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Original Article

POPLITEAL ANEURYSMS AS A CAUSE FOR ARTERIAL INSUFFICIENCY

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Summary

Clinical manifestations, possibilities for accurate diagnosis of popliteal aneurysms, and operative approaches applied depending on their location are presented, as well as results from treatment over a four-year period. Popliteal artery aneurysms accounted for 5.63% of all 266 cases of acute arterial insufficiency. The mean age of the patients was 68.8 years, and the male:female ratio – 4:1. In five patients (33.33%), the localization of aneurysm was unilateral. In 80% of the cases with bilateral popliteal aneurysms, the aneurysms were combined with aneurysms of other locations. The surgical technique applied was posterior approach with resection of the aneurysm and interposition of a polytetrafluoroethylene (PTFE) prosthesis. The early patency rate of the reconstructed segment was 100%. Late patency rate of the reconstructed segment was 90.9%. Despite the better late results in femoropopliteal reconstruction, we think that a posterior approach with prosthesis implantation is better because it saves the great saphenous vein. The presence of multiple aneurysms in the patients studied (80%) determined the low survival at 5 and 10 years, which makes it comparable to the results from applying the two surgical methods.

Key words: popliteal aneurysm, posterior approach, PTFE prosthesis

Introduction

Aneurysms of the popliteal artery are rare pathology – less than 1% of the diseases of the arterial system but the specific pathophysiological processes leading to acute thrombosis are a challenge to even experienced surgeons [1, 2]. A conservative treatment leads to limb loss in 15-25% of cases in the first year, which may reach 60-75% by the fifth year after complication [3].

The only alternative of conservative treatment is revascularization such as ordinary indirect thrombectomy with Fogarty catheter, which is not sufficient. Therapeutic options include autovenous femoro-popliteal bypass and ligation of the aneurysm, aneurysm resection and graft interposition – autovenous or prosthetic. Lately, endovascular stent grafting is applied [1, 4].

Materials and Methods

A retrospective analysis was made based on medical records of 15 patients with popliteal artery aneurysms (PAA) treated in the Department of Vascular Surgery at the University Hospital “Dr. Georgi Stranski” in Pleven for the period 01.01.2010 – 31.08.2013, regardless of the type of treatment administered. Patients with post-traumatic pseudoaneurysms or thrombosis of the artery, without aneurysm were not included in the study.

Cases were analyzed with respect to gender, age, risk factors, co-morbidities, clinical manifestation of the aneurysm, simultaneous multiple localization, type of applied treatment and early and late postoperative results.

All cases were diagnosed based on clinical examination and ultrasonography. Computed tomography angiography (CTA) was performed

in some of the cases. In some cases, both ultrasonography and CT-angiography were performed due to failures in expression of the condition of the runoff system (Figure 1 and Figure 2).

Eleven patients underwent surgical treatment. The following operative methods were used: resection of the aneurysm with auto- or allograft interposition (8 patients), ligation of the aneurysm followed by femoro-popliteal bypass reconstruction (3), ilio-femoral bypass (1), and calf amputation in the setting of a working reconstruction (1).

Results

Demographics and co-morbidities of the patients are presented in Table 1.

Table 1. Demographic characteristics of the patients

| Characteristics | Number of patients |
|---------------------------------------|--------------------|
| Male | 12 |
| Female | 3 |
| Mean age | 68.8 years |
| Arterial hypertension | 11 |
| Ischaemic cardiac disease | 8 |
| Heart failure | 5 |
| Ischaemic cardiopathy | 2 |
| Myocardial infarction | 1 |
| Cerebrovascular disease | 2 |
| Rhythm and conductive disorders | 5 |
| Chronic obstructive pulmonary disease | 5 |
| Diabetes | 1 |
| Others | 3 |



Figure 1. Duplex scanning of popliteal aneurysm – absence of flow



Figure 2. CT-angiography

Popliteal artery aneurysms rate accounted for 5.63% of all the 266 patients with acute arterial insufficiency of the limbs treated in the clinic for the period analyzed. The average age of the patients was 68.8 years (age range 57-82 years). Two patients were under age 60, six – under 70, and seven patients were over 70. The male:female ratio was 4:1. Analysis of co-morbidities showed that only one patient had a single risk factor – arterial hypertension. All other patients had severe co-morbidities, with a prevalence of cardiovascular diseases.

The patients operated on presented with acute ischemia (eight patients), chronic ischemia (two patients). One patient had no ischemic complains. In the group of non-operated on patients, two had acute ischemia, one presented

with subacute ischemia, and one – with chronic ischemia.

Five patients had unilateral localization of the aneurysm (33.33%). In patients with bilateral localization (10 patients) other localization of the dilatative arteriopathy were found: an aneurysm of the femoral artery – 4 cases, an abdominal aorta aneurysm (AAA) – 2 cases, a thoracic aorta aneurysm – 2 cases. This showed that in 80% of the cases with bilateral popliteal aneurysms, the aneurysms were combined with aneurysms in other locations. In 5 patients, another form of dilatative arteriopathy was observed – an elongation and kink of the iliac segment.

The main diagnostic modality was clinical examination, which confirmed popliteal artery aneurysms in 12 patients. In the rest of the patients, clinical examination did not manifest the aneurysm because of its superior location (1st segment of popliteal artery). Duplex scanning was conducted to evaluate the aneurysm in 11 patients. Ultrasonography was used to measure ankle brachial pressure index (ABPI). Failing or insufficient expression of the distal landing zone necessitated CT-angiography in 10 cases for

visualization of the segment. In our series, the value of duplex scanning to assess the patency of the runoff system was not sufficient, and angiography was performed (Figure 3).

The results obtained through angiography showed that only 2 patients had normal runoff (3 arteries), 3 patients had good runoff (2 arteries), and 5 had poor runoff (2 of them had only one patent artery, and arteries were not visualized in the rest of the patients). The typical “dog leg” symptom [5] was observed in 4 patients (Figure 4).

The surgical techniques we preferred was posterior approach with resection of the aneurysm and interposition of polytetrafluoroethylene (PTFE) prosthesis with external support in 7 patients, and autovenous reconstruction in one patient. Medial approach was used in 3 of the cases, where ligation of the aneurysm and autovenous femoro-popliteal bypass was made. In one of the patients, an early postoperative thrombosis of the external iliac artery made us perform ilio-femoral bypass.

The results of the surgical techniques applied can be assessed as very good. The early patency rate of the reconstructed segment was 100%. A complication, which occurred in another segment in one of the patients, necessitated ilio-femoral reconstruction. In one of the patients, a low amputation was done in the setting of a working reconstruction, due to devitalized foot at the time of admission to hospital. Late patency rate of the reconstructed segment was 90.9%. One patient developed late thrombosis of both the



Figure 3. CT-angiography – presence of good landing zone

reconstructed segment and the superficial femoral artery one year after the reconstruction. One patient had recurrence of the ischemic symptoms, where control angiography showed working reconstruction with no tibial vessels.

Four patients in the series were not operated. Two patients presented with acute ischemic syndrome in the setting of patent posterior tibial artery and excellent ABPI – 1.0.

These cases were assessed as microembolization. One patient refused surgical treatment, and the second one had severe high-risk comorbidities that contraindicated surgical treatment. The third patient with an over-one-month rethrombosis of the reconstructed popliteal segment and superficial femoral artery was successfully treated with conservative vasodilatative therapy. The fourth patient (a 68-year-old female) died prior to operation because of severe hemorrhagic stroke.



Figure 4. Dog leg symptom

Discussion

In our series, the average age of patients was 68.8 years (age range 57-82). Two of them were under 60, and 9 patients (60%) were over 65. This supports the data of other authors, where the average age of the patients was 67 years [4] and

68.4 years [2], respectively, with domination of males aged over 65. It should be noted that our patients had severe co-morbidities with a prevalence of cardiovascular diseases that was higher as compared to ones cited in the literature. The highest incidence was that of ischemic heart disease in its various forms – 78.57% (33% reported in literature), followed by arterial hypertension – 73.3% (42% in literature), and COPD – 33.33% (13% in literature) [4]. The percentage of patients with diabetes in our study and studies by other authors was low – 6.6% and 4%, respectively. In our study, bilateral localization of PAA was found in 10 patients (66.66%). According to Beseth and Moore [4], bilateral localization was observed in 75% of cases, and according to other authors – in 47% to 63% of the cases [2, 6]. What is more important is the fact that in our patients with bilateral localization of PAA, there were other aneurysms of different localizations in 80% of them. Similar findings were reported by other authors: 78% combined with other localizations [6], 33% to 54% in conjunction with an abdominal aortic aneurysm [2, 4, 7], 50% – in combination with iliac aneurysms, and 12.5% – in combination with femoral or thoracic aneurysms [4].

The average diameter of the aneurysms in our patients was 44.3 mm (21 mm to 80 mm). In only in two cases the diameter of the aneurysm was less than 30 mm, in three cases – 40 mm, and in all other cases – over 40 mm. According to literature data the diameter of PAA varied widely [8, 9], and the average diameter was 3.2 cm (1.9 cm to 6.2 cm) [4].

Despite the presence of prominent non-pulsing mass in the popliteal region, patients were hospitalized with a diagnosis of acute ischemia, after which an aneurysm was detected. Our results are comparable to those reported in the literature. In our series, symptomatic aneurysms represented 93.33% (14 patients) of the cases, of which 12 patients (80%) presented with symptoms of acute ischemia and thrombosis of the aneurysm, and 2 patients (13.33%) – with clinical subacute ischemia. The relative share of symptomatic aneurysms ranges from 30% to 73%, as reported by Bouhoutsos and Martin [10] and up to 80% by Varga et al., Anton et al., and Carpenter et al. [11-13], where in 54% of cases the ischemia was acute [11].

Surgical treatment of aneurysms of the popliteal artery has undeniable advantaged over observation and conservative treatment. According to Dawson et al., 35% of the non-

operated patients develop ischemic complications, and 25% of those operated later need amputations [3].

There are two surgical accesses to the popliteal artery described in literature – medial and posterior. The medial approach was described by Edwards W. S. in 1969. To this day, this approach has been considered as standard treatment for PAA [4]. A disadvantage of this access is the persistent vascularization of the aneurysm by collaterals, which may lead to its growth in 10-30% of cases, and to rupture in isolated cases [14]. The alternative posterior approach was described by Jose Goyanes as early as 1906 in Madrid [2]. A direct substitution with posterior approach avoids the shortcomings of the medial approach and allows for intraaneurysmal ligation of branches, preventing endoleaks type II [4]. The posterior approach consists of resection, endoaneurysmorrhaphy and interposition of prosthesis or, less commonly, anautovenous conduit, since the approach limits the possibilities to use the great saphenous vein [4]. Despite its excellent early and late results in both cases, most of the authors have reported a significantly better later patency when an autologous vein is used [4, 15, 16].

In fact, defining the surgical approach for reconstruction does not seem so important because in patients with multiple localizations, ten-year survival was only documented in 16% of cases [3]. Pulli et al. have reported a greater importance of the condition of the runoff vessels, indicating a 5-year patency in symptomatic aneurysms 51.6%, and 86.5% - in asymptomatic ones [17]. Huang et al. have pointed out the type of prosthetic material as more important, and have reported 63% late patency using PTFE prostheses, and 94% patency using the great

saphenous vein for a 5-year period [18]. According to Ravn et al. data from the Swedish National Register of 571 operated patients with 717 PAA, limb salvage was achieved in 88% of the cases. The reasons for failure were: symptomatic arterial disease, poor outflow of the tibial-peroneal segment, patients older than 70, and implantation of a prosthesis without thrombolysis [19]. Despite the good late results obtained after thrombolysis, followed by surgery [8, 20], the procedure is not recommendable in patients at high risk of bleeding, limb-threatening ischemia requiring urgent surgery, and in patients older than 70 [21].

The role of endovascular procedures with implantation of a stent-graft after fibrinolysis of thrombosed aneurysm or runoff segment in surgical treatment of PAA has been increasing in the last decade [8, 21, 22]. Some authors have reported a two-year patency of 77% to 87% [23], and others – 70% to 76% patency [22]. Despite some advantages of endovascular treatment, however, it is associated with higher percentage of reinfection and has no advantages over open surgery either in death rates or in terms of cost [24].

Conclusions

Despite the better late results achieved in femoropopliteal reconstruction, we conclude that a posterior approach with prosthesis implantation saves the great saphenous vein. The presence of multiple aneurysms in the patients we studied (80%) determined the low survival at 5 and 10 years, which makes the results of the two surgical methods comparable.

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