

Outcome of Early Surgical Intervention in Acute Lower Limb Ischemia due to Thromboembolism

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Abstract:

Keywords:

Acute limb ischaemia, Thromboembolism.

Background: Acute lower extremity ischemia is a common vascular disease and considered limb- and life- threatening. The present study evaluated and compared the outcome of early and late surgical intervention in acute lower limb ischemia due to thromboembolism.

Methodology: This non randomized comparative parallel study was conducted at the Department of Cardiovascular Surgery, NICVD, Dhaka, Bangladesh from January 2007 to December 2008 for duration of two year. Total 80 patients were enrolled in this study. The patients were divided into equal two groups, Group A, for early surgical intervention (with in 24 hours) and Group B, late surgical intervention (more than 24 hours).

Results: Mean (\pm SD) age of both Group A and Group B was 51.93 (\pm 11.73) and 47.00 (\pm 11.01) years. Male and female ratio of the total study population was 1.76:1 Pain and absence of pulse distal to occlusion was common for all. Cold extremity, sensory deficit, motor deficit, diminish vascular flow was the commonest findings of both group. In Group A, 57.5% had superficial femoral artery occlusion, 22.5% had iliac artery and 20.0% popliteal artery occlusion. In Group B, 42.5% had superficial femoral artery occlusion, 32.5% had popliteal artery occlusion and 25.0% had iliac artery occlusion. Fasciotomy was performed in 15.0% patients of Group A and in 22.0% patients of Group B. After Fogarty embolectomy in group A and group B had warm extremity (80.0% vs. 65.0%), pulsation distal to occlusion (90.0% vs. 75.0%), intact sensory function (82.5% vs. 67.5%), intact motor function (80.0% vs. 65.0%), and normal vascular flow by Doppler US (80.0% vs. 65.0%). During postoperative period history of bleeding, infection, reperfusion injury, muscle necrosis and limb amputation were 12.5% vs. 10.0%, 5.0% and 7.5%, 17.5% vs. 35.0%, 15.0% vs. 12.5% and 37.5% vs. 32.5% respectively.

Conclusion: Duration of embolism may be the significant factor determining the outcomes of the management of acute arterial embolism in the lower extremities. The 24- hour duration of arterial embolism is a crucial factor influencing the surgical the management and early diagnosis and shifting of patients to specified centre as early as possible to save limb as well as life.

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Introduction:

Acute lower extremity ischemia (ALI) is a common vascular disease and is a cause of considerable morbidity and mortality. It is considered as limb- and life-threatening condition usually requiring revascularization therapy within 24 hours.¹ Acute peripheral arterial occlusion (APAO) can be associated with a spectrum of presenting signs and symptoms. In an extreme case, a patient without underlying arterial occlusive disease who suffers from an acute embolic occlusion at the superficial femoral bifurcation may present with a profoundly ischemic lower extremity, requiring urgent intervention.² It is well established that arterial

embolism is a common cause of acute lower limb ischemia. Emboli from the proximal sources either cardiac or proximal aorta commonly occlude the bifurcation of the arteries of the lower extremity.³⁻⁶ Despite many progresses in the fields of the immediate management of ALI and in the area of the revascularization procedures, APAO continues to be associated with substantial limb loss and considerable mortality. Indeed, most recent large series report that 30-day mortality still accounts for approximately 15.0%, while the amputation rate (10.0%-30.0%) varies much more.⁷ Embolectomy is generally indicated in the presence of severe acute ischemia, usually indicated by loss of sensitivity, discolouration of

the skin, decreased skin temperature and moderate rigor of the muscles. Although early diagnosis and treatment is important, the time factor does not contraindicate the surgical treatment itself. When ischemia becomes irreversible, there is blotchy cyanotic discoloration not influenced by digital pressure, the calf muscle has a firm consistency and there is anesthesia and paralysis of the extremity.² Very little published epidemiological data are available to establish the real incidence of APAO in the general population. An audit carried out in Gloucestershire have found a 14/100,000 incidence of acute limb ischemia (ALI) in the general population, which increases to 17 per 100,000 if bypass graft occlusions were included.⁸ The Swedish Vascular Registry confirms the data, reporting 13/100,000 regional incidence.⁹

A few study of management of peripheral limb ischemia were done previously in Bangladesh. They were limited on outcome of treatment of peripheral limb ischemia irrespective of the time of intervention. This comparative study evaluated the outcome of early surgical intervention in lower limb ischemia due to thromboembolism.

Methods and Materials:

The present study evaluated the outcome of early and late surgical intervention in acute lower limb ischemia due to thromboembolism. It was a non randomized comparative parallel study conducted in the Department of Cardiovascular Surgery, National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh between the periods January 2007 and December 2008.

Patients who were scheduled for surgical revascularization for ALI due to thromboembolism were enrolled in the study. Convenient non-probability sampling technique was applied in the study. Total number of patients was 80. The patients were divided into equal two groups. Group A (n=40) for early surgical intervention (within 24 hours) and Group B (n=40) for late surgical intervention (more than 24 hours). Patient with chronic lower limb ischemia, patient with major tissue loss or permanent nerve damage, patient with prosthetic graft, patients with gangrenous limb,

patients with known pre-existing peripheral vascular disease and re-operation were excluded from the study. Doppler studies were done in every patient before and after operation for diagnosis and to evaluate post operative outcome. All data were analyzed by using computer based SPSS (statistical programme for social science). Data were expressed in frequency, percentage, mean \pm SD as applicable. Comparison between the groups was done by Chi-squared test and Student t test as applicable. p value of less than 0.05 was considered as significant.

Results:

In the present study Mean (\pm SD) age of Group A and Group B were 51.93 (\pm 11.73) and 47.00 (\pm 11.01) years respectively. In Group A maximum 30.0% belonged to 45 to 55 years age range followed by 25.0% within 55-65 years, 20.0% were within 35 to 45 years, 15% above 65 years and 10.0% up to 35 years age range. In Group B maximum 42.5% belonged to 35 to 45 years age group followed by 32.5% within 45 to 55 years, 10.0% above 65 years, 7.5% up to 35 years and 7.5% 55-65 years age group. Male and female in Group A and in Group B were 67.5% and 32.5% and 60.0% and 40.0% respectively.

Regarding occupation in Group A, service holder, housewife, businessman, retired and other professionals were 12.5%, 32.5%, 30.0%, 15.0%, and 10.0% respectively and in Group B they were 25.0% maximum 37.5%, 7.5% 10.0% and 20.0% respectively. Smoker in Group A and Group B were 62.5% and 50.0% respectively. In Group A and Group B there were 42.5% and 27.5% had diabetes mellitus respectively. In group A 55.0% were hypertensive and in group B 40.0% were hypertensive (Table I). All patients of group A and group B had history of pain and absence of pulse distal to occlusion. 92.5% patients of group A had cold and 7.5% had warm extremity, on the other side in group B 97.5% had cold and 2.5% had warm extremity. Intact sensory function in Group A and Group B were 12.5% and 7.5% respectively and intact motor function were 20.0% and 10.0% respectively.

By Doppler USG evaluation only 2.5% patients of Group A had found diminish vascular flow and rests 97.5% had absent vascular flow, in Group

B 5.0% and 95.0% patients had diminished and absent vascular flow respectively (Table II). In Group A maximum had occlusion in superficial femoral artery (57.5%) followed by iliac artery (22.5%) and popliteal artery (20.0%). In Group B occlusion in superficial femoral artery, popliteal artery and iliac artery occlusion were 42.5%, 32.5% and 25.0% respectively. In patients of Group A 27.5% had viable muscle, 67.5% had borderline and 5.0% had no viability. In Group B 22.5% had viable muscle, 67.5% had borderline and 10.0% had dead muscle.

Table-I
Distribution of characteristics of patients by group.

	Group A n=40	Group B n=40	p value
Age(yrs)			
<35	04 (10.0)	03 (07.5)	
35-45	08 (20.0)	17 (42.5)	
45-55	12(30.0)	13(32.5)	
55-65	10(25)	03(7.5)	
>65	06(15)	04(10.0)	
Mean± SD	51.93± 11.73	47.00± 11.01	0.056***
Sex			
Male	27(67.5)	24(60.0)	
Female	13(32.5)	16(40.0)	0.485*
Occupation			
Service	05(12.5)	10(25.0)	
Housewife	13(32.5)	15(37.5)	
Business	12(30.0)	03(07.5)	0.063
Retired	06(15.0)	04(10.00)	
others	04(10.0)	08(20.0)	
Habits			
Smoking	25(62.5)	20(50.0)	0.260*
Alcohol	03(07.5)	03(0.75)	0.999*
Comorbid Diseases			
Diabetes Mellitus	17(42.5)	11(27.5)	0.160*
Hypertension	22(55.0)	16(40.0)	0.179*
Ischaemic heart disease	15(37.5)	12(30.0)	0.478*
Atrial fibrillation	18(45.0)	24(60.0)	0.179*
Mitral stenosis	06(15.0)	03(07.5)	0.479**
Stroke	02(05.0)	02(05.5)	0.999**

*Chi-square test was done to measure the level of significant

**With Yates's correction

***t test was done to measure the level of significant

Table-II
Distribution of the clinical presentation and laboratory finding group.

	Group A (n=40)	Group B (n=40)	P value
Limb pain	40(100.0)	40(100.0)	
Limb Temp			
Cold	37(92.5)	39(97.5)	0.608**
warm	03(07.5)	01(02.5)	
Absence of pulse beyond occlusion	40(100.0)	40(100.0)	
Sensory function			
Intact	05(12.5)	03(07.5)	0.709**
Diminish	35(87.5)	37(92.5)	
Motor function			
Intact	08(20.0)	04(10.0)	0.210*
Diminished	32(80.0)	36(90.0)	
Doppler finding beyond occlusion			
Diminished	01(02.5)	02(05.0)	
Absent	39(97.5)	38(95.0)	0.999**

*Chi-square test was done to measure the level of significant

**With Yates's correction

Fasciotomy was performed in 15.0% patients of group A and 22.0% patients of Group B. After Fogarty embolectomy 80.0% patient of Group A and 65.0% of Group B had warm extremity, 90.0% and 75.0% patients of both Group A and Group B had pulsation distal to occlusion respectively. In Group A and Group B 82.5% and 67.5% patients had intact sensory function and 80.0% and 65.0% had intact motor function. Doppler USG evaluates 80.0% patients of Group A and 65.0% patients of Group B had normal vascular flow. During postoperative period 12.5% patients of Group A and 10.0% of Group B had history of bleeding, 5.0% of Group A and 7.5% of Group B had developed infection, 17.5% patients of Group A and 35.0% patients of Group B had reperfusion injury. Muscle necrosis and limb amputation was observed in 15.0% and 12.5% patients of Group A and 37.5% and 32.5% patients of Group B respectively (Table III).

Table-III

Distribution of Site of arterial occlusion, per operative findings, outcome and complications by group.

	Group A n=40	Group B n=40	P value*
Site of occlusion			
Iliac artery	09(22.5)	10(25.0)	0.342
SupFemoralartery	23(57.5)	17(42.5)	
Popliteal artery	08(20.0)	13(32.5)	
Muscle Viability			
Present	11(27.5)	09(22.5)	0.648
Absent	02(05.0)	04(10.0)	
Borderline	27(67.5)	27(67.5)	
Fasciotomy performed			
	06(15.0)	09(22.5)	0.390
Outcomes			
Diminished Temperature of Limb	08(20.0)	14(35.0)	0.133
Presence Pulse beyond occlusion	36(90.0)	30(75.0)	
Intact Sensory function	33(82.5)	27(67.5)	
Motor function intact	32(80.0)	26(65.0)	0.133
Doppler beyond occlusion			
Normal	32(80.0)	26(65.0)	0.322
Diminish	05(12.5)	09(22.5)	
Absent	03(07.5)	05(12.5)	
Complications			
Bleeding	05(12.5)	04(10.0)	0.999**
Infection	02(05.0)	03(07.5)	0.999**
Reperfusion injury	07(17.5)	14(35.5)	0.075**
Muscle necrosis	06(15.0)	15(37.5)	0.022**
Limb amputation	05(12.5)	13(32.5)	0.032**
Death	02(05)	04(10.0)	0.671**

*Chi-square test was done to measure the level of significant

**With Yates's correction

Discussion:

Acute lower extremity ischemia continues to be associated with significant limb loss and mortality despite advances in endovascular-based therapies and overall improved critical care.¹ In the present study total 80 patients with acute lower limb ischemia were enrolled and they

were divided into equal two groups, Group A for early surgical intervention (within 24 hours) and Group B for late (more than 24 hours). The aim of this study was to evaluate the outcome of surgical intervention in acute lower limb ischemia due to thromboembolism. In the present study the mean (\pm SD) of age in Group A and Group B were 51.93 (\pm 11.73) and 47.00 (\pm 11.01) years respectively. In the present study in Group A 67.5% were male and 32.5% were female and in Group B 60.0% were male and 40.0% were female. Male and female ratio was 1.76:1. Antusevas and Aleksynas,¹⁰ in a study of 74 men with acute ischemia in the lower limb found that mean \pm SD of age was 68.3 \pm 12 years, and for 68 women that was 76.2 \pm 8 years. In Mutirangura et al.¹¹ series mean (\pm SD) age of early acute and late acute group was 61.0 \pm 17.0 and 61.6 \pm 17.0 years respectively which was inconsistent with our result. Iyem and Eren,¹² in a study of the 122 patients showed that mean \pm SD of age was 54.2 \pm 16.8 years. In their study 71 were male and 51 were female. In Mutiranrura et al.¹¹ series in early acute group male and female was 48.4% and 51.6% and in late acute group 70.0% and 30.0% respectively and male and female ratio in their study was 1.67:1, which is consistent with our result.

In Group A 62.5% were smoker and in Group B 50.0%. In group A and group B 7.5% from each group had history of taking alcohol. Diabetes mellitus present in 42.5% and 27.5% in Group A and Group B respectively. In group A 55.0% had HTN and in group B 40.0% had Hypertension. Atrial fibrillation, Aortic stenosis and stroke observed in both group A and group B and were 45.0% and 60.0%, 15.0% and 7.5% and 5.0% and 5.0% respectively. In the present study there is no statistically significant difference in age, sex, occupation, smoking habit and medical condition between the groups. In Mutiranrura et al.¹¹ series 48.4% of early acute group and 56.7% of late acute group were smoker and 27.5% patients were hypertensive and 27.5% were diabetic.

Acute ischemic pain (93.4%) was the most common clinical manifestation of acute arterial embolism of their series followed by pallor (94.5%), sensory loss (86.8%), and paralysis (74.7%). Muscle weakness was more

predominant in late acute embolism (86.7% vs. 51.6%, $p < 0.001$). In our series pain and absence of pulse distal to occlusion were the common clinical presentation. More than ninety percent (92.5%) patients of Group A and nearly all cases in Group B (97.5%) had cold extremity. Only 12.5% and 7.5% patients in Group A and Group B had intact sensory function respectively. In Group A and Group B had intact motor function 20.0% and 10.0% respectively. By Doppler USG evaluation only 2.5% patients of Group A had found diminish vascular flow and rests 97.5% had absent vascular flow and in Group B 5.0% and 95.0% patients had diminished and absent vascular flow respectively.

In Group A 57.5% had superficial femoral artery occlusion followed by 22.5% iliac artery and 20.0% popliteal artery occlusion. In Group B 42.5% had superficial femoral artery occlusion, 32.5% had popliteal artery occlusion and 25.0% had iliac artery occlusion. Antusevas and Aleksynas,¹⁰ in a study showed that thrombosis damaged the femoral artery for 37.9%, iliac artery for 22.7%, popliteal artery for 22.2% patients and embolism was in the femoral artery for 32.9%, popliteal artery for 4.7%, and tibialis artery for 7% patients.

In Group A, 27.5% had viable muscle, 67.5% had borderline and 5.0% had no viability and in Group B 22.5% had viable muscle, 67.5% had borderline and 10.0% had dead muscle ($p > 0.05$). Fasciotomy was performed in 15.0% patients of Group A and 22.0% patients of Group B ($p > 0.05$). After Fogarty embolectomy 80.0% patient of Group A and 65.0% of Group B had warm extremity and 90.0% and 75.0% patients in Group A and Group B had pulsation distal to occlusion respectively. In Group A and Group B, 82.5% and 67.5% patients had intact sensory function and 80.0% and 65.0% had intact motor function. Doppler US evaluates 80.0% patients of Group A and 65.0% patients of group B had normal vascular flow. No statistically significant differences were observed between groups in term of different outcomes. During postoperative period 12.5% patients of Group A and 10.0% of Group B had history of bleeding, 5.0% of Group A and 7.5% of Group B had developed infection, 17.5% patients of Group A and 35.0% patients of Group B had reperfusion injury. Muscle necrosis and limb

amputation was observed in 15.0% and 12.5% patients of Group A and 37.5% and 32.5% patients of Group B respectively ($p < 0.05$). Similar observation was seen in Mutiranrura et al.¹¹ series. Limb ischemia beyond 24 hours of their series had the tendency to result in extensive gangrene (3.2% vs. 26.7%, $p < 0.015$) and a higher incidence of primary major amputation (3.2% vs. 20.0%, $p < 0.05$). Antusevas and Aleksynas,¹⁰ in a study showed the total death rate in the group of 142 patients with acute leg ischemia was 4.2% (6 patients), the death rate in the of 76 patients with emboli group was 5.3% (4 patients) and in the of 66 patients with acute thrombosis group - 3% (2 patients). Iyem and Eren,¹² in a study showed that complications like fasciotomy, amputation; Infection, Myonephro-pathic metabolic syndrome; venous thrombosis and mortality were 11.47, 7.37, 9.01, 4.09, 2.45 and 9.01. Abir et al.¹³ and Cranley et al.¹⁴ in their study showed that amputation rate following operations undertaken during the first 12 hours is reported in the range of 2.1% to 5.9%; but the rate increases to 39.2% after 12 hours. Hight et al.¹⁵ analyzed 11 different series between 1954 and 1974 and determined an amputation rate of 4% to 48% and a mortality rate of 14% to 50%. In a study by Yangni et al.¹⁶ that included 24 patients, the amputation rate was reported as 29.2% and the mortality rate as 29.2%. In another study by Karapolat et al.¹⁷ the amputation rate of arterial embolectomy beyond 24 hours was reported to be 11.4%. Iyem and Eren,¹² in a study showed that 11.47% had fasciotomy and 7.37% had amputation. Becquemin and Kovarsky,¹⁸ and Pellegrino,¹⁹ in their study found that the major amputation rate in thrombosis and embolism cases were 16.0% and 11.0%. Illuminati et al.²⁰ in their study found that the major amputation rate in thrombosis and embolism cases were 37.7% and 17.2% and Kuukasjarvi and Salenius,²¹ in their study found that the major amputation rate in thrombosis and embolism cases were 26.0% and 10.0%.

Due to the toxic metabolic product accumulated in and released by the more than 24-hour ischemic tissue, alteration of the systemic haemodynamics leading to multiple organ dysfunction and major amputation was not uncommon of major limb loss before and after revascularization and the less successful outcomes of treatments were observed in those patients with more than 24-hour duration.

Complete revascularization rate was observed in both group of our study was 80.0% and 65.0% respectively ($p > 0.05$). The successful revascularization after the initial embolectomy was similar in Mutiranrura et al.¹¹ series in the management of early acute embolism than that of late acute embolism (83.9% vs. 58.3%, $p < 0.001$). These were the consequence of the adhesiveness between the emboli and the endothelium of the occluded arterial segment where the duration of occlusion lasted more than 24 hours. Therefore, the complete removal of those emboli could not be simply accomplished by surgical embolectomy alone. Despite the deployment of varying modalities of primary treatment, major amputation after revascularization in patients with late acute embolism superseded those with early acute embolism (24.4% vs. 7.4%, $p < 0.106$). Total death rate was reported 5.0% and 10.0% for Group A and Group B respectively. Almost similar result (9.7% vs. 15.0%) was observed by Mutiranrura et al.¹¹. Taviloglu et al.²² showed that mortality rates have reported as 12.5% within 12 hours and 37.7% thereafter.

Conclusion:

Duration of embolism may be the significant factor determining the outcomes of the management of acute arterial embolism in the lower extremities. The higher tendency of developing extensive limb gangrene, the higher number of major limb loss before and after revascularization and the less successful outcomes of treatments were observed in those patients with more than 24-hour duration.

Recommendation:

Duration of arterial embolism is a crucial factor influencing the surgical management of acute lower limb ischaemia due to thromboembolism. So, early diagnosis and shifting of patients to specified centre as early as possible to save limb as well as life.

Conflict of Interest - None.

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