Popliteal artery entrapment syndrome: case report

Síndrome do aprisionamento da artéria poplítea: relato de caso

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Abstract

Popliteal artery entrapment syndrome is the compression of the popliteal artery and is the main cause of intermittent claudication in young patients. An 18-year-old man was admitted at our service complaining of right foot paresthesia, coldness, and pallor that appeared 24 hours after physical activity. Posterior tibial and dorsal artery of foot pulses were not present in right lower limb. Diminished posterior tibial and dorsal artery of the foot pulses were found in left lower limb at dorsal flexion and forced plantar flexion. After surgery, both pulses were present. This syndrome is more frequent in men and its prevalence varies between 0.16 and 3.5%. Popliteal artery entrapment type III is most common. Non-treated entrapment can lead to embolism, thrombosis and post-stenotic aneurysms. The syndrome must be considered as a cause of lower limb pain specially in young men with intense sport practice history.

Keywords: popliteal artery; constriction, pathologic; /surgery.

Resumo

A síndrome do aprisionamento da artéria poplítea caracteriza-se pela compressão desta artéria sendo a principal causa de claudicação intermitente em jovens. Homem, 18 anos, branco, apresentava parestesia, frialdade e palidez do pé direito, iniciada 24 horas após exercício físico. Em membro inferior direito, ausência de pulsos tibial posterior e dorsal do pé. À flexão dorsal e flexão plantar forçadas, houve diminuição dos pulsos tibial posterior e dorsal do pé à esquerda. Tratado cirurgicamente, o paciente apresentou pulso em ambas as artérias. A síndrome é mais frequente em homens e a prevalência varia entre 0,16 e 3,5%. O aprisionamento da artéria poplítea tipo III é mais comum. A falta de tratamento pode levar à embolia, trombose e aneurismas pós-estenóticos. Esta síndrome deve ser lembrada como causa de dor na perna, especialmente em homens jovens e de prática esportiva intensa.

Palavras-chave: artéria poplítea; constrição patológica; /cirurgia.

Introduction

The popliteal artery entrapment syndrome (PAES) is the clinical result of extrinsic compression of the popliteal artery. It can present as an anatomical or congenital anomaly or as an acquired or functional form. The anatomical anomaly is the result of abnormal embryological development of the popliteal artery or the musculotendinous structures around it; in the functional or acquired form, the artery is compressed as a result of hypertrophy of adjacent muscles[1].

It was first described in Edinburgh in 1879 by medical student Anderson Stuart, who had dissected the amputated leg of a 64-year-man, victim of gangrene by thrombosis of the popliteal artery[2]. Hammings described the first case in which this syndrome was surgically treated (section of the medial head of the gastrocnemius muscle), in 1959[3]. Love and Whelan[4] proposed the name "popliteal artery entrapment syndrome", which has been used since then.

PAES predominantly affects men (15:1)[5,6] and is identified as the main etiology of intermittent claudication in young patients[7,8], with symptoms appearing usually after physical activity. As the artery compression results in repeated trauma, the complications, besides causing incapacity for physical exercise, include: stenosis, emboli, post-stenotic aneurysms and thrombosis[8,9].

The purpose of this article is to report a case of popliteal artery entrapment, discussing its diagnosis, classification,

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Financial support: none.
Conflict of interest: nothing to declare.
Submitted on: 06.27.11. Accepted on: 09.13.11.
J Vasc Bras. 2011;10(4):325-329.

complications and treatment, and to review the literature for non-experts.

Case report

A 18-year-old caucasean male patient, a delivery bicycler, with no medical history, was admitted to our service with right foot paresthesia, coldness and pallor that had appeared when he was riding his bicycle 24 hours earlier. He reported right calf fatigue for over two years and paresthesia when making greater muscular effort while bicycling.

On physical examination, the patient had normal right femoral and popliteal pulses, no pulses in the right posterior tibial and dorsalis pedis arteries and no bruits in the right lower limb. He had paresthesia, coldness and pallor of the right toes, but motor function was normal. Pulses were normal and no bruits were audible in the left lower limb. Reduced left posterior tibial and dorsalis pedis pulses were found on forced dorsal flexion and plantar flexion of the left foot.

Doppler ultrasonography showed no flow in the distal portion of the right anterior tibial and posterior tibial arteries. At forced dorsal flexion and plantar flexion, total compression of both right and left popliteal arteries occurred. The right and left popliteal arteries had a proximal diameter of 0.7 mm, and the right popliteal artery had a distal diameter of 0.9 mm (ectasia).

Preoperative arteriography at rest showed bilateral medial deviation of the popliteal artery, as illustrated in Figure 1. At forced dorsal flexion of the foot, bilateral popliteal artery compression occurred at the knee joint line. Such compression was more pronounced in the right limb. In addition, segmental occlusion of the distal anterior tibial and posterior tibial arteries were observed, as previously reported by Doppler ultrasonography. Computed tomography showed bilateral extrinsic compression of the popliteal artery at forced dorsal flexion, with no identification of the structure that caused the compression.

With the diagnosis of popliteal artery entrapment, the patient underwent surgical treatment. The posterior approach, using the italic S incision was selected (Figure 2). The right limb was operated first. The surgical findings were the same in both limbs, i.e., the popliteal artery was displaced medially of its usual course, not running along the popliteal vein and the posterior tibial nerve between the heads of the gastrocnemius muscles, but medially to the medial gastrocnemius muscle tendon, as illustrated in Figure 3. The popliteal artery was dissected proximally and distally to the compression site and partial myectomy was performed in the medial gastrocnemius muscle, with popliteal artery release (Figure 4). After myectomy in the medial head of the gastrocnemius muscle and popliteal artery release, intraoperative arteriography was performed, with dorsal flexion of the foot, which did not show any compression (Figure 5). The patient presented normal right dorsalis pedis pulse in the immediate postoperative period. The posterior tibial pulse was also present at follow-up.

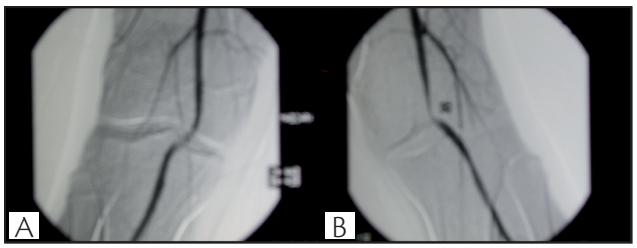

Figure 1. Preoperative arteriography showing bilateral medial bypass of popliteal arteries at dorsal foot flexion.

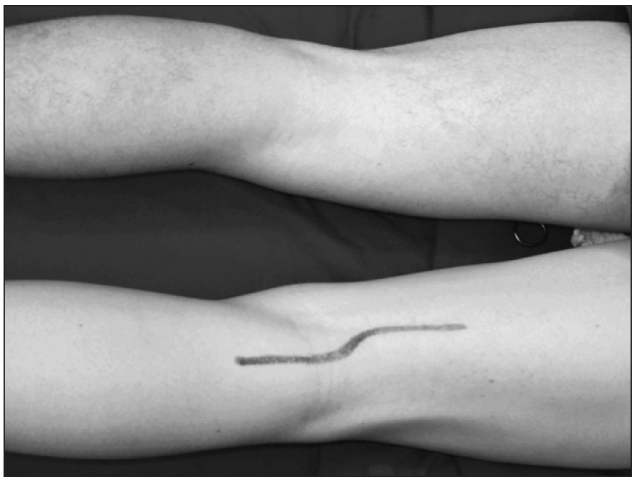

Figure 2. Preoperative italic S marks of the incision for posterior access.

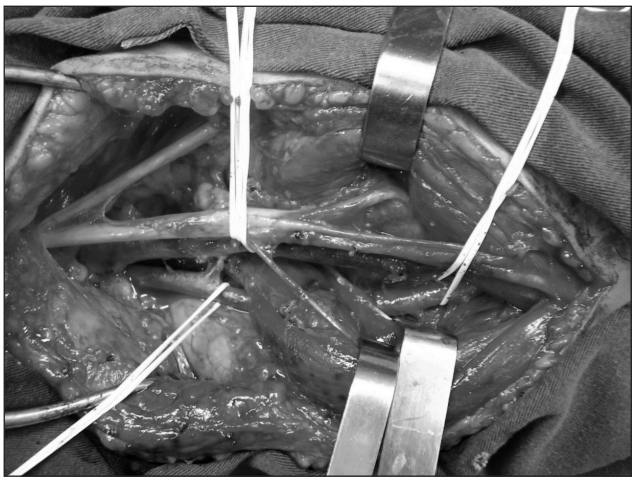

Figure 3. Surgical field showing a normal anatomically insertion of the medial gastrocnemius muscle; the popliteal artery runs medially to the medial gastrocnemius muscle tendon, but does not follow the popliteal vein and posterior tibial nerve that run between the heads of the gastrocnemius muscle.

The patient is under clinical follow-up with pulses prevent even at forced dorsal foot flexion. The same operation was performed on the left lower limb 90 days after the first surgical intervention.

Discussion

Popliteal artery entrapment syndrome is more frequent in men, and most cases are unilateral[1]. Imaging exams are decisive for the diagnosis of this syndrome [10-12], and may include Doppler ultrasonography[10,11], computed axial tomography[12], magnetic resonance[10] and angiography[12]. The latter are more useful for allowing better surgery planning[10,12]. The combined use of more than one imaging exam can be more effective than just one exam[12].

The prevalence of PAES in the general population ranges from 0.16 to 3.5%, and type III is the most common form, affecting 35% of all cases[11]. The patient PAES is young, with a recent history of intense sport practice[13].

A Brazilian study investigated the presence of this syndrome in 42 asymptomatic individuals, half of whom were athletes and half were sedentary subjects. Popliteal compression was detected in 6 individuals (14.2%), 2 (4.7%) in athletes and 4 (9.5%) in non-athletes, with no statistically significant relation between PAES and physical activity[14]. In this study, pocketDoppler exam of the posterior tibial artery and the ankle-brachial index were compared to the Doppler ultrasonography for the diagnosis of PAES. Both showed good sensitivity and specificity and were suggested as diagnostic screening instruments in individuals suspected of having the syndrome[14].

The importance of correct diagnosis and treatment of PAES is reflected on the differential diagnosis and the resulting complications of the disease. The physician should distinguish PAES from arteritis, neurogenic claudication, muscle diseases, adventitial tumors in the popliteal artery, cystic disease of popliteal artery and traumatic causes of lesion in the popliteal artery[11]. Non-treated popliteal artery entrapment can lead, in the anatomical form, to complications, such as stenosis, embolism, post-stenotic dilatation and arterial thrombosis, and in the functional form, to incapacity to practice physical exercises[9,15].

The most common symptoms are: intermittent claudication[9,11,12,16], in 40% of the patients[11], and feet and calf pain, which appear after physical exertion[9,17]. Intermittent claudication - complaints of pain only while walking – can occur[9]. Our patient reported calf fatigue and toe paresthesia during intense cycling, being asymptomatic in the left side, despite the popliteal artery compression at forced dorsal flexion.

It should be observed that the patient had no other diseases, such as diabetes and atherosclerosis[9]. Patients without thrombotic complications have normal pulses with the lower limbs in neutral position and may have

Figure 4. Arteriography during the surgery showing absence of artery compression at dorsal foot flexion.

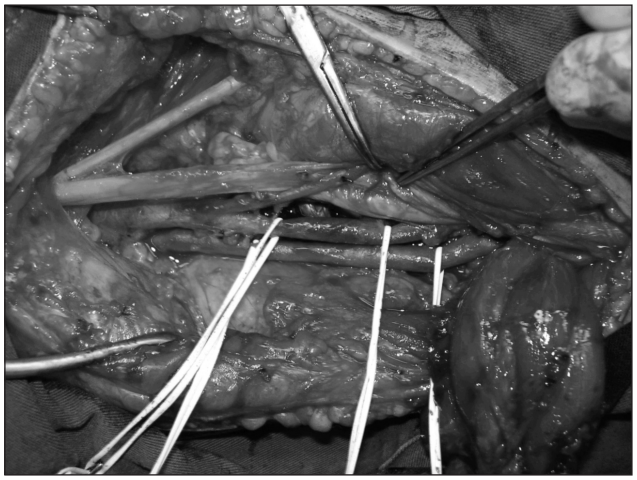

Figure 5. Popliteal artery route correction after a partial myectomy in the medial head of the gastrocnemius muscle.

reduced or no pulses at forced dorsal foot flexion[9]. In the case presented here, there were no posterior and dorsal tibial pulses in the right foot, without popliteal artery thrombosis; what probably happened was an intense artery spasm, due to repeated trauma, as the intraoperative control arteriography after partial myectomy in the medial head of the gastrocnemius muscle showed normal flow in the posterior and dorsalis pedis arteries and pulses were detected at digital palpation.

In Brazil, the first case reports on PAES were made by Ximenes and Ristow et al.[19,20]. Gallicchio and Schaffer[21] and Castiglia[22] were the first to publish Brazilian book chapters on the subject,

Created in 1971 by Delaney and Gonzáles, the classification of the various types of popliteal artery entrapment initially included only types I, II, III and IV[3,9]. In 1979, type V was added by Rich et al.[18]. In 1999, Levien and Veller[8] stated that 50% of the population can have functional compressions and that, in these cases, the treatment should be primarily clinical. Then, type VI was added[8]. Therefore, the most frequent popliteal artery entrapment classification used today is:

TYPE I – Medial deviation of the popliteal artery, medially to the medial tendon of the gastrocnemius muscle that is inserted in the internal condyle of the femur.

TYPE II – The popliteal artery is normal, running anteriorly to the medial tendon of the gastrocnemius muscle that, for having its insertion more laterally than usual, compresses the artery.

TYPE III – The gastrocnemius muscle has an additional tendon, which is inserted more laterally, compressing the artery.

TYPE IV – The popliteal muscle compresses the popliteal artery, with normal anatomy of the gastrocnemius muscle.

TYPE V – The popliteal artery and the popliteal vein are simultaneously compressed.

TYPE VI – Muscle hypertrophy with normal structure, resulting in functional compression of the popliteal artery and the popliteal vein.

Figure 6 shows types I, II, II and IV of popliteal artery entrapment and the normal anatomical relation. The case reported was classified as type I.

The treatment of PAES caused by muscle insertion anomalies has a formal surgical indication, even in the asymptomatic patient[12], thus preventing vascular complications that cause limb loss. In these cases, the operation eliminates the factor that causes entrapment and repairs the artery. We have two approached to the popliteal fossa:

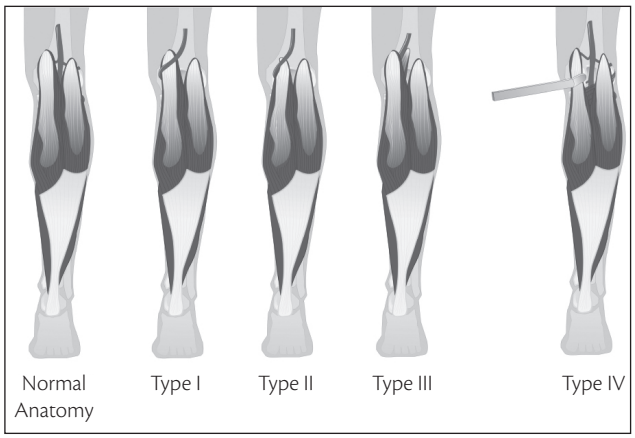

Figure 6. Illustration of the normal anatomy and the various types of popliteal artery entrapment syndrome according to the modified classification of Delaney and Gonzáles.

medial and posterior accesses[3,9,12]. The posterior approach, made through a S shaped incision, allows a better view of the structures, making it easier for the surgeon[12]. The medial approach, which was used for the first time in a functional entrapment case in 1974 by Darling et al.[23], is indicated in the presence of artery thrombosis, to allow dissection of the great saphenous vein to be used as a graft[9,12,15], as well long occlusions, in which a femoropopliteal bypass is required[9]. The question of surgical access to the popliteal fossa is still not a consensus[3]. In the case reported here, the posterior approach was used, with perfect view for treatment of the anomaly. We believe that, in cases of PAES without stenosis or post-aneurysmatic dilatation and with compression only, the posterior access is the best option, as we could explore the whole popliteal fossa without anatomical anomalies going unnoticed and exclude the presence of other factors for stenosis[3].

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Analysis and interpretation: N/A
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Critical revision of the article: ALSF, NMJ
Final approval of the article*: MB, AS, RPH, ALSF, NMJ
Statistical analysis: N/A
Overall responsibility: NMJ
*All authors have read and approved the final version submitted at the J Vasc Bras.