

Surgical results of acute thromboembolic limb ischemia in octogenarians

Seksen yaş ve üzeri hastalarda akut tromboembolik ekstremitte iskemisinin cerrahi sonuçları

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ABSTRACT

Objectives: The aim of this study was to evaluate surgical outcomes of octogenarian patients presenting with acute limb ischemia (ALI) and undergoing urgent thromboembolectomy.

Patients and methods: Between January 2016 and March 2018, the medical charts of a total of 27 octogenarian patients (16 females, 11 males; median age 85.2±4.3 years; range, 80 to 95 years) who were diagnosed with acute thromboembolic ischemia of the lower or upper limb and underwent urgent thromboembolectomy at our institution were retrospectively analyzed. The 30-day mortality rate of ALI was evaluated. Demographic and clinical characteristics of the patients, associated pathologies, and postoperative outcomes including infection, gastrointestinal bleeding, hematoma, revision surgery, and amputation were recorded.

Results: Nineteen patients (70.3%) had acute lower limb ischemia, while eight patients (29.7%) had acute upper limb ischemia. Acute ischemic pain was the most commonly seen symptom (n=26, 96.3%). Atrial fibrillation was the most common comorbidity in 62.9% patients. Postoperative complications included hematoma (n=5, 18.5%), wound infection (n=4, 14.8%), and gastrointestinal bleeding (n=2, 7.4%). Re-embolectomy was performed in three patients (11.1%). Fasciotomies were performed during follow-up due to compartment syndrome in three patients (11.1%) and these patients subsequently underwent lower limb amputation. The 30-day mortality occurred in two patients due to renal failure and the mortality rate was found to be 7.4%.

Conclusion: Based on our study results, ALI in octogenarians has different outcomes. Our findings suggest that patients with neurological deficit due to delayed ischemia and those with diabetes mellitus and severe ischemia face a higher risk in mortality and morbidity.

Keywords: Embolectomy; limb ischemia; octogenarian; thromboembolism.

ÖZ

Amaç: Bu çalışmada, akut ekstremitte iskemisi (AEİ) olan ve acil tromboemboliktomi yapılan seksen yaş ve üzeri hastaların cerrahi sonuçları değerlendirildi.

Hastalar ve Yöntemler: Ocak 2016 - Mart 2018 tarihleri arasında hastanemizde alt veya üst ekstremitte akut tromboembolik iskemisi tanısı konan ve acil tromboemboliktomi yapılan 80 yaş ve üzeri toplam 27 hastanın (16 kadın, 11 erkek; medyan yaş 85.2±4.3 yıl; dağılım, 80-95 yıl) tıbbi dosyası retrospektif olarak incelendi. Akut ekstremitte iskemisinin 30 günlük mortalite oranı değerlendirildi. Hastaların demografik ve klinik özellikleri, eşlik eden hastalıkları ve enfeksiyon, gastrointestinal kanama, hematoma, revizyon cerrahisi ve amputasyon dahil olmak üzere ameliyat sonrası sonuçlar kaydedildi.

Bulgular: On dokuz hastada (%70.3) akut alt ekstremitte iskemisi var iken, sekiz hastada (%29.7) akut üst ekstremitte iskemisi vardı. Akut iskemiyeye bağlı akut ağrı, en sık görülen semptomdu (n=26, %96.3). Atriyal fibrilasyon, hastaların %62.9'unda en sık görülen komorbidite idi. Ameliyat sonrası komplikasyonlar hematoma (n=5, %18.5), yara yeri enfeksiyonu (n=4, %14.8) ve gastrointestinal kanama (n=2, %7.4) idi. Üç hastada (%11.1) emboliktomi yeniden yapıldı. Üç hastaya (%11.1) kompartman sendromu nedeniyle fasyotomi uygulandı ve bu hastalara akabinde alt ekstremitte amputasyonu yapıldı. İki hastada böbrek yetmezliğine bağlı mortalite izlendi ve mortalite oranı %7.4 olarak bulundu.

Sonuç: Çalışma sonuçlarımıza göre, ALI seksen yaş ve üzeri hastalarda farklı sonuçlar doğurmaktadır. Çalışma bulgularımız uzamış iskemisi nedeniyle nörolojik defisit gelişen hastalar ve diabetes mellitus ve şiddetli iskemili hastaların mortalite ve morbidite açısından daha yüksek bir risk ile karşı karşıya olduğunu göstermektedir.

Anahtar sözcükler: Emboliktomi; ekstremitte iskemisi; 80 yaş ve üzeri; tromboemboli.

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Acute limb ischemia (ALI) is defined as rapid decrease of perfusion which causes a potential threat to limb viability.^[1] Thromboembolectomy using the Fogarty balloon catheter which can be performed in eight hours has long been the primary surgical treatment option for critical ALI.^[2] Delayed or unsuccessful treatment is associated with significant morbidity and mortality.^[3] Acute upper or lower limb ischemia secondary to arterial thromboembolism is a common problem in geriatric patient population. However, there is a limited number of data available regarding the results of ALI treatment in elderly patients. Octogenarians typically present with multiple comorbidities which may complicate the disease management. The common etiology is atrial fibrillation (AF) in these patients.^[4] Although conventional medical therapy with warfarin has been used widely, additional complications related to the use of warfarin continue to be seen. In recent years, new generation of oral anticoagulants are on the scene and have begun to be used in octogenarians. To address the shortcomings of the current literature, in the present study, we aimed to evaluate octogenarian patients presenting with ALI and undergoing thromboembolectomy at our institution.

PATIENTS AND METHODS

Study design

Between January 2016 and March 2018, a total of 27 octogenarian patients (16 females, 11 males; median age 85.2±4.3 years; range 80 to 95 years) with acute upper or lower limb ischemia who underwent urgent thromboembolectomy with the Fogarty balloon catheter (Edwards Lifesciences, Irvine, CA, USA) were retrospectively analyzed. The diagnosis of ALI was based on clinical examination and the absence of distal vascular pulses. In addition, colored arterial Duplex ultrasound (DUS) and computed tomography angiography (CTA) were performed to confirm the diagnosis of ALI. Patients with aortic dissection, graft occlusion, or trauma were excluded from the study.

Pre-, intra-, and postoperative variables including age, gender, history of prior stroke, diabetes mellitus, hypertension, presence of AF, coronary artery disease, cardiac valve disease, peripheral arterial disease, intensive care unit and hospital stay, and mortality were noted. In addition, postoperative infection, gastrointestinal bleeding, hematoma, amputation, renal failure, and reoperation rates were recorded.

Data were collected directly from the patients' medical records. To evaluate the origin of the arterial occlusion, all patients were examined via transthoracic echocardiography during the postoperative period.

This retrospective study was approved by the Clinical Research Ethics Committee (Number: 2018/0083, Date: 10.04.2018). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Operation technique

All urgent embolectomy procedures were performed under local anesthesia with mild sedation. Arteriotomy was applied after systemic heparinization (5000 IU, standard heparin, intravenous), and the Fogarty balloon catheter was used for embolectomy (Figures 1, 2). We did not use vascular clamps in any operation due to potential endothelial injury.^[5] In all procedures, vascular loops were used for arterial clamping. Low-molecular-weight heparin (LMWH) was administered (enoxaparin 1 mg/kg subcutaneously, bid) to all patients postoperatively and, if necessary, oral anticoagulant treatment with warfarin or rivaroxaban was applied for maintenance.

Outcomes

The primary outcome of the study was 30-day mortality regarding to ALI. The secondary outcomes were the determination of demographic features of patients, the associated pathologies and postoperative outcomes including infection, gastrointestinal bleeding, hematoma, revision and amputation.

Statistical analysis

Statistical analysis was performed using the GraphPad Prism v.3.10 statistical software (GraphPad Software, La Jolla, CA, USA). Descriptive data for continuous variables were presented in mean and standard deviation (SD), number (n) and frequency (%), or median and interquartile range (IQR). The Pearson chi-square test and Fisher's exact test were used to compare the results. A *p* value of <0.05 was considered statistically significant.

RESULTS

Of 27 patients, 19 (70.3%) had acute lower limb ischemia, while eight (29.7%) had acute upper limb ischemia. All patients underwent urgent embolectomy. Demographic and clinical characteristics of patients are shown in Table 1.



Figure 1. A 86-year-old female patient with acute left lower limb ischemia. (a) A preoperative image showing color changes in left leg. (b) Rapid improvement after embolectomy procedure within eight hour.

Acute ischemic pain was the most common clinical manifestation (n=26, 96.3%) of ALI in the study. The other symptoms were as follows: poikilothermia (n=18, 66.6%), paresthesia (n=17, 62.9%), pallor (n=14, 51.8%), and paralysis (n=5, 18.5%).

The femoral artery bifurcation was the most common area of occlusion in the study group (n=12, 44.5%). The other sites were brachial artery bifurcation

(n=8, 29.6%) and popliteal artery (n=7, 25.9%). Eleven patients (40.7%) presented within the first 12 h, while 16 patients (59.3%) presented after a delay of more than 12 h. The anatomic and clinical features of patients are shown in Table 2.

Atrial fibrillation was the most common comorbidity and the etiologic reason for thromboembolism in 17 patients (62.9%), while the other concomitant



Figure 2. Intraoperative images of embolectomy procedure. (a) Vascular loops were used for femoral artery clamping and an arteriotomy was performed. (b) Acute-subacute organized thrombus materials which were removed from femoral artery.

Table 1. Demographic and clinical characteristics of patients

Variable	n	%	Mean±SD	Min-Max
Age (year)			85.2±4.35	80-95
Gender				
Female	16	59.2		
Male	11	40.8		
Associated pathologies				
Atrial fibrillation	17	62.9		
Coronary artery disease	11	40.7		
Peripheral arterial disease	7	25.9		
Cardiac valve disease	3	11.1		
Prior stroke	4	14.8		
Diabetes on insulin	10	37.1		
Hypertension	13	48.2		
Localizations				
Left lower limb	9	33.3		
Right lower limb	10	37.1		
Left upper limb	5	18.5		
Right upper limb	3	11.1		
Outcomes				
Infection	4	14.8		
GIS bleeding	2	7.4		
Hematoma	5	18.5		
Reembolectomy	3	11.1		
Amputation	3	11.1		
Renal failure	2	7.4		
Mortality	2	7.4		

SD: Standard deviation; Min: Minimum; Max: Maximum; GIS: Gastrointestinal system.

diseases were hypertension (n=13, 48.2%), coronary artery disease (n=11, 40.7%), insulin-dependent diabetes (n=10, 37.1%), chronic peripheral arterial disease (n=7, 25.9%), stroke (n=4, 14.8%), and cardiac valve disease (n=3, 11.1%).

Postoperative complications included hematoma in five (18.5%), wound infection in four (14.8%), and gastrointestinal bleeding in two patients (7.4%). Re-embolectomy was performed in three patients (11.1%). Fasciotomies were performed during follow-up in the presence of compartment syndrome in three patients (11.1%) and these patients underwent lower limb amputation. The length of stay was 5.3 days, and the 30-day re-admission to hospital rate was 18.5% (n=5). In addition, 30-day mortality occurred in two patients due to renal failure and the mortality rate was 7.4%. In the analysis of ischemia time, even 11 patients were admitted within 12 h, 16 patients were admitted after 12 h. In addition, all patients who underwent fasciotomy, re-embolectomy or amputation were in the delayed group. Our results showed that the patients presenting after 12 h had a higher rate of amputation, re-embolectomy, and mortality, although there was no statistically significant difference (p=0.248).

Table 2. Anatomic and clinical features of patients

	n	%
Trombus site		
Common femoral artery	12	44.5
Popliteal artery	7	25.9
Brachial artery	8	29.6
Presentation time		
<12 hours	11	40.7
>12 hours	16	59.3
Clinical manifestation		
Pain	26	96.3
Pallor	14	51.8
Poikilothermia	18	66.6
Paresthesia	17	62.9
Paralysis	5	18.5

The mean follow-up was 4.1±1.3 months. All patients underwent control arterial DUS and no residual thrombus was noted. During follow-up, 17 patients with AF were treated with warfarin (n=11) and rivaroxaban (n=6). The selection of anticoagulant agent was made according to the international normalized ratio (INR) levels of each patient. In the patients with inadequate INR levels at three consecutive times, rivaroxaban was used for the maintenance. Eight patients were followed by only acetylsalicylic acid (100 mg) once a day per oral.

DISCUSSION

This single-center, retrospective study was designed to investigate the outcomes of ALI in octogenarian patients undergoing embolectomy procedures. Although previous studies have addressed into the risk factors and timing of ALI, there is a limited number of data regarding outcomes of octogenarian population in the literature.

The etiology of ALI is various. Ueberrueck et al.^[6] investigated the risk factors and management of arterial embolism of the upper and lower limbs and reported that the most common cause of the embolism (73%) was AF. Similarly, the most common comorbidity was AF in our study sample (n=17, 62.9%). According to their study, 32.2% of the patients received oral anticoagulation, and 37.9% antiplatelet therapy after discharge. In our study, antiplatelet therapy was used in 37% patients (n=10), while oral anticoagulation was used in 62.9% patients (n=17). The main reason of this difference was the high presence of AF in the cohort of the aforementioned study.^[6] Also, chronic peripheral

arterial disease was one of the common causes of ALI in our study.

While there are limited data on the incidence of ALI in the general population and the estimated ratio is 14 per 100,000 and to compose 10 to 16% of the vascular workload, it is not known what the exact incidence of patients over 80 years presenting with ALI. In general, ALI continues to have a particularly severe short-term outcomes both in terms of amputation and mortality with 30-day amputation rates of 10 to 30% and a mortality rate of around 15%.^[7] In our study, the amputation rate was seen as 11.1% and 30-day mortality was 7.4%, consistent with the literature data.

The diagnosis of ALI in the emergency setting is still controversial. It can be diagnosed based on the patient history, physical examination, and imaging studies. Imaging modalities such as DUS, CTA, and magnetic resonance angiography are used frequently owing to the ease of establishing disease and the low risk of complications.^[8] The main question should be whether the DUS imaging alone can be used for successfully revascularization planning for ALI. In our study, DUS was the main utility for the diagnosis of ALI. Crawford et al.^[9] performed a prospective study and they evaluated the utility of DUS imaging alone for the diagnosis and treatment of ALI. In their study, diagnosis by DUS imaging alone was compared with contrast angiography and CTA. Surgical outcomes and survival for patients who were evaluated by preoperative DUS imaging alone for ALI were equal to patients who were evaluated with CTA. Therefore, the authors concluded that preoperative DUS imaging alone was sufficient for operative planning in patients with symptoms suggestive of ALI. Thus, it can be understood that DUS is safe and adequate tool for the diagnosis of ALI and decision of embolectomy procedures.

The high risk factors for amputation are severe ischemia, prolonged ischemic time, smoking, and diabetes mellitus.^[10,11] In our study, three patients (11.1%) underwent amputation and all of them were diabetic, presented after 12 h, and had severe ischemia including neurological deficit. However, even the number of patients who underwent amputation was higher in this group, there was no statistically significant difference in the presentation time among the patients. The main reason of this situation may be the low number of patients in the cohort. According to the current literature, the rate of lower limb

amputation was reported as 4.4% by Spanos et al.^[4] and they concluded that amputation was only associated with diabetes mellitus in their study.

Furthermore, the 30-day mortality rate of ALI was 7.4% in our study. Zaraca et al.^[12] analyzed factors influencing the results of surgical management for acute lower limb ischemia and they reported that age over 80 is a risk factor which affected long-term outcomes after thromboembolectomy for acute lower limb ischemia. In previous studies, the mortality rate for the patients who underwent urgent lower limb embolectomy was reported between 13 and 35%.^[13,14] In addition, functional dependence status, chronic renal failure, steroid use, and age >70 years predicted the highest mortality in the aforementioned studies.

This study has some limitations. First, the number of patients included in the study was relatively low due to the single-center design. Second, this study has a retrospective nature lacking long-term outcomes.

In conclusion, our study results show that ALI in octogenarians has different outcomes. Our findings suggest that patients with neurological deficit due to delayed ischemia and those with diabetes mellitus and severe ischemia face a higher risk in mortality and morbidity.

Declaration of conflicting interests

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