Surgical results of acute thromboembolic limb ischemia in octogenarians

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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.
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 embolectomy (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 \( p < 0.05 \) 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.
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

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**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.

**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.
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%. 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. 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. 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. 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. 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. 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%. 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.

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