

# What Should Be the First Treatment of Popliteal Artery Entrapment Syndrome

Erdal Simsek, MD,<sup>1</sup> Onursal Bugra, MD,<sup>2</sup> M. Akif Teber, MD,<sup>3</sup> and S. Fehmi Katircioglu, MD<sup>1</sup>

**Introduction:** Popliteal artery entrapment syndrome (PAES) is the rare congenital abnormality. It is a threat to the lower extremity due to ischemia in young adults.

**Case Report:** A 32-year-old health worker (medical doctor) applied to our clinic with a complaint of lower extremity pain, paleness, and coldness, post-exercise. He did not have any complaint to make him think as ischemia. Peripheral arterial angiography was applied, but the main diagnosis was given by magnetic resonance imaging angiography. Medical thrombolytic treatment, femoral embolectomy and then tendon resection, approached posteriorly, were applied to the popliteal region.

**Discussion:** Repeated exterior microtraumas cause thickening in the arterial wall, early atherosclerosis, thrombus and ischemia. To diagnose this entity is difficult. Treatment should be surgical, oriented to abolish the compression.

**Conclusion:** In this case, we wanted to emphasize how quiet the progression of the PAES may be, and effacement of the compression is essential in the treatment. Femoral embolectomy does not have any aid to treatment.

**Keywords:** arterial occlusive diseases, popliteal artery, vascular surgical procedures

## Introduction

Popliteal artery entrapment syndrome (PAES) is the rare congenital abnormality. Stuart defined this syndrome in the amputated leg in the year of 1879. Female to male ratio is 2,93:1.<sup>1)</sup> It occurs as a result of compression of the muscles and tendons near the popliteal artery.<sup>2)</sup> It happens mostly in young males who exercise or who is in the army. Real frequency is not known but in recent studies frequency was reported as 3.5%,

in autopsies.<sup>3)</sup> By the case, we want to emphasize how the PAES can be silent and how important to abolish the compression in the treatment.

## Case Report

A 32-years-old young, active, and exercising health worker was referred to the clinic with complaints of recent coldness and paleness in the right lower extremity after violent effort. In the physical examination, right lower leg was cold and pale. There was no pulse in the arteries of popliteal, tibialis posterior and the dorsalis pedis. He had been smoking 10 cigarettes in a day. Serologically, liver, kidney functions and blood lipid, coagulation tests were normal. Doppler ultrasonography stated popliteal artery as thrombosed. In the emergency conditions, lower extremity arterial angiography was applied. The popliteal artery was completely occluded, and collaterals, in the proximal parts of the posterior tibial and peroneal arteries, were packed with thrombus. Defective appearance was seen in the proximal part of the peroneal artery. There was not any finding of compression in the angiography.

<sup>1</sup>Department of Cardiovascular Surgery, Etlik İhtisas Training and Research Hospital, Ankara, Turkey

<sup>2</sup>Department of Cardiovascular Surgery, Bolu İzzet Baysal University, Bolu, Turkey

<sup>3</sup>Department of Radiology, Etlik İhtisas Training and Research Hospital, Ankara, Turkey

Received: April 11, 2012; Accepted: June 20, 2012

Corresponding author: Erdal Simsek, MD. Department of Cardiovascular Surgery, Etlik İhtisas Training and Research Hospital, Ankara, Turkey

Email: erdaldr@yahoo.com

©2014 The Editorial Committee of *Annals of Thoracic and Cardiovascular Surgery*. All rights reserved.



**Fig. 1** Gastrocnemius muscle compression to the popliteal artery.

The treatment of intra-arterial streptokinase was started to the area of thrombus in the popliteal region as 5000 units in an hour, by a catheter. In the control angiography, some lysis was observed, but the vessel was still obstructed (obstruction was detected as unopened). It was planned to apply femoral embolectomy. The obstructed area was crossed by 3 french Fogarty catheter, high amount of subacute thrombus was detached. The backflow was very good. In the post-operative followups, dorsalis pedis and posterior tibial pulses were filiform. Low molecular weight heparin and oral anticoagulant treatment were started to our patient. 2 days after operation, pulses could not take. Control doppler ultrasonography detected the popliteal area as obstructed again. Right knee magnetic resonance imaging (MRI) visualized the compression effect of the medial part of the gastrocnemius muscle on the artery (**Fig. 1**). Arterial occlusion and collateral development were detected in the angiography (**Fig. 2**). The operation/surgical exploration was planned. Posterior approach to the popliteal area was applied for the best anatomical approach. The medial part of the gastrocnemius that pressed was cut. The arterial wall that was compressed was thick, fibrotic and aneurysmatic. Diseased part was resected, but end-to-end anastomosis was not possible. Proximal part of the artery was dilated due to obstruction. So autogen graft could not be used because of the inadaptable diameters. PTFE graft with a ring of 7 mm was used. Postoperatively the dorsalis pedis and posterior tibial pulses had been taken. 2 days after the operation he was discharged with oral anticoagulant therapy. 9 months after, graft was open in the control, now the patient goes on ordinary life.



**Fig. 2** Arterial occlusion and developed collaterals.

## Discussion

Popliteal artery is the short segment that is affected from atherosclerosis, aneurysm, trauma, arterial thrombus, buerger's disease and popliteal entrapment syndrome. The real prevalence of the PAES is not known, but it was stated as 3.5% in the post-mortem studies.<sup>3)</sup> It occurs bilaterally in 27–67% of cases.<sup>4)</sup> Repeated external microtrauma cause thickening of the arterial wall, early atherosclerosis, thrombus and ischemia. Acute thromboembolic states evolve due to atherosclerosis in the branching areas of the artery.<sup>5)</sup> Whereas, regarding PAES that is related to the compression, thromboemboli occur in the non-branching area. In this type of the emboli, one must suspect from the PAES.

An abnormally growing shape in the muscular and arterial structure can cause different types of the syndrome.<sup>6,7)</sup> The mostly used classification is published by Whelan although many ones are made (**Table 1**). PAES can develop anatomically and functionally. If the muscle is normal and does not cross the artery and adherent to the hypertrophic muscle sheath, PAES is functional. Anatomical PAES patients are older than functional PAES patients (average age 24–43), and patients are frequently male (40–70%).<sup>8)</sup>

Diagnosis is difficult, mostly young, active exercising, and has a lower risk of cardiovascular atherosclerosis according to the men who are the same age. There

**Table 1 PAES Classification according to Whelan and Rich (5,6)**

Type	Classification
I	Atypical shift of the Popliteal artery towards medial, normal MHGM.
II	Abnormal lateral deviation of MHGM and medial deviation of popliteal artery.
III	Compression of accessory part of MHGM to normal positioned popliteal artery.
IV	Abnormal positioned popliteal artery, under the fibrous bands in the popliteal fossa or in the deep part of the popliteal muscles.
V	Any form of the entrapment including both popliteal artery and the vein.

MHGM: medial head of gastrocnemius muscle

is not atherosclerosis in the arterial structure. Together with a sudden and strong contraction of the muscular tendon sheath, there is destruction in the wall of the artery and development of abundant collaterals.

Calf ache, progrediens and intermittent claudication complaint occur in the patients; by way of arterial compression during plantar flexion, dorsiflexion. According to some research, PAES is bilateral in the 25% of cases; but according to the other two studies, the bilateral rate is 67–81%.<sup>4,9,10</sup> In these cases, bilateral symptoms were reported as 25–58%. An asymptomatic quite form, as in our patient, is very rare. Early diagnosis is important for the treatment without compression changes in the arterial wall. So, during the operation only to abolish the compression is enough, without intervene the artery. If the changes in the arterial wall occur, intervention to the artery should be done even you abolish the compression.

MRI is very valuable and noninvasive method, besides it shows the anatomical structure of the popliteal artery, adjacent tissues, their relationship with the artery and external compression.<sup>11)</sup>

Digital subtraction angiography (DSA) findings are nonspecific for many cases and designate anatomical features of the arterial lesion. Typical findings of the DSA are medial deviation of the proximal part of the popliteal artery, segmental occlusion in the middle part, and post-stenotic dilatation of the distal part.

Rosset, et al. detected occlusion in the 36%, deviation in the 24%, aneurysm or ectasia in the 9% and dynamical stenosis in the 32% of the cases with the DSA.<sup>9)</sup> Additionally, distal crural emboli occur in the 43% of the cases. DSA does not detect the soft tissue problems resulting with occlusion.

Doppler ultrasonography is fast, cheap, noninvasive method that helps to the diagnosis. It gives lesser information about soft tissue according as MRI.

Computed tomography angiography is also other valuable diagnostic method. It distinguishes bone, muscle and adipose tissue in the popliteal fossa. It displays the relationship between artery and surrounding tissue.<sup>12,13)</sup>

Symptomatic, progressive PAES must be treated because repeated microtraumas cause progressive fibrosis, thrombus, and acute occlusion. According to one study, early elective surgical treatment is the mostly preferred method and complication ratio is found more in an emergent surgery.<sup>14)</sup> Standard treatment of the PAES is the resection of muscle and tendon that press on artery and if necessary, surgical intervention composing bypass graft. According to the literature, direct thrombolysis and percutaneous transluminal angioplasty combined with decompression surgery can provide recovery without doing surgical bypass.<sup>15)</sup>

## Conclusion

PAES, diagnosed at a young age (before 50), occurs as a progressive and symptomatic or asymptomatic disease. Early intervention can be done for the progressive, symptomatic case, but emergency conditions can be met in asymptomatic cases. In young patients, in a case of an affected popliteal artery, PAES should be suspected, even if it is asymptomatic. There is no help to do femoral embolectomy, moreover it can be harmful. The disease progresses so quiet that sudden acute ischemia can be the result. Remind PAES in case of sudden, acute ischemia in young adults that exercise if there is not any known risk factor for atherosclerosis, and intervention should be planned according to this.

## Disclosure Statement

The authors do not have a conflict of interest.

## References

- 1) Psathakis D, Psathakis N. Popliteal compression syndrome: an overproportional incidence. *VASA* 1991; **20**: 256-60. (in German)
- 2) Insua JA, Young JR, Humphries AW. Popliteal artery entrapment syndrome. *Arch Surg* 1970; **101**: 771-5.
- 3) Gibson MH, Mills JG, Johnson GE, et al. Popliteal entrapment syndrome. *Ann Surg* 1977; **185**: 341-8.

- 4) Collins PS, McDonald PT, Lim RC. Popliteal artery entrapment: an evolving syndrome. *J Vasc Surg* 1989; **10**: 484-9; discussion 489-90.
- 5) Karabay Ö, Yürekli İ, Hassas E. Akut extremity ischemia. *Türkiye Klinikleri J Gen Surg-Special Topics* 2008; **1**: 26-31.
- 6) Whelan TJ, Haimmovici H. *Vascular surgery: principles and techniques*. 2nd ed. New York: McGraw-Hill, 1984; pp 557-567.
- 7) Rich NM, Collins GJ, McDonald PT, et al. Popliteal vascular entrapment. Its increasing interest. *Arch Surg* 1979; **114**: 1377-84.
- 8) Turnipseed WD. Popliteal entrapment syndrome. *J Vasc Surg* 2002; **35**: 910-915.
- 9) Rosset E, Hartung O, Brunet C, et al. Popliteal artery entrapment syndrome. Anatomic and embryologic bases, diagnostic and therapeutic considerations following a series of 15 cases with a review of the literature. *Surg Radiol Anat* 1995; **17**: 161-9, 23-7. (in English, French)
- 10) Kim HK, Shin MJ, Kim SM, et al. Popliteal artery entrapment syndrome: morphological classification utilizing MR imaging. *Skeletal Radiol* 2006; **35**: 648-58.
- 11) Tercan F, Oğuzkurt L, Kizilkılıç O, et al. Popliteal artery entrapment syndrome. *Diagn Interv Radiol* 2005; **11**: 222-4.
- 12) Radonić V, Koplić S, Giunio L, et al. Popliteal artery entrapment syndrome: diagnosis and management, with report of three cases. *Tex Heart Inst J* 2000; **27**: 3-13.
- 13) Müller N, Morris DC, Nichols DM. Popliteal artery entrapment demonstrated by CT. *Radiology* 1984; **151**: 157-8.
- 14) Halliday AW, Taylor PR, Wolfe JH, et al. The management of popliteal aneurysm: the importance of early surgical repair. *Ann R Coll Surg Engl* 1991; **73**: 253-7.
- 15) di Marzo L, Cavallaro A, Sciacca V, et al. Surgical treatment of popliteal artery entrapment syndrome: a ten-year experience. *Eur J Vasc Surg* 1991; **5**: 59-64.