Popliteal artery aneurysms.

Thirty-year experience at the ABC Medical Center

Guillermo Alfonso Rojas-Reyna, Jorge Cervantes-Castro, Raúl Alvarado-Bachmann, Ricardo Wellman-Wollenstein, and Andrés Cervera-Servin

Abstract

Background: Although popliteal artery aneurysms (PAA) are rare (0.1% of the general population), they are the most common of the peripheral aneurysms. They are associated with concomitant contralateral PAA and abdominal aortic aneurysm (AAA), with a high risk of complications and an elevated morbidity and mortality.

Methods: We performed a retrospective, transversal and retrolective study of a series of cases. We reviewed the clinical records of 11 patients with the diagnosis of PAA at the ABC Medical Center in Mexico City.

Results: All patients were males, and seven (63.63%) had bilateral PAA resulting in a total of 18 aneurysms; 54.54% had concomitant AAA with an association of 71.42% in the cases of bilateral PAA. Primary risk factors were smoking (90.90%) and hypertension 63.60%. Six (33.33%) aneurysms demonstrated acute thrombosis and critical leg ischemia. Eight (44.44%) aneurysms treated electively had a favorable outcome. The six (33.33%) thrombosed aneurysms showed morbidity, amputation and mortality rates of 66.66, 33.33 and 16.66%, respectively. For the other four (22.22%) aneurysms, treatment was deferred. Specific analysis of the thrombosed PAA demonstrated that the two main factors that predicted thrombosis were hypertension (p = 0.029) and bilaterality.

Conclusions: In view of the high morbidity and mortality rates of thrombosed PAA, it is advisable to perform elective surgical treatment in any popliteal aneurysm >2 cm and with the presence of mural thrombus, torsion and, especially, if it is bilateral and the patient is hypertensive.

Key words: popliteal aneurysm, popliteal artery thrombosis, abdominal aortic aneurysm, acute arterial insufficiency of the lower extremities.

Introduction

Popliteal artery aneurysms (PAA) are uncommon and show a prevalence of 0.1% of the general population and 1% in males between 65 and 80 years of age.1,2 They are the most common type of peripheral artery aneurysm, representing 70%.3 It is defined as PAA when a transverse dilatation exists of the popliteal artery >2 cm or >150% of the normal artery diameter.4

The most accepted etiology is arteriosclerosis; however, inflammatory causes have recently been proposed. In histological...
studies of the walls of the aneurysm, rupture of the elastic lamina has been observed along with evidence of active proteolysis with increase in the cellular expression of CPP-32 and increase in T-lymphocytes, probably associated with the cellular apoptosis routes. In this regard and in relation to the concept of disease or systemic metabolic disorder in patients with PAA, it has been referred to as an aneurysmal dilatation in up to 40% of the saphenous vein grafts in comparison to 2% when arterial derivations are used due to obstructive disease.5,9 Mention has also been made of structural or traumatic factors associated with turbulent blood flow caused by distal branches of the popliteal artery and fatigue of its walls, secondary to constant knee flexion.2,10 Other more rare causes are mycotic aneurysm and collagenopathies such as Marfan’s syndrome, Ehlers-Danlos syndrome and Behcet’s disease.5,9,10

Popliteal aneurysms are frequently asymptomatic; however, as opposed to other central (aortic) and peripheral aneurysms, its principal danger is not rupture (<4-7%)10-12 but the risk of thrombosis and distal ischemia in up to 33% of the cases, a complication which carries a 5% mortality and an amputation rate of 20-40%.2,13,14 In a Mayo Clinic report in 1953 regarding the natural history of 100 cases of PAA during a period of 50 months, it was noted that 34% of the extremities affected suffered some type of complication and 23% required a major amputation.12 Other studies recently have documented that popliteal aneurysms carry a complication rate of 68-77% at 5 years, with the great majority presenting during the first 2 years, with an annual frequency of 14-24%.9,11,14,16,17

Historically, treatment of PAA has evolved over time. The ancient Greeks (Antillus, third century B.C.) would apply a proximal tourniquet to open the aneurysmal sac and evacuate its contents, after which they would release it in an attempt to identify and ligate the proximal and distal popliteal artery, as well as bleeding vessels. However, this type of treatment was never successful. Pott (1714-1788) assured that amputation was the best option for the management of symptomatic popliteal aneurysms. Hunter (1728-1793) emphasized the importance of developing collateral circulation to achieve viability of the extremity and performed proximal arterial ligation of the aneurysm without exposing it, which allowed thrombosis as well as development of collateral circulation. Matas (1860-1957) at the end of the 19th century described the obliterative-reconstructive endoaneurysmorraphy where by utilizing a proximal tourniquet the aneurysmal sac would be exposed and opened, its contents would be emptied, the internal vessels would be sutured and finally its walls sewn over a catheter to re-establish circulation. In 1906 he published the results of 19 popliteal aneurysms treated with this technique. Finally, in 1905 Goyanes in Spain originated the modern treatment for PAA, with the first reports of excision of the aneurysm and revascularization with the popliteal vein. In 1913, Pringle used the reverse saphenous vein.4,10,19

Although it is an infrequent pathology because there are no studies in our setting that describe the epidemiological behavior of PAA as well as the variables that are usually related to its complications, and because at present the risk factors that facilitate this pathology have increased, we decided to analyze the experience of our group in the management of popliteal aneurysms during the last 30 years.

**Materials and Methods**

A descriptive, transversal and retrolective study was performed of a series of cases in a systematized manner in the clinical archives of the Centro Médico ABC from all the medical records with diagnosis of popliteal aneurysm in the last 30 years.

All patients who presented popliteal aneurysm regardless of type of treatment were included. Exclusion criteria were those patients who presented traumatic pseudoaneurysms, as well as cases of popliteal artery thrombosis due to other causes. Patients without complete medical records for data analysis were also excluded.

The following variables were measured: sex, age, risk factors (arterial hypertension, smoking, dyslipidemia), mode of presentation, bilaterality of the aneurysm, presence of abdominal aortic aneurysm, complications at the time of the diagnosis, established treatment, length of hospital stay, morbidity and mortality.

**Statistical Analysis**

Numerical variables were described using means ± SD and interquartile interval [Md (25-75)] according to the type of distribution shown. Categorical variables were described using frequency and percentage. Between-group comparisons were made using Student’s t-test, Mann-Whitney U test or Fisher exact test; p <0.05 was considered statistically significant.

**Results**

Eighteen patients had diagnosis of PAA. Of these, seven patients were excluded: six due to being traumatic popliteal pseudoaneurysms and one classified as femoral aneurysm without popliteal component.

Of the 11 patients studied, seven (63.63%) presented bilateral popliteal aneurysm for a total of 18 aneurysms: eight (44.44%) left and ten (55.55%) right. Of these patients, six (54.54%) had concomitant aneurysm of the abdominal aorta (AAA): five (71.42%) within the seven cases of bilateral PAA and one (25%) associated with the four unilateral popliteal aneurysms.

All patients were males with an average age of 68.38 years (range: 54-95 years).

Principal risk factors were smoking and arterial hypertension in 90.90% and 63.60% of the cases, respectively.
Of the 18 aneurysms, six (33.33%) presented a clinical picture of thrombosis and distal ischemia, two (11.11%) with intermittent claudication, five (27.77%) with pain and sensation of a mass in the pelvic cavity, and the remaining five patients (27.77%) were asymptomatic with the diagnosis being incidentally established when studying other aneurysms (AAA or PAA contralateral).

Of the 18 aneurysms, eight (44.44%) were electively treated in our hospital center with either medical exclusion of the aneurysm or femoral popliteal artery bypass with reverse ipsilateral saphenous vein in 100% of the cases. All cases had a satisfactory evolution with an average hospital stay of 7.44 days.

Of the six (33.33%) thrombosed aneurysms with distal ischemia, two (11.11%) were managed on an outpatient basis with anticoagulation (low molecular weight heparin/warfarin) preserving the extremity, but with sequelae of pain at rest and incapacitating intermittent claudication. In the second patient, an attempt was made at revascularization surgery without success, resulting in supracondylar amputation. The other four (22.22%) patients with thrombosed PAA were treated in our institution where exclusion of the aneurysm and femoral/popliteal artery revascularization with ipsilateral reverse saphenous vein was accomplished on the first patient, but due to the lack of distal arterial beds the graft thrombosed with consequent gangrene and resulted in supracondylar amputation. The second patient was managed with exclusion of the aneurysm, thrombectomy, transoperative intra-arterial local thrombolysis (rTPA) of the distal beds, and revascularization of the femoral trunk-tibioperoneal artery with non-reverse ipsilateral saphenous vein. During the immediate postoperative period, a second intervention was needed for drainage of the hematoma, managing to finally salvage the extremity with excellent distal pulses. The third patient had preoperative rTPA for ipsilateral femoral approach. Once the aneurysm, as well as the distal beds, was thrombolyzed (Figures 1 and 2), exclusion of the aneurysm was done along with femoral/popliteal arterial bypass with reverse ipsilateral saphenous vein bypass, with excellent results. For the fourth patient, local rTPA was attempted with bleeding at the access site (arterial femoral) and rethrombosis of the aneurysm with consequent gangrene of the extremity. The patient refused amputation and died as a result of multiple organ failure.

For the 4 (22.22%) remaining patients, treatment was deferred by the patient in three cases and due to the unfavorable medical condition of one patient.

A specific analysis of the thrombosed popliteal aneurysms showed that the two principal risk factors for predicting thrombosis, independent of size and morphology, were the presence of arterial hypertension and bilaterality (Table 1). We also noted highly unfavorable therapeutic results with a high morbidity rate (66.66%), amputation (33.33%) and mortality (16.66%), in comparison with the negative morbidity and mortality rates of the PAA managed electively.

Table 1. Risk factors

<table>
<thead>
<tr>
<th>Associated factors</th>
<th>Thrombosed aneurysms</th>
<th>Uncomplicated aneurysms</th>
<th>$p$ Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average age (years)</td>
<td>70.09</td>
<td>68.78</td>
<td>0.351</td>
</tr>
<tr>
<td>Smoking</td>
<td>100%</td>
<td>88.0%</td>
<td>0.688</td>
</tr>
<tr>
<td>SAHT</td>
<td>100%</td>
<td>44.4%</td>
<td>0.029</td>
</tr>
<tr>
<td>AAA</td>
<td>60%</td>
<td>50.0%</td>
<td>0.635</td>
</tr>
<tr>
<td>CLAP</td>
<td>80%</td>
<td>50.0%</td>
<td>0.516</td>
</tr>
</tbody>
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SAHT, systemic arterial hypertension; AAA, abdominal aortic aneurysm; CLAP, contralateral popliteal aneurysm.

Discussion

PAA is an infrequent entity; however, its presentation may be subtle. For this reason, it is of vital importance to maintain a

Figure 1. Angiography: bilateral popliteal aneurysm. The left is thrombosed.

Figure 2. Arteriography. (A) Popliteal aneurysm. (B) Post-thrombolysis popliteal aneurysm.
high index of clinical suspicion and to perform a careful physical examination. In our setting, there is a high index of hypertension and smoking, factors highly related to this pathology as demonstrated by our series.

Patients with PAA tend to have important co-morbidities because they are usually elderly male patients with risk factors for cardiovascular and pulmonary disease and a life expectancy of 60% and 44% at 5 and 10 years, respectively.1,4,9,13,20

Patients with PAA have a tendency for polyaneurysmal disease because they can be bilateral in up to 50-70% of cases. They may be associated with other aneurysms such as femoral (15-40%) and abdominal aorta (30-50%), as illustrated in this study. For this reason, these patients require routine and lifelong vascular evaluation.1,10,11,21

As mentioned previously, the principal complication is thrombosis with consequent critical ischemia of the extremity in up to 33% of the cases. Predictive factors are size of PAA >2 cm, torsion and the presence of mural thrombus.14,28 Ramesh mentions that the association of a PAA >3 cm with torsion of >45º was found in 87% of the thrombosed aneurysms.22 In our study it was observed that the existence of a contralateral popliteal aneurysm as well as arterial hypertension were predisposing factors of thrombosis, with the latter being statistically significant (p = 0.029). Pittathankal et al. and Biasi et al. also observed that PAA in patients without arterial hypertension tend to stay stable in comparison with hypertensives (p = 0.02).23,24 Treatment for thrombosed PAA is complicated with high index of loss of extremity and death, with the observation that in the patients in whom limb salvage was achieved, 10% remained with residual symptoms (pain and claudication) and the permeability of the graft is only 65% at 5 years.9,25 Other complications described are deep venous thrombosis and neurological damage due to direct local compression.10

The standard treatment of popliteal aneurysm is surgical exclusion and femoral popliteal revascularization with saphenous vein graft (ideally) or prosthetic, demonstrating that the permeability and salvage (87-98%) of the extremity at 5 years is much better when performed with saphenous vein (77-94 vs. 29-42%).3,11,24,26

At present, great enthusiasm exists with endovascular exclusion of the PAA performed for the first time in 1994 by Martin with a homemade endoprosthesis.14,27,28 Despite the technological advances in the fabrication of these devices and of the apparent advantages of this minimally invasive technique (use of local anesthesia, less morbidity-mortality, operative time and hospital stay), the rate of permeability reported at 1 and 12 months is 64 and 47%, respectively.3,12 In another series, the rate of permeability at 18 months was 55%.29,30 This type of treatment is unfavorably compared with conventional surgery, which has rates of permeability and limb salvage at 10 years of 80-86% and 87-98%, respectively.12,26,31 Other complications of endovascular therapy are endoleak (37%) and migration and fracture of the endoprosthesis (37.2%). Until now there are no evidence I studies that recommend its routine use.3,9,17,29,30

In conclusion, given the unfavorable results of the thrombosed PAA in the present series, as well as those in the literature, it is recommended to perform elective surgery on all popliteal aneurysms that meet any of the following criteria: size >2 cm, presence of mural thrombus or torsion >45 degrees, and specifically bilaterality or being associated with arterial hypertension.

Current standard treatment is surgical exclusion of the aneurysm and femoral/popliteal artery bypass with saphenous vein.

References