Annals of Surgical Case Reports

Case Report
Published: 25 Aug, 2020

Popliteal Artery Entrapment Syndrome

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Abstract

A Case report of a young patient presented to our vascular surgery department with a claudication affecting the right limb for 8 months. MRT and Angiography examination showed type 3 popliteal artery entrapment syndrome. This syndrome was corrected by resection the fibrous slip and reconstruction of the popliteal artery by using a saphenous vein graft. The postoperative follow up was without complication with disappearance the claudication symptoms.

Keywords: Popliteal artery entrapment; Gastrocnemius muscle; Functional angiography

Case Presentation

In April 2019, a 22-year-old male was admitted complaining of right calf pain accompanied with coldness and numbness for 8 months, which he had experienced during exertion. He was 120 kg in weight, 180 cm in height and smoked cigarettes daily. Physical examination revealed a young man with sinus rhythm, and with pulse rate of 70/min. Blood pressure was within normal range. Right pedal pulses were absent. The Ankle Brachial Index (ABI) was 0.6.

The patient underwent assessment that included Doppler ultrasound, contrast-enhanced Computed Tomographic (CT) and Digital Subtraction Arteriography (DSA). The Doppler ultrasound showed abnormality at the popliteal artery with absent lumen and without Doppler signal (Figure 1).

A MRT scan at the level of femoral condyles showed localized stenosis of the popliteal artery between the femoral condyles. The intercondylar fossa showed a segment of the popliteal artery to be flattened and compressed by muscular structure (Figure 2A and 2B). Using the Digital Subtraction Angiography (DSA), in both the neutral position and functional assisted DSA, showed by complete occlusion of the popliteal artery with a collateral circulation around the occluded vessel was seen (Figure 3).

The decision for surgical repair was taken. The decision was to use a posterior approach to give the best view of the anatomic structures, which were compressing the popliteal artery [1-5].

During the surgical intervention, the popliteal artery at the segment PI showed no abnormality with pulse. At segment PII, there was no pulse to be found and the artery was compressed by muscular slip (Figure 4 and 5). From the anatomy location, this is an accessory fibrous band of the gastrocnemius muscle. By the resection of this segment, it showed a chronically occluded popliteal artery. The popliteal artery at this segment was replaced using an autologous venous graft using great saphenous vein in end-to-end anastomosis technique [6-10].

The subsequent postoperative follow up was uneventful and the patient was discharged in 2 weeks. The patient received oral anticoagulant therapy (Rivaroxaban) 15 mg for 6 weeks, twice daily and then 20 mg once daily, for 6 months.

The patient no longer has any problems upon walking. A 6 months follow up examination showed a normal saphenous vein bypass patency (Figure 4).

Discussion

Popliteal Artery Entrapment Syndrome is a consequence of an abnormal positioning of the popliteal artery in relation to its surrounding structures.

In 1879, Anderson Stuart from Edinburgh was the first to describe the anatomical basis of popliteal entrapment. In 1959, Hamming and Vink performed the first operative decompression at Leyden [5].

Popliteal Artery Entrapment Syndrome (PAE) is an important infrequent cause of serious

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Received Date: *13 Jul 2020*
Accepted Date: *22 Aug 2020*
Published Date: *25 Aug 2020*

Citation:
Qozat A. Popliteal Artery Entrapment Syndrome. Ann Surg Case Rep. 2020; 3(2): 1033.

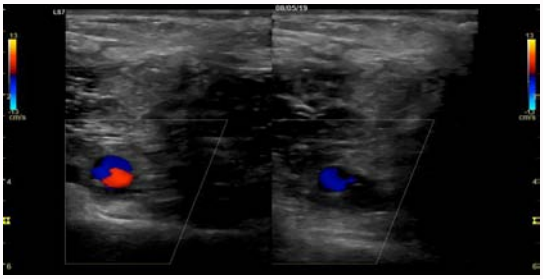

Figure 1: Comparing Duplex examination at the level of popliteal arteries right and left limb with absent signal on the right side.

Figure 2: The intercondylar fossa showed a segment of the popliteal artery to be flattened and compressed by muscular structures.

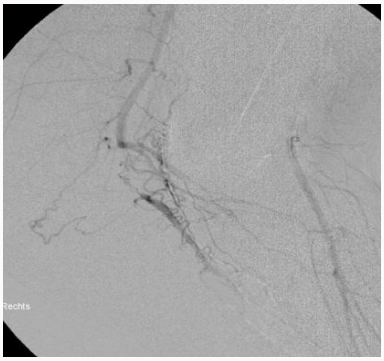

Figure 3: Showed by complete occlusion of the popliteal artery with a collateral circulation around the occluded vessel was seen.

disability among young adults with different anatomic relationships between the popliteal artery and the surrounding Musculo-tendinous structures [11,12].

The PAE term was first introduced in 1965 in Reed General Hospital in USA [6].

The Anatomic incidence is 3 per 86 and the clinical incidence is 17 per 4 million [7-10]. Acute Ischemia appears to be due to non-developed collaterals [7].

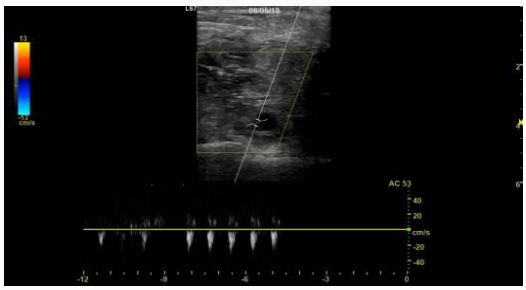

Figure 4: The patient no longer has any problems upon walking. A 6 months follow up examination showed a normal saphenous vein bypasss patency.

Figure 5: At segment PII, there was no pulse to be found and the artery was compressed by muscular slip.

This anomaly usually affects young men (aged 20 to 40 years) as the most common of several unusual entities that cause intermittent claudication in young adults.

Other causes of acute vascular insufficiency of the limb in young persons are premature accelerated atherosclerosis, thromboangiitis obliterans, adventitial cystic disease, adductor canal outlet syndrome, Takayasu's arteritis, and coagulopathy [2].

Most commonly, PAE is found in young sportsmen or soldiers with well-developed muscles, because the exercise and enlargement of muscles adjacent to the popliteal artery exacerbates the consequences of the anomalous relationship between the muscles and artery [3].

Many classification systems were introduced to differentiate between possible different types of PAE. In the Heidelberg classification system [1], the classifications are the following:

- **Type I:** The popliteal artery has an atypical course,
- **Type II:** The muscular insertion is atypical, and
- **Type III:** Both conditions are present.

These abnormal anatomic relationships can produce extrinsic compressions of the popliteal artery and cause vascular damage.

Levin published a detailed classification for the PAE, where type 3 PAE considered by finding a fibrous slip originating from gastrocnemius muscle and producing pressure over the popliteal artery leading to obstruction of the popliteal artery [13,14].

Types of PAE

- **Type I:** Medial head of the gastrocnemius muscle is normal and the popliteal artery is displaced around and beneath the muscle.

- **Type II:** The medial head of gastrocnemius muscle arises from an abnormally lateral position. The popliteal artery descends normally, but it passes medial and goes beneath the muscle.
- **Type III:** The popliteal artery is compressed by an abnormal slip of the gastrocnemius muscle.
- **Type IV:** The popliteal artery is entrapped by a fibrous band or by the poplitieus muscle.
- **Type V:** Any of the types above which include the popliteal vein.
- **Type VI:** Hypertrophied medial head of the gastrocnemius muscle or compression by soleal sling. Functional popliteal artery entrapment syndrome has been described in cases of patient with normal anatomy [10].

There are many clinical examination techniques

There is the positional stress test where the patient is asked to hyperextend his leg and to contract the gastrocnemius muscle by means of an active planter extension or by maximal passive dorsal flexion, which may lead to a popliteal artery compression and the reduction of the blood flow would lead to the disappearance or decrease of pulses of the foot [9]. In this case, the disease was chronic that has led to total obstruction of the popliteal artery with permanent absence of the pedal pulse and unrelated to pulse-examination in relation to limb hyperextension examination.

The Doppler examination uses active planter extensions against resistance and passive dorsiflexion of the foot, which compresses the popliteal artery and reduces blood flow.

We defined a significant stenosis as one of the Peak Systolic Velocity (PSV) as greater than 2. Turbulence with aliasing of a signal is required to diagnose hemo-dynamically significant stenosis. In this case, there was no duplex signal found at the occluded segment of the popliteal artery.

By using the CT [14], the reduction in diameter of the artery was used for grading the stenosis and the diameter of the area of the most severe arterial reduction in any plane was compared to the diameter of the most normal looking segment proximal and distal to the stenosis.

The DSA compared the foot in a neutral position with the arteriography during an active planter extension of the foot for an assessment of compression of the artery in the popliteal fossa [13].

In a classic PAE, the angiographic occlusion of the popliteal artery should be noticed by actively flexing the ankle, but in advanced stages, compression is also seen with active dorsiflexion. Here was found a popliteal artery with contrasting in static and active limb examination.

The best surgical approach is a posterior S- shaped incision in the popliteal fossa, which enables a full exposure of the popliteal artery and the surrounding structures.

Musculo-tendinous division alone is performed for a compressed and undamaged popliteal artery, but for a damaged popliteal artery, a venous interposition bypass using reversed great saphenous vein is preformed. Thromb-endarterectomy is difficult to be performed.

When the lesion extends beyond the adductor canal or down to popliteal trifurcation, reconstruction using a femoro-popliteal bypass is the better solution.

Acknowledgement

I want to acknowledge Prof. Dr. Wozniak for advising me and reviewing my work every step of the way.

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