



Original Research

Is Medial Approach for Surgical Treatment of Popliteal Artery Aneurysm Still Safe ?

L'approche médiale dans la chirurgie des anévrismes poplités toujours sûre ?

R Atipo-galloye^{1,2}, J.C Edzan¹, S.H Moumpala¹, B.N Tseyi Ossere¹, R Sayah³.

(1) : Department of Polyvalent surgery, Brazzaville teaching hospital

(2) : University of Marien N'gouabi, Faculty of health sciences, Brazzaville.

(3) : Department of cardiovascular surgery, International University hospital Cheikh Zaid, Rabat

Corresponding author:

Pr R Atipo-galloye

Cardiovascular surgeon, Associate Professor

Marien N'GOUABI University, Faculty of health sciences, Brazzaville Brazzaville teaching hospital, polyvalent surgery department Brazzaville, République du Congo.

Mail : reddyatipo@hotmail.fr

Tel :

00242065431560/00242050263851

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ABSTRACT

Background. Popliteal artery aneurysm (PAAs) is the most common peripheral artery aneurysm, but thromboembolic complications may result in limb loss. The aim of this study was evaluate the management and early outcomes for popliteal aneurysm. **Patients and methods.** A retrospective review of all patients with popliteal aneurysm between 2016 and 2020. Data collected included findings at presentation, operative details, graft patency, complications, and 30-day mortality.

Results. Twenty-seven limbs were operated on in 25 patients, consisting of 21 (84%) men and 4 (16%) women. Initial findings included 21 (84%) unilateral and 4 (16%) bilateral PAAs with a mean diameter of 35 ± 9 mm. Nine symptomatic patients with, thrombosis (n=4), intermittent claudication (n=2), critical ischemia (n=2), and local pain (n=1). Medial approach was realized in 20 (80%) patients. Proximal and distal ligation with bypass grafting was used in seventh (68%) patients, aneurysmectomy with interposition in eight (32%). Great saphenous vein was used in all cases. The 30-day postoperative mortality was 0%, and two amputations were necessary after failed bypass grafting in emergency patients. Two compartment syndrome, and one deep wound infection were reported. The perioperative 30-day primary patency rate was 86.6%, and secondary patency rate at 6 months was 100%. **Conclusion.** Results of management of popliteal arterial aneurysm on asymptomatic patients seem better than in emergency cases. Medial approach remains one of the best option for surgical treatment.

RÉSUMÉ

Introduction. Les anévrismes de l'artère poplitée sont les plus fréquents des anévrismes périphériques, et leurs complications thromboemboliques peuvent entraîner une amputation. L'objectif de cette étude est d'évaluer le traitement chirurgical et les suites opératoires. **Patients et méthodes.** Il s'agit d'une étude retrospective, incluant tous les patients opérés pour anévrisme de l'artère poplitée entre Juin 2016 et Juin 2020. Les données collectées incluaient ; la clinique, le périopératoire, et la mortalité hospitalière. **Résultats.** Vingt-sept anévrismes de l'artère poplitée ont été opérés parmi 25 patients, 21 (84%) hommes et 4 (16%) femmes. On notait 21 (84%) unilateral and 4 (16%) bilateral anévrismes poplités, avec un diamètre moyen de 35 ± 9 mm. Neuf patients étaient symptomatiques avec, thrombose (n=4), claudication intermittente (n=2), ischémie aiguë (n=2), douleurs (n=1). L'abord médial a été réalisé chez 20 (80%) patients. Ligature proximale et distale associée à une pontage a représenté dans 68%, et la mise à plat plus greffe dans 32%. La veine grande a été le principal greffon utilisé. La mortalité hospitalière était nulle ; amputations ont été réalisées après occlusion du greffon chez deux patients opérés en urgence. Deux cas de syndrome de loges ont été rapportés ; avec une infection du site d'anastomose. La perméabilité primaire des trente premiers jours était de 86.6%, et la perméabilité secondaire à 6 mois était de 100%. **Conclusion.** Les résultats de la chirurgie des anévrismes de l'artère poplitée chez les patients asymptomatiques par rapport aux urgences. L'abord médial reste une des meilleures options de la chirurgie.

INTRODUCTION

Popliteal artery aneurysm (PAA) is the most common peripheral artery aneurysm [1]. These aneurysms account for up to 70% of all peripheral arterial

aneurysms [2]. The main cause is atherosclerosis, but the disease seems to be multifactorial [3]. Popliteal aneurysms are bilateral in 50% to 70% of the cases and are associated with abdominal aortic aneurysm in 40% to 50% of the cases [4]. The most frequent and severe

complication is the thromboembolism, with subsequent acute limb ischemia and major amputation rate of up to 30% in surgical series [5].

Management of popliteal aneurysm throughout history has been surgical both for prevention and management of complications.

Open surgical treatment includes in situ arterial replacement or a bypass using autologous or prosthetic graft. The most common performed surgical technique for PAA repair is the medial approach with proximal and distal aneurysm ligation, followed by autologous or polytetrafluoroethylene (PTFE) bypass grafting. The 5-year primary patency rates for this technique are 50 to 86% [6].

An alternative technique is the posterior approach. This technique includes a curved incision in the fossa poplitea. The disadvantages of the posterior approach might be more dissection-related complications compared with medial approach. So far, little is known about the results of this posterior technique. In a recent noncontrolled case series that reported early and mid-term outcomes of PAA repair with posterior technique, the 2-year primary patency rate was 92.2% [7].

In surgical cardiovascular unit of Brazzaville teaching hospital, we used preferentially medial surgical approach for treating PAA.

The purpose of this study was to evaluate the management and early outcomes of popliteal aneurysm in our department.

PATIENTS AND METHODS

A retrospective study was carried out at Brazzaville teaching hospital, in surgical polyvalent department from June 2016 to June 2020. Data from all interventions were collected in our database, which included demographic data, preoperative risk factors, clinical status, diagnostic workup, intraoperative features, and early and mid-term outcomes. PAA was defined as focal dilatation of the popliteal artery by $\geq 50\%$ over expected normal diameter (0.9 ± 0.2 cm), as measured with ultrasonography, or a diameter > 1.5 cm when measured intraoperatively [8]. The primary endpoints were long-term limb salvage and graft patency rates (12 months); secondary endpoints were immediate and 30-day limb salvage and graft patency rates.

All revascularizations were performed through by median approach. If the aneurysm involved the proximal popliteal artery, inflow for the bypass was the superficial femoral or common femoral artery. Proximal and distal ligation was usually done for small aneurysms, and endoaneurysmorrhaphy was performed at the discretion of the surgeon, usually in patients with large aneurysm (> 2 cm) or if large genicular arteries were noted on preoperative imaging.

The aneurysm was opened, thrombus evacuated, and lumen oversewn. A thigh tourniquet facilitated endoaneurysmorrhaphy in a bloodless field. Reconstruction was performed with autologous bypass.

All patients received 5000 UI of heparin before the popliteal artery was cross-clamped and 160 mg

acetylsalicylic acid (ASA) daily for at least 3 months postoperatively.

The following additional preoperative variables were collected for the 18 aneurysms: gender, presence of bilateral PAA, presence of abdominal aortic aneurysm, symptoms (acute, chronic, or asymptomatic), diameter of the PAA, vascular risk factors, type of preoperative imaging.

Perioperative variables collected were type of bypass/interposition graft (great saphenous vein) and 30-day complications.

Follow-up variables were hemodynamic stenosis or occlusion of the bypass/interposition graft, renewed symptoms, endovascular or surgical reinterventions, absence or existence of flow in the PAA, major amputation of the ipsilateral leg, and mortality.

The surveillance program consisted of postoperative clinical and ultrasonographic or tomography examinations at 1, and 6 months. Graft patency was assessed, including the native artery proximal and distal of the anastomoses. In addition, duplex ultrasound imaging was used to examine flow in the eliminated aneurysm sac.

Primary patency was defined as uninterrupted flow ($<50\%$ stenosis) in the bypass/interposition graft with neither an additional procedure performed nor an intervention to solve disease progression in the adjacent native vessel. Secondary patency was defined as restoration of graft patency by percutaneous or surgical intervention because of occlusion or technical problems with the graft or the anastomosis. Acute limb ischemia was classified according to the acute limb ischemia classification by Rutherford and al [9].

Standard descriptive statistics were used with Microsoft Excel 2016. Qualitative variables were expressed in percentage, and quantitative variables in mean \pm standard deviation.

RESULTS

Preoperative data

Between June 2016 and June 2020, 25 patients were diagnosed with 42 PAAs at surgical cardiovascular unit of Brazzaville teaching hospital.

Open surgical intervention revascularization were done in twenty-seven limbs with PAAs. Of these, 21 men (84%) and 4 women (16%).

Preoperative characteristics have been summarized in table I.

Table I : Preoperative characteristics

Data	n (%)
Sex	25(100)
Male	21(84)
Female	4(16)
Age, mean (range)	58(23-75)
Vascular risk factors	
Coronary heart disease	5(20)
Renal	2(8)
Hyperlipidemia	6(24)
Hypertension	11(44)
Diabetes mellitus	4(16)
Smoking	5(20)

All PAAs were of atherosclerotic origin.

Four patients (16%) of the whole study had bilateral PAAs, of which 3 PAAs were not treated because of asymptomatic aneurysms; less than 20 mm. A concomitant abdominal aortic aneurysm was present in 5 patients (20%). Nine patients (36%) were symptomatic; 4 (16%) with thrombosis, 2(8%) with intermittent claudication, 2(4%) with critical ischemia, 1(4%) presented with local pain. 15 (64%) patients remain asymptomatic.

The mean diameter of the PAAs at the time of intervention was 35 ± 9 mm (range, 22 to 65 mm).

In the sixteen asymptomatic patients, an indication for surgical intervention in these patients was yearly growth of $> 10\%$, with an absolute mean diameter of 32 ± 8 mm.

Operative data

Ten patients (66.6%) had been operated in elective surgery.

Autologous vein was the preferred graft material, with the ipsilateral reversed great saphenous vein used in all patients. Medial incision has been preferred, by comparison with posterior, respectively 80%, 20%. In seventh cases (68%), proximal and distal ligation of the aneurysm with bypass grafting was performed. The remaining eight patients (32%) underwent aneurysmectomy with graft interposition. The outflow vessel was in most cases the below knee popliteal artery (89.3%), and in 10.7% of the cases it was represented by a tibioperoneal trunk or tibial vessel.

The 30-day postoperative mortality rate was 0%, and two amputations were necessary. This amputation was below the knee, after failed bypass grafting in patients operate in emergency. In the first 24 hours postoperatively, two compartment syndrome (dermo fasciotomy), one deep wound infection (surgical drainage).

Follow-up

The perioperative 30-day primary patency rate was 86.6%.

Median hospital length of stay was 9 days (4-21 days).

Mean follow up was 6 months (range, 1-8 months), and no patient was lost to follow-up.

Two patients underwent reintervention to salvage a failing graft. The secondary patency rate was 100%.

DISCUSSION

This study has certain limitations. It is a retrospective nonrandomized study, with a relatively short period of follow-up, and a low number of patients.

Open surgical repair is a well-established method of treatment of PAAs, providing excellent results in several studies with large number of patients and long term follow-up [10,11].

On the basis of these results and considering the high risk of severe complications in patients with untreated aneurysms [12]. It is nowadays accepted that the indication for treatment is the presence of asymptomatic aneurysms larger than 20 mm in patients at low surgical risk [13].

Mean PAAs diameter was 35 ± 9 mm. Some authors found a correlation between aneurysm size and clinical presentation: symptomatic patients presented with larger

aneurysms [14]. Increasing size in addition to development of symptoms were indications to intervene in 30% of 58 asymptomatic patients in one prospective multicenter study [15].

Galland et al found that the mean expansion rate of PAAs was 1.5 mm/y for aneurysms < 20 mm, 3.0 mm/y for size 20 to 30 mm, and 3.7 mm/y for size > 30 mm [16].

Indications for interventions are well defined for patients who present with acute ischemia and for most of those who have chronic ischemic symptoms. Patients with severe claudication, rest pain, and tissue loss are considered for elective repair, and patients who have symptoms of local compression are also candidates for surgical repair.

Indications for asymptomatic patients and for those with mild-to-moderate claudication are less well defined. Factors affecting surgical decision include the rate of development of symptoms, aneurysm size, mural thrombus, evidence of previous thromboembolism, risk of surgical repair, and long-term surgical outcome. Management of asymptomatic aneurysm remains controversial. Proponents of conservative treatment have treated popliteal aneurysm nonsurgically. Hands and Collins reported that in a group of 7 patients with asymptomatic aneurysm treated conservatively, no complications developed, although all of the patients had died by 6-year follow-up [17].

We had used for our patients a medial approach. We prefer this approach for its best exposure of popliteal aneurysm, and also a possibility to harvest a great saphenous vein.

The proximal anastomosis was the superficial femoral artery in all cases, and an infrapopliteal artery was used distally. The benefits of using the tibial arteries for the distal anastomosis, if needed, were emphasized by Aulivola et al [5]. The medial approach is considered for several authors as preferred route by comparison with posterior approach [18]. A major disadvantage of the medial approach is the risk of remaining patent side branches of the aneurysm sac. In the present series, two patients in the medial group showed postoperative flow and aneurysm growth that required immediate reintervention.

In our series, ten patients have been operated after elective surgery. Mortality and complications after elective vs emergency repair are major factors affecting the decision to treat asymptomatic PAAs early. In a review of 13 surgical series, Michaels and Galland found that asymptomatic patients had 0.4% mortality and a 0.8% early rate of limb loss, whereas symptomatic patients had 4.7% mortality and an 18.2% rate of early amputations [19].

In certain tertiary hospitals facilities, there is the possibility of endovascular technique [20].

Thrombolytic therapy has been widely advocated before surgical revascularization in patients with occluded PAAs and acute ischemia; however, the limb must be capable of withstanding an additional period of ischemia. Therefore, thrombolytic pretreatment is discouraged in

patients with level IIB acute limb ischemia or irreversible major tissue changes [9,21-22].

CONCLUSION

It seems clear that the results of operation on asymptomatic PAAs are good and are significantly better than those underwent emergent surgery and presented acute complications. We conclude that patients with PAA should undergo repair before the onset of acute complications and the need for emergent surgery. Medial surgical approach remains the best surgical root without less complications.

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