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Original Article

Popliteal artery aneurysm is a cause that should not be forgotten in acute limb ischemia

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Abstract

Aim: The aim of our study is to determine the amputation rates in patients with acute limb ischemia (ALI) who were monitored for one year and to identify the factors influencing these rates, as well as to examine the effects of popliteal artery aneurysm (PAA) on acute limb ischemia.
Material and Methods: Between January 2022 and January 2023, a retrospective analysis was conducted on 103 patients who presented to our clinic with ALI. Among patients, 59.2% (n=61) were not amputated and classified as Group-1. Group-2 comprised 40.8% of the patients (n=42) all of whom required amputation in the follow-up period. Cases of ALI attributable to atrial fibrillation and trauma were excluded from the study. Both groups were compared in terms of amputation rates in the follow-up period and demographic characteristics. All patients were Rutherford Stage IIa and IIb. Unsalvageable Rutherford Stage3 patients were also excluded. All patients who underwent amputation had exclusively undergone embolectomy; no amputations were observed in patients with PAA (p=0.01).
Results: The average age of the patients was 70.01±12.56 years (min 31-max 89). Seventy-five patients were male (72.8%), while twenty-eight patients were female (27.2%). The etiology of ALI was identified as thromboembolic events secondary to atherosclerotic peripheral artery disease (APAD) in 92 patients (89.3%), and as PAA in 11 patients (10.7%). Sixty-six (64.7%) patients underwent solely embolectomy, nine (8.7%) patients received combined embolectomy with thrombolytic therapy and twenty-eight patients (27.4%) patients underwent surgical revascularization. In the first year follow-up, 42 (41.2%) patients had undergone amputation. All patients who underwent amputation had exclusively undergone embolectomy; no amputations were observed in patients with PAA (p=0.01).
Conclusion: Blinded embolectomy may be the first line surgical treatment for ALI but it has higher amputation rates in 1-year follow-up. While PAA is considered one of the rare causes of ALI, it should be kept in mind as one of the etiological factors in patients presenting with ALI. With appropriate treatment, amputation rates are significantly lower in patients with PAA.

Keywords: Acute limb ischemia, popliteal artery aneurysm, embolectomy, surgical revascularization

INTRODUCTION

Acute limb ischemia (ALI) describes the sudden disruption of blood flow in the extremities attributed to any precipitating etiology [1]. In etiologic factors, embolic and thrombotic events are commonly observed, except for traumas [2]. The true incidence of ALI cannot be precisely estimated due to the diversity of presenting symptoms upon referral [3].

Popliteal artery aneurysm (PAA) is present in the etiology of ALI, yet there is no consistent information available regarding its incidence but epidemiological studies include both chronic limb ischemia and ALI without clear differentiation [3]. Upon the examination of current guidelines, unequivocal evidence regarding the precise significance of PAA in the etiology of ALI is not discernible. PAA represents the most prevalent form of peripheral artery aneurysms, frequently presenting asymptomatically in patients with a prevalence rate of 0.007% in men and 0.001% in women [4]. Typically, patients are referred with symptoms indicative of ALI in the absence of prior clinical manifestations [4]. An estimated 17-46% of patients with PAAs may present with

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severe ALI [5]. In a review of multiple studies examining over 4000 patients, 40% of patients were found to be asymptomatic [6]; however, there is a lack of data regarding the frequency of detection of PAA in cases of ALI. Among asymptomatic patients with PAAs, 14% to 24% will become symptomatic within 1 to 2 years and 31% to 68% will develop complications during the patient's lifetime [7]. Symptoms typically arise from either acute or chronic limb ischemia due to the embolization of distal vessels with or without thrombosis of aneurysmal sac [8]. The significance of PAA in ALI is unquestionable; however, the literature does not definitively provide the frequency of ALI attributable to PAA and amputation rates.

The objective of our study is to investigate the frequency of PAA among patients presenting to our clinic with ALI over a one-year period, as well as to compare the amputation rates and clinical follow-ups of these patients with those who develop ALI due to atherosclerotic peripheral artery disease (APAD).

MATERIAL AND METHODS

All patient data were collected retrospectively from hospital database. In this study, adherence to the principles of the Helsinki Declaration has been observed. The study was approved by the Ethics Committee of our institution (AESH-EKI-2023-502, 06/09/2023).

Between January 2023 and January 2024, a total of 183 patients presenting to our clinic with ALI were included in the study.

Patients who developed ALI due to atrial fibrillation, trauma or iatrogenic causes, as well as those classified as Rutherford Stage 3 (80 patients), were excluded from the study.

Among the remaining 103 patients, 10.7% (n=11) had PAA. The remaining 89.3% (n=92) presented with ALI due to APAD. Patients who did not require amputation in the one-year follow-up period were classified as Group-1 (n=61). The remaining 42 patients required amputation during the follow-up period and were classified as Group 2.

Statistical Analysis

Both groups were compared in order to determine the factors affecting amputation in terms of demographic characteristics, surgical interventions and etiological factors. Continuous variables with a normal distribution were represented by standard deviation (SD) and mean, and were compared between groups of healthy individuals and patients subjected to amputation using independent samples t-test. Categorical variables were expressed as percentages and frequencies, compared between groups using chi-square test. A significance level of $p<0.05$ was considered as statistically significant for all statistical tests. All statistical analyses were conducted using IBM SPSS Statistics for Windows, version 25.0 (Armonk, NY: IBM Corp.).

RESULTS

The average age of the patients was 70.01±12.56 years (min 31-max 89). Seventy-four of the patients were male (72.5%), while twenty-eight patients (27.5%) were female. Among the patients followed up in the study, 66 (64.7%) underwent blind embolectomy, 9 (8.7%) received combined embolectomy and thrombolysis, 28 (27.5%) underwent surgical revascularization except embolectomy. In the follow up period, 42 patients (41.2%) required amputation. The demographic characteristics of patients were presented in Table 1.

Table 1. Demographic characteristics

	Amputated (n=42)	Not amputated (n=61)	P value
Age (year)	72.61±12.70	68.20±12.23	0.08
Gender			
Male	22	53	0.001
Female	20	8	
CAD	16	20	0.676
DM	34	36	0.031
CRF	16	4	0.001
HT	32	44	0.820
CVE	14	4	0.001
Treatment method			
Embolectomy	42	24	0.001
Thrombolysis	0	8	
Surgical revascularization	0	28	
Acetylsalicylic acid	31	14	
Acetylsalicylic acid + clopidogrel	11	47	

CAD: coronary artery disease, DM: diabetes mellitus, CKD: chronic kidney disease, HT: hypertension, CVE: cerebrovascular event

The etiology of ALI was defined as thromboembolic events due to APAD in 91 patients (89.3%) and as PAA in 11 patients (10.7%). Amputation rates were higher in male gender (p=0.01), also patients with chronic kidney disease (CKD) and cerebrovascular events (CVE) had higher amputation rates (p=0.01 and p=0.01 respectively). Also patients who were treated with embolectomy combined with thrombolytics and those who received surgical revascularization had lower amputation rates (p=0.01 and p=0.01 respectively). All patients with PAA were treated with femoro-popliteal bypass with saphenous vein graft. Surgical revascularization methods were presented in Table 2.

Table 2. Types of surgical procedures

Aorta-bifemoral bypass	4
Femoropopliteal bypass	17
Iliofemoral bypass	3
Distal bypass	4

DISCUSSION

ALI is a clinical condition that arises from the sudden disruption of blood flow in the arteries of the extremities due to any etiological cause, the etiological causes of ALI are generally classified based on the presence of embolus and thrombosis [9]. PAA, however, is considered to be one of the rare causes of ALI. The precise incidence of PAA as a cause of ALI is not definitively known.

In our study, the incidence of PAA in patients presenting with ALI to our clinic within one year was found to be 10.7%. Although this rate may not fully represent a scientific significance due to the small sample size and short follow up duration, it does suggest that PAA could be considered as an important etiological factor in ALI.

PAA represents the most commonly encountered aneurysm of peripheral vessels outside of the aortoiliac system and brain [10]. PAA typically manifests itself through symptoms of acute or chronic peripheral vascular disease and presents itself during the sixth and seventh decades of life [6]. Thrombosis of the PAA sac leads to ALI by causing inflow and/or outflow occlusion [11]. If adequate collateral circulation is absent, severe limb ischemia may be observed in these patients, as the aneurysmal sac chronically releases silent thromboembolism into the distal bed [6]. In a series examining 895 patients, early amputation rate was determined to be 14% in patients who developed ALI due to PAA [12]. Among asymptomatic patients with PAAs, 14% to 24% will become symptomatic within 1 to 2 years and 31% to 68% will develop complications during the patient's lifetime [6-12]. In our study, no amputations were deemed necessary in patients with PAA in one-year follow up period. We attribute this outcome to both sufficient level of distal bed perfusion in the included PAA patients and prompt diagnosis and treatment.

In our study, the proportion of patients who did not require amputation during the one-year follow-up period was determined to be 59.2%; in various studies, this rate ranges between 60% and 69.2% [13]. The discrepancy observed in our study may be attributable to the relatively small size of the study population.

Another interesting finding that emerged from our study is that amputations during the follow-up period were observed only in patients who underwent embolectomy. During the follow-up period, no amputations were observed in patients who received combined thrombolytic therapy and embolectomy, nor in those who underwent surgical revascularization. We believe this result is due to the inability to provide adequate runoff during blind embolectomy, which is likely caused by the secondary thrombus burden in the collateral vasculature. Another finding from our study is that patients requiring amputation had a higher incidence of cerebrovascular disease and chronic renal failure. This finding is consistent with larger-scale studies reported in the literature [13].

Given its intrinsic high morbidity and mortality rates, acute limb ischemia mandates prompt diagnosis and appropriate treatment. The etiology of acute limb ischemia is recognized in contemporary guidelines as being synonymous with chronic peripheral vascular disease [3]. Nevertheless, it is noteworthy that popliteal artery aneurysm, the most prevalent peripheral arterial aneurysm, also occupies a significant position in its etiology as we mentioned in our study. In all of our patients with PAA, no need for amputation developed throughout the follow-up period following excision of the aneurysmal sac and bypass with saphenous vein graft.

CONCLUSION

Embolectomy still remains the initial surgical treatment for ALI; however, when performed alone, the amputation rates within the first year are considerably higher compared to combined therapies and surgical revascularization. In accordance with our study findings, PAA assumes notable significance in the context of ALI. Notably, among patients presenting with popliteal artery aneurysm, the absence of amputation within a one-year period was consistently observed following expedited and appropriate surgical revascularization.

Limitations

The most significant limitations of our study include its retrospective nature and the relatively small sample size. Furthermore, our study does not encompass a patient cohort treated with endovascular techniques, which currently play a pivotal role in the management of acute limb ischemia (ALI).

Ethics Committee Approval: The study was approved by the Ankara Etlik City Hospital Ethical Commitee (AESH-EKI-2023-502, 06/09/2023).

Patient Consent for Publication: Not necessary for this manuscript

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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