

A RETROSPECTIVE STUDY OF LIMB ISCHEMIA SURGERY IN A TERTIARY HEALTH CENTRE: INSIGHTS & COMPARISON WITH WESTERN STANDARDS.

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Abstract

Background: Limb ischemia is a common clinical condition that comes with significant morbidity and mortality. Peripheral arterial disease is the leading cause of both acute and critical limb ischemia. It is followed by trauma and embolism. We review our fourteen years' experience of surgical treatment of limb ischemia and its impact on morbidity & mortality in comparison to Western Standards. **Materials and Methods:** Clinical presentation, radiological investigations, timing of intervention, operative techniques, midterm & post-operative outcome of patients of acute & critical limb ischemia who were surgically treated between November 2010 to June 2024 at Swami Rama Himalayan University, Dehradun were studied. **Results:** Out of 238 patients studied in this period 167 were males (70.16%) and 71 were females (29.8%). Of these, 155 patients (65.12%) were of ALI and 83 patients (34.87%) were of CLI. Average age of patients with acute limb ischemia was 46.3 years and with critical limb ischemia was 53.7 years. Average hospital stays was 8.2 days (median 7 days). Ten patients needed amputation (4.2%) and four needed re-intervention (1.68%). Four patients died (1.68%) of which three were in immediate postoperative period and one died thirteen months after surgery. **Conclusion:** Emergency surgery within 6-12 hours of acute and traumatic limb ischemia and early bypass grafting in critical limb ischemia is the key to limb and life salvage. Peripheral angiography was the single gold standard investigation for planning and prognosticating surgical intervention. Even patients who presented in Rutherford II b stage required much distal amputation following surgical intervention and had good functional limb with prosthesis. Correction of associated cardiac comorbidities proved to be life saving for these patients.

INTRODUCTION

Peripheral arterial disease is present in over 12 million Americans and 200 million individuals world-wide. There is 3 to 6 fold increase in risk of cardiovascular morbidity and death as compared to individuals without PAD.^[1,2]

In India, the prevalence of peripheral arterial disease varies from 7.6% to 26.7%. Critical limb ischemia represents approximately 1% of total number of patients with PAD and overall mortality approaching 50% at 5 years and 70% at 10 years.^[3,4]

In US, acute limb ischemia occurs in 14 out of every 100,000 people per year. Patients with Embolic limb ischemia are at higher risk of death because of

underlying cardiac disease. Patients with thrombotic occlusion are more likely to lose limb.^[5,6]

Those with CLI have higher incidence of cardiovascular comorbidities and reflect significant systemic atherosclerotic burden. At 1 year, 25% of patients with CLI will be dead, 30% will undergo amputation and only 45% will be alive with both limbs. At 5 years over 60% of patients with CLI will be dead.^[7,8]

In this study we would be evaluating cases of acute & critical limb ischemia who were surgically treated in our institute over a period of fourteen years and compare them with literature available from West.^[9]

Our primary objectives are to study:

a. Factors influencing limb salvage amongst patients undergoing surgical interventions for acute & critical limb ischemia.

b. Impact of time of surgical intervention on the outcome of these subjects.

And secondarily to know the:

c. Etiological profile of patients of limb ischemia requiring surgical intervention in this region of India.

MATERIALS AND METHODS

We studied the clinical presentation, radiological investigations, timing of intervention, operative techniques, mid-term & post-operative outcome of 238 patients of acute and critical limb ischemia who were surgically treated at Swami Rama Himalayan Institute at Dehradun [an apex Referral center of Uttarakhand (India) and a teaching hospital] between Nov. 2010 to June 2024.

All patients of critical limb ischemia and acute limb ischemia were heparinized immediately after admission and preliminary evaluation.

These patients were subjected to following investigations:

1. Complete hemogram
2. KFT
3. LFT
4. Blood Group
5. Viral markers
6. ECG
7. Echo
8. Chest x-ray with cervical spine in upper limb ischemia to rule out presence of cervical rib.
9. Peripheral angiography/ CT angiography
10. CAG in patients of CLI with RWMA on ECHO along with PAG
11. Patients of trauma with ALI underwent X-ray of affected limb along with CT angiography.

Operative techniques

CLI – All patients of critical limb ischemia underwent bypass grafting under general anesthesia. Median laparotomy was used for abdominal aorto-femoral bypass grafting. Abdominal aorta was approached trans-peritoneally and anastomoses were re-peritonized. Transverse loin incision (renal transplant) incision was used for iliac artery exposure in ileo-femoral and or ileo-popliteal bypass grafting. In case of ascending aorta to femoral bypass, mid sternotomy was used to access ascending aorta.

Femoral artery in groin was exposed through transverse along the crease groin incision.

For exposing popliteal artery in infra-genicular region, longitudinal incision along medial border of tibia were used.

For axillo-femoral bypass grafting, axillary artery was exposed through transverse infraclavicular incision & femoral artery was exposed thru along the crease groin incision.

Dacron ‘Y’ graft was used for aorto-bi-iliac bypass grafting. All others were ring enforced carbon coated ePTFE (expanded-polytetra-flouro-ethylene) conduits either 7mm or 8mm in diameter. All the grafts were tunneled through subcutaneous plane. For aorto-femoral bypass, grafts were tunneled through abdominal cavity.

ALI – All embolectomies, except for those associated with trauma, were performed under regional blocks and vessels were exposed through standard incisions. In cases of trauma and open fractures, vessels were explored in the wounds and repaired after fixation of fractured bones under general anesthesia.

Fogarty embolectomy catheters were used for arterial embolectomies. Reverse saphenous vein interposition grafts were used when vessels were damaged for significant length. They were harvested either from wound site or from contra-lateral leg above the ankle.

In cases of trauma with significant muscle laceration, Romo-vac suction drains were used. They were removed on an average of 2.8 days post-operatively. Patients with cervical ribs underwent excision through supra-clavicular approach and brachial embolectomy at cubital fossa.

Postoperative care and follow-up

All patients who underwent laparotomy were kept fasting in postoperative period till return of bowel activity. On an average this period was of 48 – 72 hours. For this period, patients were kept on intravenous fluids. All patients were kept on intravenous low molecular weight dextran at a rate of 40 ml/hour for first 48 hours after surgery. All patients received low molecular weight heparin as single daily dose according to their weight. This was started usually 6 hours after surgery after watching drain.

Patients receiving artificial conduits were started on oral anti-coagulants post operatively and were advised to continue the same lifelong. Patients who underwent embolectomy were kept on oral anticoagulants for 6 weeks and those who received reverse saphenous vein grafts were on oral anticoagulants for 3 months. Patients with valvular heart disease & in atrial fibrillation, were kept on oral anticoagulants lifelong and were advised valve replacement. Patients of CLI, who had RWMA in ECHO, were advised coronary angiography and further treatment. In all cases INR was maintained between 2 to 3. Ten patients underwent amputation in same admission. Average hospital stay was 8.2 days ranging from 3 to 15 days. Follow-up visits were scheduled after 1 week, 1 month, 3 months and 6 months thereafter.

RESULTS

A total of 238 patients were seen during our study period. There were 167 males (70.16%) and 71 females (29.83%). Mean age of patients presenting with acute limb ischemia was 46.3 years ranging

from 17 to 84 years and those with critical limb ischemia was 53.7 years, ranging from 28 to 75 years. Upper extremity involvement occurred in 62 patients (26.05%) and lower extremity in 176 patients (75.21%). Main cause of ALI was thrombosis in 63.9% of patients which was mainly secondary to trauma. In patients with critical limb ischemia, atherosclerosis was the commonest cause of peripheral vascular disease and smoking being most common associated risk factor.

Patients of acute embolism presented with sudden onset of pain and loss of function of affected limb. Average time lost from onset of symptoms to hospitalization was 1.4 days. Patients with critical limb ischemia presented with decreasing claudication distance, rest pain and ulcers.

Peripheral angiography was the gold standard test which was done on 169 patients. CT angiography was done in 50 patients. Exceptions were patients with open fractures or traumatic transected vessels exposed in wound.

Echocardiography was done on patients with acute embolism. Nine patients had rheumatic heart disease with mitral stenosis and were in atrial fibrillation. After embolectomy, they were advised mitral valve replacement. Seven of them underwent the same at our center at a later date.

Seven patients of CLI on ECHO had RWMA and were subjected to coronary angiography along with peripheral angiogram. One patient had normal coronaries, three had non critical CAD. Two patients had single vessel disease and underwent PTCA later. One patient had 100% blocked LAD & underwent Off Pump CABG when he received LIMA to LAD along with bilateral Common Femoral to Superficial Femoral bypass grafting using 7 mm ring enforced ePTFE conduits.

Patients with upper limb ischemia were subjected to X-ray Chest AP view along with cervical spine. Seven patients had cervical ribs & underwent cervical rib excision along with brachial embolectomy.

Average hospital stay was 8.2 days ranging from 3 to 15 days. There were four deaths in our study (1.68%). Two patients were of poly- trauma in whom vascular repair was done. The other two patients were in CLI group following bypass grafting. One death was in immediate postoperative period secondary to pulmonary embolism. Second patient was of bilateral axillo-femoral bypass grafting who died 13 months after surgery He was lost to follow up & did not maintain INR. He presented with shock resulting from bilateral lower limb ischemia (gangrenous changes) secondary to conduits getting blocked. Four patients required redo surgeries (1.68%). One was redo bypass for blocked conduit. Two patients underwent graft embolectomies. One patient required redo brachial embolectomy secondary to polycythemia.

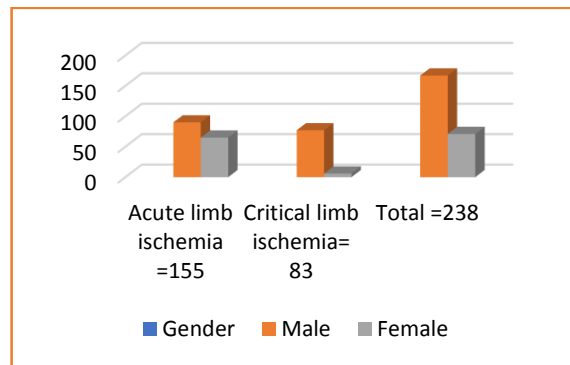


Figure 1: Gender of the participants

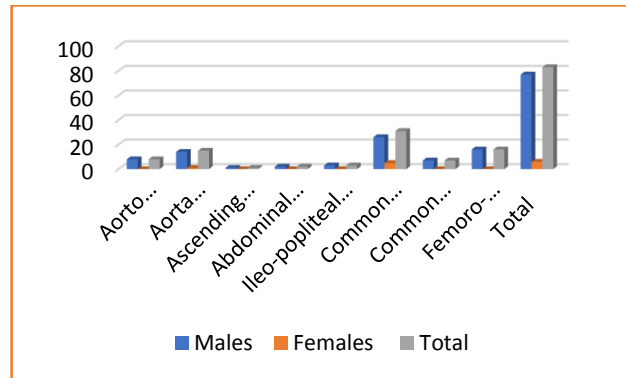


Figure 2: Type of Bypass grafting

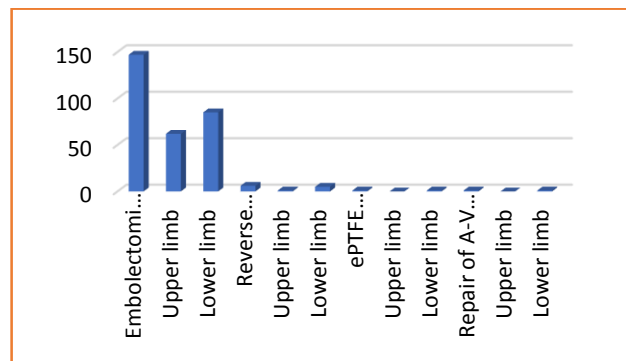


Figure 3: Acute limb ischemia

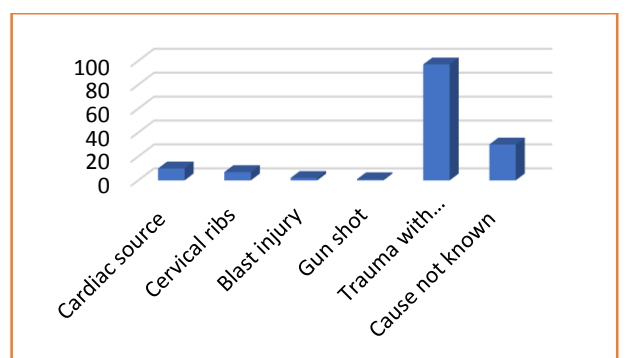


Figure 4: Embolectomies

Table 1: Gender and age of the participants.

Parameter	Acute limb ischemia =155	Critical limb ischemia= 83	Total =238	Percentage
Gender				
Male	90	77	167	70.16
Female	65	6	71	29.83
Mean Age	46.3 years	53.7 years		

Table 2: Type of Bypass grafting

Type of bypass grafting	Males	Females	Total	Percentage
Aorto bifemoral bypass graft (abdominal aorta)	8	0	8	9.6
Aorto femoral bypass graft unilateral (abdominal aorta)	14	1	15	18
Ascending aorta to bilateral femoral bypass grafting	1	0	1	1.2
Abdominal aorta to bi-iliac bypass grafting	2	0	2	2.4
Ileo-popliteal bypass grafting	3	0	3	3.6
Common femoral to - superficial femoral bypass graft (adductor canal)	26	5	31	37.34
Common femoral to superficial femoral cross over graft	7	0	7	8.4
Femoro-popliteal bypass grafting	16	0	16	19.2
Total	77	6	83	100

Table 3: Acute limb ischemia

	Number	Percentage
Embolectomies	147	100
Upper limb	62	40
Lower limb	85	54
Reverse Saphenous vein interposition graft	6	3.8
Upper limb	1	16.67
Lower limb	5	83.33
ePTFE conduit interposition	1	0.64
Upper limb	0	0
Lower limb	1	0.64
Repair of A-V fistula + pseudo-aneurysm	1	0.64
Upper limb	0	0
Lower limb	1	0.64

Table 4: Embolectomies

Embolectomies	Number	Percentage
Cardiac source	10	6.8
Cervical ribs	7	4.7
Blast injury	2	1.36
Gun shot	1	0.68
Trauma with fractures	97	65.98
Cause not known	30	20.4

DISCUSSION

Acute and critical limb ischemia are common devastating and life threatening conditions which are treatable with timely intervention. Patients with ALI & CLI are seriously sick patients who present clinical challenges to treating surgeons. Even with improvement in limb salvage rates in current times, only 70% of patients move with intact limb. 15% of patients lose their lives and 15% of patients require major amputations.^[10]

Currently not much data is available on demography of ALI and CLI and its outcome in Indian literature [11]. We analysed our experience of fourteen years to understand the demography and outcome of ALI & CLI in Indian population and compared the results with data available mainly from West.^[12]

In our study there was a male preponderance as reported in most other studies and lower limb ischemia was more common than upper limb ischemia.^[10]

Peripheral arterial disease is the leading cause of CLI in our study and smoking being the most common association. Out of 83 patients in our study who required bypass grafting, 66 were smokers (79.51%). Three others were intravenous drug abusers. Ten patients needed major or minor amputations (4.2%) which was much less as compared to the data available [12]. Late presentation to hospital was the cause as some of them presented after onset of gangrenous changes.

A large part of our study comprises of patients with CLI where process was chronic and collaterals were present, which played a role in limb salvage. Policy of immediate heparinization and use of single diagnostic investigation, the peripheral angiogram / CT angiogram, which was done on immediate basis and quick surgical intervention may attribute to lower amputation rates.

Thrombosis was more common than embolism as cause of ALI in our series. Literature describes higher incidence of embolism than thrombosis for ALI.[13] Thrombosis has better effect on outcome as it is often

incomplete and slow process allowing collateral formation.

In our series only four patients died, a surprisingly low mortality rate (1.68%). Most studies report mortality rate of 5-15% and even higher of 40% in elderly population. A younger patient population and trauma (medically healthy patients) being the most common cause of acute limb ischemia may be the reason for low mortality in our study. Lesser incidence of cardiac cause associated with our patients may be the other cause. Illuminati et al observed higher mortality rate in ALI due to embolism rather than thrombosis (31% vs 19.2%) and more major amputation in thrombosis than embolism (37.7% vs 17.2%)[14]. The duration of symptoms (arterial occlusion) before presenting for treatment was an important factor responsible for amputation in both ALI & CLI in our study.

Nine patients (3.78%) with acute embolism, who were in atrial fibrillation, were found to have Rheumatic Mitral stenosis on ECHO. Seven of these patients underwent Mitral valve replacement at our centre within 6 weeks of their embolectomies.

Seven patients of CLI (2.94%) had associated CAD which was addressed with PTCA & CABG along with peripheral bypass grafting. These procedures not only salvaged their limbs but also saved their lives.

Studies showed poor prognosis and significantly higher rate of amputation in patients who presented 24 hours after onset of symptoms [15]. In our study we assume that poor level of health awareness, faith on local and household remedies, financial constrain and their increased level of tolerance till disabling symptoms set in, may be the cause for late presentation.

CONCLUSION

Acute and critical limb ischemia is common devastating and life threatening condition causing challenges to treating surgical team. Immediate heparinization and use of single gold standard test (peripheral angiography / CT angiography) not only acts as a road map for intervention but also helps prognosticate the outcome. Quick resuscitation in trauma cases and prompt surgical intervention goes a long way in limb and life salvage. Even in patients presenting in Rutherford IIb group, the level of amputation goes down and gives patient's at-least a useful prosthesis. Early presentation to health care

centre can be emphasized by creating public awareness and can be the key to limb salvage.

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