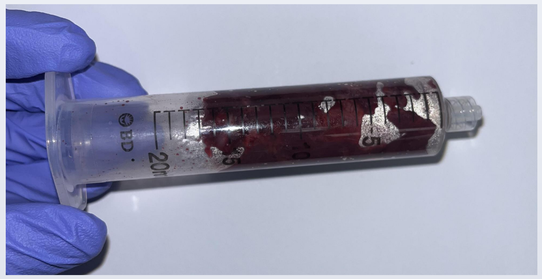

Figure 3: Syringe containing approximate volume of resected gastrocnemius musculature

Postoperatively the patient's incision healed. She completed physical therapy and advanced back to sport activities. There were no complications or recurrence of symptoms.

DISCUSSION

Developing a successful diagnosis of FPAES presents a challenge to providers. Foot and ankle surgeons may encounter CECS in practice and it is imperative functional popliteal artery entrapment remain part of the differential diagnosis. Turnipseed et al. looked at a cohort of nearly 1,700 patients, which demonstrated that almost half of the patients with FPAES had coexistent symptoms of CECS or had been previously treated for CECS. Clinically, patients with FPAES compared to those with CECS often experience a quicker resolution of symptoms post-exertion. CECS symptoms may take minutes to hours for complete resolution. Compartmental pressure testing is paramount to distinguish between the two diagnoses.[5]

DISCUSSION CONTINUED

Specific popliteal artery entrapment protocols have been designed to assess the vasculature at the time of possible compression. Placing a patient in active plantarflexion can cause an increase in arterial velocity indicating compression along the vessel. MRI offers a static view of the contents of the popliteal fossa allowing one to distinguish between functional and anatomic popliteal entrapments. Further testing is more invasive using contrast mediated angiography.[7] As in our case, FPAES was confirmed with dynamic conventional angiography.

Both surgical and nonoperative treatment options have been developed for the treatment of FPAES. Recent literature suggests the use of botox injections may offer symptomatic relief by denervating the gastrocnemius musculature inducing partial paralysis of the muscle which ultimately reduces popliteal artery compression.[8] Further research on conversative measures is needed, but surgical myomectomy continues to be the primary treatment option for FPAES.[3]

CONCLUSION

We aim to educate providers on the clinical signs and symptoms of this disorder which may prompt earlier referral, diagnosis, and hopefully facilitate quicker time to treatment and recovery. Based on clinical suspicion and knowledge, foot and ankle providers should be comfortable recognizing signs and symptoms of functional popliteal artery entrapment syndrome and knowing when to make an appropriate vascular referral for this condition.

REFERENCES

1.Igari K, Sugano N, Kudo T, Toyofuku T, Jibiki M, Inoue Y, et al. Surgical treatment for popliteal artery entrapment syndrome. Ann Vasc Dis. 2014;7(1):28-33.
2.Grimm NL, Danilkowicz R, Shortell C, Toth AP. Popliteal Artery Entrapment Syndrome. JBJS Rev. 2020;8(1):e0035.
3.Lovelock T, Claydon M, Dean A. Functional Popliteal Artery Entrapment Syndrome: An Approach to Diagnosis and Management. Int J Sports Med. 2021;42(13):1159-1166.
4.Gaunder C, McKinney B, Rivera J. Popliteal Artery Entrapment or Chronic Exertional Compartment Syndrome? Case Rep Med. 2017;2017:6981047.
5.Turnipseed, William D. "Functional Popliteal Artery Entrapment Syndrome: A Poorly Understood and Often Missed Diagnosis That Is Frequently Mistreated." Journal of vascular surgery 49.5 (2009): 1189–1195. Print.
6.Causey, Marlin Wayne et al. "Intraoperative Duplex and Functional Popliteal Entrapment Syndrome: Strategy for Effective Treatment." Annals of vascular surgery 24.4 (2010): 556–561. Print. Accessed July 29, 2024
7.Hislop M, Kennedy D, Cramp B, Dhupelia S. Functional Popliteal Artery Entrapment Syndrome: Poorly Understood and Frequently Missed? A Review of Clinical Features, Appropriate Investigations, and Treatment Options. J Sports Med. 2014;2014:105953.
8.Shahi N, Arosemena M, Kwon J, Abai B, Salvatore D, DiMuzio P. Functional Popliteal Artery Entrapment Syndrome: A Review of Diagnosis and Management. Ann Vasc Surg. 2019;59:259-267.