Case Report

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Endovascular treatment of popliteal artery aneurysms: A report of three cases

Elif Coşkun, Levent Altınay, Anıl Tekin, Ufuk Tütün

Department of Cardiovascular Surgery, Medicine Faculty of Bülent Ecevit University, Zonguldak, Turkey

ABSTRACT

Popliteal artery aneurysms (PAAs) are the most common arterial aneurysms of the lower extremity. In recent years, technological developments in health sciences have provided us to adapt the endovascular treatment approach, which is the most commonly used intervention in the treatment of this pathology, currently. Herein, we represent our experience in three cases with a PAA who underwent endovascular treatment.

Keywords: Complication; endovascular stenting; popliteal artery aneurysm.

Popliteal artery aneurysms (PAAs) are the most common forms of peripheral arterial aneurysms with an incidence of 1% in the overall population.[1] Abdominal aortic aneurysms and PAAs frequently coexist in many cases, and the incidence of bilateral PAA is about 50%.[2] It is more common in older (>60 years) male population, and atherosclerosis is the most common etiology, followed by other causes, such as entrapment of popliteal artery, collagen tissue disorders, infections, and traumas.[3] In the majority of cases, these aneurysms are asymptomatic. The main symptom is claudication or rest pain in the lower extremity. A popliteal artery aneurysm typically contains mural thrombi, which makes the risk of embolism of distal arteries is non-negligible. Herein, we represent our experience on endovascular repair of three cases with PAA.

CASE REPORT

Case 1- A 66-year-old male patient was referred to our clinic by the health practitioner with chronic left leg pain. He had a history of operation due to herniated nucleus prolapses five years ago. He was an ex-mine worker with comorbidities including hypertension for 10 years and smoking history of 1 to 1.5 packs/day for 30 years. The laboratory analysis showed normal results, except for increased low-density lipoprotein level (LDL: 212 mg/dL). His physical examination findings were normal. A 1.5-cm popliteal artery aneurysm with a 12-mm mural thrombus was observed on arterial Doppler ultrasonography (DUSG) of the left lower extremity. On bilateral lower extremity computed tomography angiography (CTA), a 13-mm fusiform aneurysm with a 5-mm mural thrombus in the right popliteal artery and a 16-mm fusiform aneurysm with a 12-mm mural thrombus in the left popliteal artery were observed (Figure 1a). The patient was scheduled for an endovascular intervention with the diagnosis of bilateral PAAs.

Operation technique

A written informed consent was obtained from the patient. The right common femoral artery (CFA) was cannulated with a 6F introducing sheath under local anesthesia. After the administration of a standard-dose intravenous heparin (1 mL, IV), lower extremity angiography which revealed the fusiform aneurysm in

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Correspondence: Elif Coşkun, MD. Bülent Ecevit Üniversitesi Tıp Fakültesi Kalp ve Damar Cerrahisi Anabilim Dalı, 67600 Esenköy, Kozlu, Zonguldak, Türkiye.
e-mail: drelfco@gmail.com

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the right popliteal artery was performed (Figure 1b). A 0.035×260 cm hydrophilic-coated guidewire was passed through the aneurysm sac with the help of 0.035x135 cm SpeX (SpeX shapeable tip, Reflow Medical Inc., San Clemente, CA, USA) support catheter. Then, a 5×60 mm Heliflex TI (Hexacath, Rueil-Malmaison, France) peripheral self-expandable bioactive stent and a 7×80 mm MC-Peripheral 6F II self-expandable stent (Medicut Stent Technology, Pforzheim, Germany) were placed consecutively to cover the aneurysm sac. A balloon dilatation (7×60 mm Oceanus 35 balloon, iVascular, Life Vascular Devices Biotech, S.L, Barcelona, Spain) was performed in these stents. Then, the left CFA was cannulated with 6F introducing sheath and left lower extremity angiography was performed. The fusiform aneurysm in the left popliteal artery was visualized (Figure 1c). A 5×40 mm Heliflex TI peripheral self-expanding bioactive stent was placed to cover the aneurysm in the same fashion. No intraoperative complication occurred during the procedure. The patient was discharged with acetylsalicylic acid 100 mg/day and clopidogrel 75 mg/day. At two months of follow-up, the patient had no vascular complaints.

Case 2- A 92-year-old male patient presented with pain and cyanosis in his right foot for about a week. On the right lower extremity DSUG examination, a 2-cm PAA including partial thrombus material and total occlusion of distal arteries were observed. He had a history of indecisive prostate gland malignancy diagnosis. He received no regular medication. The ejection fraction was 20% on transthoracic echocardiography. There were no abnormalities in his laboratory examinations, except for increased white blood cell count ($20.49\times10^3/\mu L$). The pulses of the right posterior tibialis artery and dorsalis pedis artery were not palpable on physical examination. He had physical signs of distal arterial embolism and motor deficit below the knee (Figure 2a). On the lower extremity CTA, a totally thrombosed 3×3 cm arterial aneurysm in the right popliteal artery was observed, and the patient was scheduled for urgent endovascular intervention.

Operative technique

A written informed consent was obtained from the patient. After standard heparin (1 cc, IV) administration and catheterization, lower extremity angiography was performed. The aneurysm sac in the right popliteal artery was unable to be visualized due to the thrombus material inside. A 0.035×260 cm hydrophilic-coated guidewire was introduced through the aneurysm sac with the help of 0.035×135 cm SpeX support catheter. Then, a 6×60 mm iVolution (iVascular, Life Vascular Devices Biotech, S.L, Barcelona, Spain) peripheral self-expandable bioactive stent and a 6×80 mm MC-Peripheral 6F II (Medicut

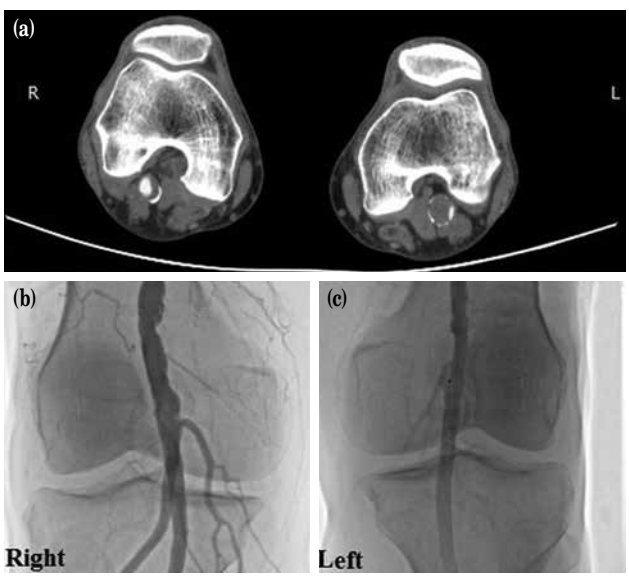

Figure 1. (a) Bilateral popliteal artery computed tomography angiography presenting 13-mm fusiform aneurysm in 2-cm segment of right popliteal artery and 16-mm fusiform aneurysm in 2.4-cm segment of left popliteal artery. **(b)** An angiographic image of right popliteal artery aneurysm. **(c)** An angiographic image of left popliteal artery aneurysm.

Figure 2. (a) A macroscopic view of right lower extremity before intervention. **(b)** Computed tomography angiography image of a 3×3-cm totally thrombosed aneurysm of right popliteal artery. **(c)** An angiographic image of right popliteal artery.

Stent Technology) self-expandable stent were placed consecutively to cover the aneurysm sac. A balloon dilatation was performed to the endovascular stents using a 6×80×140 mm Oceanus (iVascular) balloon dilatation catheter. The procedure was completed uneventfully. However, the patient underwent right lower extremity amputation.

Case 3- A 69-year-old male patient presented with an acute onset left leg pain to the emergency response clinic. He had a history of hypertension and chronic renal disease. In the laboratory examinations, LDL 177 mg/dL, creatinine 1.7 mg/dL, and blood urea was 57 mg/dL. All the peripheral arterial pulses were palpable, and no signs of ischemia were found on physical examination. On DSUG of the left lower extremity, a 6.5×2.5-cm aneurysm and thrombus material occluding 80 to 90% of the popliteal artery lumen were observed. The patient was scheduled for elective endovascular intervention.

Operative technique

A written informed consent was obtained from the patient. After standard dose heparin (1 mL, IV) administration and catheterization, lower extremity angiography was performed. Vascular ectasia was observed in all major vessels. There was an aneurysm partially filled with an occluding thrombus in the left popliteal artery (Figure 3). A 0.035x260 mm hydrophilic-coated guidewire was placed through the aneurysm sac. Then, a 10×80 mm iVolution (iVascular) and a 10×40 mm Heliflex TI (Hexacath, Rueil-Malmaison, France) peripheral self-expandable vascular stents were placed to cover the aneurysm sac. A balloon dilatation was performed using a Restorer (iVascular) balloon dilatation catheter. The procedure was completed uneventfully. The patient was discharged on the postoperative second day with a prescription of oral acetylsalicylic acid 100 mg/day and clopidogrel 75 mg/day. At one month of follow-up, he had no vascular complaints.

Figure 3. An angiographic image of popliteal artery aneurysm before and after stent graft implantation.

DISCUSSION

Although most PAAs are asymptomatic, clinical presentation may vary from intermittent claudication to acute limb ischemia, leading to extremity amputation.[4] Popliteal artery is the main source of blood supply to lower extremity. The impaired blood flow to lower extremity due to thrombus inside PAA may cause critical limb ischemia and amputation.[2] Imaging techniques such as DSUG and CTA are often used for the diagnosis of PAA. Preoperative evaluation of aneurysm size and relation with the surrounding tissues can be easily done with these techniques.

Currently, open surgery is the gold standard in the treatment of PAAs. It includes resection of the aneurysm sac and bypassing with a synthetic polytetrafluoroethylene (PTFE) or an autologous (saphenous vein) graft. There is, however, a controversy in the treatment of PAAs presenting with acute limb ischemia. Some authors advocate only thrombolytic treatment, while some others suggest surgical treatment in addition to thrombolysis.[5] Open surgical treatment is strongly indicated in symptomatic patients, irrespective of the aneurysm size; however, in asymptomatic cases, open surgery is recommended for aneurysms greater than 2 cm in diameter.[6] Nonetheless, there is still a controversy on optimal treatment options.[6]

All of our cases underwent endovascular treatment with similar indications. The first case with bilateral PAA was symptomatic and there was a mural thrombus in the aneurysm sac. In the second case, the aneurysm was >3 cm and there was limb ischemia due to distal arterial embolism. The third case was also symptomatic, and the aneurysm was >2.5 cm and there was a mural thrombus inside the aneurysm sac.

The endovascular repair of PAA was for the first time reported in 1994.[7] Currently, there are studies reporting promising patency rates after endovascular treatment of PAA with the developments in manufacturing technology of endovascular grafts.[8,9] Therefore, in recent years, endovascular treatment has become an option which is frequently used for the treatment of PAAs.

In the treatment of PAAs, open surgery is associated with several complications including major limb amputation, major hemorrhage requiring re-intervention, wound infection, nerve injury, and

deep vein thrombosis.[9,10] Endovascular treatment-related complications include endovascular graft migration, endoleak, graft occlusion/stenosis, and graft stent fractures.[11] Of note, stent graft fractures caused by flexion movement of the knee joint are still concerns for endovascular treatment. Young age and utilization of multiple stent grafts have been shown to be common causes of stent graft fractures. In addition, increased physical activity of young patients has been also blamed, it has not been proven, yet.[8]

There is still contradiction between the complication rates in the postoperative 30-day follow-up after open surgery and endovascular treatment. In several studies, higher complication rates were reported after endovascular treatments, while some others reported lower complication rates.[8,10,12] We believe that this contradiction can be attributed to different follow-up periods and antiplatelet treatments selected.[8]

All of our cases were older age (>65 years) male patients and two of them had increased cholesterol levels. Two patients had primary hypertension and one patient had low cardiac output and heart failure. Demographic and clinical characteristics of our cases are consistent with the literature. The patients were evaluated for bilateral PAAs and concomitant arterial aneurysms. One patient had bilateral PAA. Limb amputation was performed in one patient who was a delayed case. There were no procedure-related complications in any of the cases. The length of hospitalization of Cases 1, 2, and 3 was five days, three days, and five days, respectively.

In conclusion, PAAs are likely to be more common in older (>65 years) patients with increased life expectancy in the future. The method and timing of the treatment is of utmost importance due to varying clinical outcomes of PAAs. Although our experience in these cases makes our tendency grow stronger toward the endovascular treatment, further studies are needed to establish the long-term results of endovascular procedure in the treatment of PAAs. Based on our experience, we believe that the endovascular treatment of PAAs should be reserved in high-risk patients with advanced age and multiple comorbidities.

Declaration of conflicting interests

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