

# Late Presentation of Acute Limb Ischemia: Causes and Outcomes

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## ABSTRACT

**Objective:** To determine the causes of interventions in patients with acute limb ischemia (ALI), the time lapse of presentation, and the outcome.

**Study Design:** An observational study.

**Methodology:** All delayed acute limb ischemia cases (presenting later than 6 hours after the onset of symptoms) were included in the study. Cases of ALI secondary to accidental trauma were excluded except those of iatrogenic trauma like patients with intravenous drug abuse and intra-arterial accidental drug infiltration. Patients' demographic data, clinical history, aetiology, examination findings, and treatment data; including type of surgery, level of amputation, adjunctive treatment were recorded.

**Results:** Total number of delayed ALI cases was 147. Mean age was  $59.52 \pm 17.77$  years. Seventy-five (51%) were females while 72(49%) were males. The right lower limb was involved in 56(38%) cases. A hundred (68%) thromboembolectomies were successful and limbs were saved, while 19(12.9%) had failure after the procedure. Three (2%) patients expired within 24 hours of thromboembolectomy. Twenty-five (17%) had frank gangrene at presentation and ended up in amputations while 122 (82.9%) had questionable viability and underwent limb salvage procedures.

**Conclusion:** Delayed presentation of ALI is very common; timely management with effective thromboembolectomies can save limbs in most of the patients.

**Key Words:** Acute limb ischemia (ALI), Treatment, Amputation, Thromboembolectomy, embolism.

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## INTRODUCTION

Acute limb ischemia (ALI) or sudden decrease in limb perfusion for less than 14 days; it causes a potential threat to limb viability.<sup>1</sup> The two major aetiologies include arterial embolism or thrombosis of an atherosclerotic vessel. ALI is always an indication for emergency assessment but is commonly missed hence management is delayed.<sup>2</sup> Early diagnosis and treatment play an important role in decreasing psychological morbidity, limb loss, and mortality, especially in young patients.<sup>3</sup> The management of acute arterial occlusion remains a challenge for vascular specialists. Surgical thromboembolectomy and bypass grafting were the mainstays of therapy for many years.<sup>4</sup> Subsequently, endovascular interventions including thrombolytic therapy and Percutaneous transluminal angioplasty (PTA) have become one of the major treatment options for selected patients.<sup>5</sup>

Despite these advances in management, the morbidity, mortality, and limb loss rates from acute ischemia remain high, especially in this part of the world.<sup>6</sup> Regardless of the treatment modality used, early diagnosis, patient education, appropriate referral and rapid initiation of therapy are the pivotal factors in limb salvage. A timely decision and appropriate referral to the vascular unit can help a lot in solving this issue. This study was conducted to determine the acute limb ischemia causes, results of intervention, and the time lapse in presentation.

## METHODOLOGY

This observational study was conducted on all delayed ALI patients who presented and were managed at a vascular clinic/in-patient department of Shifa International Hospital, Islamabad, from January 2008 to March 2020. Delayed presentation was defined as presentation later than 6 hours after the onset of symptoms. The study was approved by the Institutional Review Board of the hospital. Those cases of ALI secondary to accidental trauma were excluded from the study. Those of iatrogenic trauma, intravenous drug abuse and intra-arterial accidental drug infiltration were included in the study.

The patients' demographic data, clinical history including aetiologies, examination findings, and treatment data; including type of surgery and level of amputation, were recorded.

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Success of vascular procedure was recorded from medical record or telephonic correspondence. Success of ALI treatment was defined as improvement of symptoms, pulsations (dorsalis pedis, posterior tibial arteries, brachial, radial, and ulnar) clinically. Using Doppler ultrasound postoperatively, a failure was defined as those cases where postoperatively patient's symptoms persisted or deteriorated and pulses remained impalpable and non-detectable on doppler as well. Only salvageable limbs *i.e.* without evidence of frank gangrene were offered revascularization procedure, and those with gangrenous limbs were offered amputations straightaway.

Data were analysed using SPSS version 23. Categorical variables are presented as absolute numbers (n) and percentages, and statistical comparisons were made by the chi-square test. Continuous variables were presented as mean  $\pm$  standard deviation (SD). The p-values of  $<0.05$  were considered statistically significant.

## RESULTS

The analysis included 147 cases of delayed ALI, which made up 73.5% of the total ALI presentations as total cases of ALI were 200 during the study period. The mean age was  $59.52 \pm 17.77$  years. The clinical presentation of this group of cases is shown in Table I. The site of ischemia, gender, aetiology, type of operative procedures in the delayed ALI presenters and their significance with time lapse are shown in Table II. A hundred (68%) thromboembolotomies were successful and limbs were saved, while 19 (12.9%) had failure after the procedure and 3 (2.04%) patients expired within 24 hours of thromboembolotomies. Twenty-five (17%) cases had frank gangrene at the time of presentation while 122 (82.9%) had questionable viability and were attempted for limb salvage procedures. Atrial fibrillation was the leading cause of limb ischemia 46 (31.3%), followed by atherosclerosis in 22 (15%), ischemic heart disease and ventricular clot in 9 (6.1%), rheumatic valvular heart disease in 5 (3.4%) and iatrogenic injury to vessels in 4 (3%).

**Table I: Clinical presentations of delayed acute limb ischemia cases (N=147).**

Clinical presentations	Statistics	
	Frequency	Percent
Blue patches, no pulses, sen+, mov+	1	0.7
Cold, dusky, sen+, mov+	1	0.7
Cold, mov-, no color change, sen-	2	1.4
Cold, pale, sen+, mov+	27	18.4
Cyanosed, cold, sen-, mov-	7	4.8
Blue patches, no pulses, sen+, mov+	30	20.4
Cold, dusky, sen+, mov+	1	0.7
Cold, mov-, no color change, sen-	25	17.0
Cold, pale, sen+, mov+	15	10.2
Cyanosed, cold, sen-, mov-	25	17.0
Blue patches, no pulses, sen+, mov+	12	8.2
Cold, dusky, sen+, mov+	1	0.7
Cold, mov-, no color change, sen-	147	100.0

The time lapse in the presentation was significantly related to the causes of ischemia ( $p=0.001$ ). Above knee amputation was done in 26 (17.7%) cases, below knee in 13 (8.8%), 2 (1.4%) had bilateral below knee amputation. Two (1.4) cases had

above elbow and 2 (1.4%) had hand amputation, while 1 (0.7%) had 3 finger amputations. A hundred (68%) cases were saved from any amputations with interventions and operative procedures as mentioned in Table I. One of the cases (0.7%) was lost to follow-up among 25 cases of frank gangrene and 3 (2%) were expired. Thirty-one (21%) had amputations in the first hand including frank gangrene cases and those of thromboembolotomies who underwent concomitant minor amputations in the same go. Time lapse of the presentation ranged between 6 hours to 21 days.

## DISCUSSION

ALI poses a threat not only to the viability of limb but also there are systemic consequences like acute renal insufficiency, hyperkalemia, and metabolic acidosis.<sup>7</sup> ALI is a very demanding problem and there is very short time to act *i.e.* only 6-8 hours to save limb from irreversible damage.<sup>8</sup> There are logistic problems, non-availability of vascular units or vascular trained personnel and lack of awareness in the general population as well as amongst general practitioners (GP); the result is loss of limb and even mortality.<sup>9,10</sup> These factors are also prime factors for delayed presentation.<sup>10,11</sup> In this centre, total of 200 cases of ALI were presented during the study period, out of which 147 (73.5%) had a delayed presentation. The delay in time-lapse in these cases had a wide range (6 hours to 21 days).

Atrial fibrillation was the commonest cause of limb ischemia (31.3% alone and 3.4% in combination with other comorbid) which is similar to many others.<sup>12-14</sup> This highlights the importance of educating atrial fibrillation patients about the possibility of ischemic events and sensitising them about prompt reporting to a vascular unit for these symptoms at warfarin clinics. The success rate of the thromboembolotomies was 68% while only 13% procedures had failed irrespective of time lapse ( $p=0.251$ ), which is similar to the worldwide data.<sup>15,16</sup> These credibly good results of thromboembolotomies in this group of cases with delayed presentation, fortifies the importance of this procedure in limb salvage. Three cases had thrombosis secondary to malignancies which is a hypercoagulable state, as reported in the literature as well.<sup>17,18</sup> Iatrogenic trauma and self-inflicted injuries in addicts (intra-arterial injection) were the cause of acute limb ischemia in 9 cases. Out of which 3 were iatrogenic. This is one of the causes which could have been prevented and taken care of earlier, if the suspicion index is high. It holds up the importance of continuous training and refresher courses for the doctors and nurses giving intravenous and intramuscular injections.

In this study, 24 (17%) cases presented with gangrenous limbs which cannot be reversed and the only treatment is amputation to save a life. While 30 (20.4%) patients presented with cyanosed limb with loss of sensations and positive movements and 17% cases had pale limbs with both absent sensations and movements. These two are also pre-gangrenous conditions and chances of associated sepsis and limb loss are always high.<sup>8</sup>

**Table II: Variables acute limb ischemia and its relationship with time-lapse (n=147) applying chi-square test.**

Variables		Frequency	Percentages	p-value
Site	Bilateral lower limb	15	10.2	0.04
	Left lower limb	36	24.5	
	Right lower limb	56	38.1	
	Left upper limb	18	12.2	
	Right upper limb	22	15	
Gender	Males	72	49	0.732
	Females	75	51	
Etiology	Thromboembolism (TE)	92	62.6	0.427
	Thrombosis (TR)	46	31.3	
	Trauma (iatrogenic and self-inflicted)	9	6.1	
Operative procedures	Amputations (both major and minor)	31	21.1	0.358
	Thromboembolectomies	87	59.2	
	Thrombectomies	4	2.7	
	Femoropopliteal bypass	2	1.4	
	Thrombo-embolctomy, excision of cervical rib±sclenotomy	3	2.1	
	Thrombo-embolctomy + Fasciotomy	16	10.9	
	Thrombo-embolctomy + Aneurysm repair	1	0.7	
	Posterior tibial artery bypass graft	1	0.7	
	Repair of brachial artery with graft	1	0.7	
	Repair of vessel	1	0.7	
Result of surgical intervention	Successful	100	68	0.251
	Failed	19	12.9	
	No intervention attempted	28	19	

Thus the majority of the cases on presentation already had advanced clinical presentation as well as corresponding to the time delay. These clinical findings are similar to Khan *et al.* from many of the clinical presentations for ALI.<sup>10</sup> Limb loss was observed in 19% cases at first hand due to delayed presentation which is similar to that reported by Khan and *et al.*<sup>10</sup> The majority of cases were females (51% vs. 49%) which is similar to those reported by Dubouis *et al.*<sup>19</sup> Mean age of presentation in this group was 59.52 ±17.77 years, which is a bit lower than reported by Umetsu and Poursina *et al.*<sup>5,20</sup> The reason could be the low life expectancy in Pakistani population. The time lapse of the first presentation in the group ranged from 8 hours to 21 days, which is wide range of presentations.

This study is unique, foregrounding the delayed presentation in this population. It may be helpful in sensitizing over the issue and to create awareness in the population at risk (with comorbid like atrial fibrillation and valvular heart disease). This study has a big limitation as it was a retrospective observational review so the authors could not find out details of all the risk factors of ALI as smoking and addiction histories, family histories, and drug histories, patients' education and socioeconomic status.

It is recommended that further studies should be carried out to survey the factors of delayed presentation on patient's end, so as to educate the public accordingly.

It is also reinforced that giving awareness about ALI in clinics where patients come for management of atrial fibrillations, valvular heart disease and rheumatic heart diseases (like warfarin clinics and cardiology clinics) should be mandatory.

## CONCLUSION

Delayed presentation is very common but it can be managed with effective thromboembolectomies, avoiding amputations

with timely presentation and reporting to the hospitals/ doctors. Patient education can save the limbs.

## ETHICAL APPROVAL:

The study was approved prior to commencement of the study by the institutional review board and ethics committee (IRB &EC) Shifa International Hospital Ltd (SIH) and Shifa Tameer-e-Millat University (STMU).

## PATIENTS' CONSENT:

Not applicable.

## COMPETING INTEREST:

All authors of the study declared no competing interest.

## AUTHORS' CONTRIBUTION:

TH, FF: Main idea and study conception.

FF, SA, MJ, SL: Data collection and statistical analysis.

TH, FF, SA, MJ, SL: Manuscript writing.

TH, FF, SA: Final review of the article.

All the authors have approved the final version of the manuscript to be published.

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