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Management of upper extremity peripheral vascular disease: a multimodality approach

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ABSTRACT

Background: It is estimated that more than 200 million people suffer from peripheral vascular disease worldwide. However very few studies are available on upper extremity vascular disease, thus making it an under diagnosed and under treated condition.

Methods: In the present study we included 20 participants suffering from upper limb peripheral vascular disease and managed them with multi-modality approach involving general surgeon, interventional radiologist and vascular surgeon for medical line of management, thrombolysis and thrombo-embolectomy procedures.

Results: In the present study we observed that early management of these patients with medical management, interventional radiology and embolectomy procedures helped in limb salvage. However alarmingly high number of patients (35%) landed up in amputation because of low index of suspicion and delayed referral.

Conclusions: A high level of suspicion and early referral to a tertiary care centre where multi-modality facilities like interventional radiology and vascular surgeon are available should be done.

Keywords: Amputation, Embolectomy, Gangrene, Peripheral vascular disease, Upper extremity

INTRODUCTION

Peripheral arterial disease is a progressive disorder characterized by progressive stenosis and/or occlusion of large and medium-sized arteries, other than those that supply the heart or the brain. Around more than 200 million people suffer from peripheral vascular diseases worldwide, being free of symptoms to severely affected patients. Peripheral arterial disease is associated with reduced functional capacity along with increased morbidity because of amputations and mortality. However peripheral vascular disease is under diagnosed and under treated disease.

Atherosclerosis with or without thrombo-embolic disease is the main etiological factor for peripheral arterial disease, but it may also result from trauma. Peripheral arterial disease in its mild form may be limited to intermittent claudication, pain in the extremities that is triggered by exertion but that ceases during rest. When ischaemia in acute peripheral arterial disease increases the risk of gangrene, amputation and premature death is also increased. In cases of chronic occlusion collateral circulation may develop which provides alternative route for blood flow to the distal muscles. Diabetes mellitus is a known risk factor for cardiovascular diseases. Patients with both diabetes and PAD have worse lower extremity function than individuals with PAD alone mostly likely due to neuropathy.¹

Clinical features

Fatigue of the limb: It is due to anaerobic muscle metabolism which causes cramp like pain in the involved extremity.

Rest pain: As the disease progresses, perfusion of the limb is so severely affected that it causes rest pain.

Ulceration and gangrene: Ulceration occurs with severe arterial insufficiency and it presents as painful erosion or non-healing ulcers over the limb. As gangrene sets in the limb becomes black and mummified. With super added infection it leads to wet gangrene.

Acutely ischemic limb is cold and white, while chronically ischemic limb is quite warm, red swollen limb.

For acute limb ischemia, three treatment options are used generally the catheter-directed thrombolysis, anticoagulation with observation, and surgical thromboembolectomy.²⁻⁶

While medical line of management, endovascular treatment and surgical reconstruction can be done in cases of chronic limb ischaemia.⁷

Peripheral arterial disease affects lower limb vessels more commonly than the upper limb vessels. There are very few studies on upper limb peripheral arterial disease. Thus, to bridge this gap in the available data, the present study was undertaken.

METHODS

This is an observational retrospective study. Between June 2019, and January 2020, 20 patients of upper limb peripheral arterial disease presented to our tertiary care center in central India. All patients, who were diagnosed to have arterial occlusion by arterial Doppler or computed tomography (CT) angiography, were included in our study, with no inclusion or exclusion criteria. Patients presenting to us with history of upper limb fatigue/rest pain/discoloration were admitted and started with medical line of management in the form of Injection Heparin 5000 IU 6 hourly with monitoring of coagulation profile, tab clopidogrel 75 mg once a day, HMG- CoA reductase inhibitor in the form of tab rosuvastatin 20 mg once a day, tab cilostazole 100 mg once a day and tab pentoxyphylline 400 mg once a day. Simultaneously cardiac evaluation in the form of electrocardiogram and 2 D echocardiography was done. Along with medical line of management, multi-modality approach in collaboration with Interventional Radiologist and Vascular surgeons was used.

Patients who were candidates for thrombo-embolectomy were worked up for surgery and were posted for the same in collaboration with vascular surgeon. Level of thrombo-embolectomy was decided as per CT angiography report. We used Fogarty catheters sizes 2 and 3 Fr for distal thromboembolectomy, and sizes 4 and 5 Fr for proximal thromboembolectomy. Distal thromboembolectomy was performed first, and the procedure was stopped once the back-flow blood was bright red in color and no more

thromboemboli could be removed with the Fogarty catheter. After completion of the distal procedure, the distal arteries were filled with a heparin solution and clamped to prevent embolization from the proximal arteries during proximal thromboembolectomy. The proximal thromboembolectomy was continued until the appearance of strong active bleeding from the proximal artery and until no further thromboemboli could be removed via the Fogarty catheter. After completion of thrombo-embolectomy, the artery was closed by primary suturing. Intra-operatively patient was assessed by palpation of distal pulsations and post operatively colour Doppler of the limb of performed.

In patients where any intervention was not possible and those not responding to medical line of management having frank dry gangrene with line of demarcation or superadded infection in the form of wet gangrene had to be posted for amputation, the level of which was decided as per line of demarcation. Vascular surgeon was involved in cases of amputation for performing intra-operative stump thombo-embolectomy.

Anticoagulation therapy with heparin and warfarin was continued during the whole period of treatment, maintaining the activated partial thromboplastin time (aPTT) between 60 and 100 seconds. Warfarin was administered orally and overlapped the heparin treatment. Heparin was stopped when the international normalized ratio (INR) reached levels between 2.0 and 2.5. Aspirin was also given. For patients with acute limb ischemia and heart problems, warfarin was continuously administered during the whole period of follow-up keeping the INR levels between 2.0 and 2.5.

RESULTS

It was observed that out of 20 patients included in the study 12 were male patients and 8 female patients, belonging to the age group between 34 years to 65 years, mean age being 49.5 years. 6 out of 20 patients (30%) had diabetes mellitus out of which 2 had uncontrolled blood sugar levels while 4 out of 6 had good blood sugar control. Others were found to have co-morbidities like hypertension, hypothyroidism, acute kidney injury. 8 out of 20 (40%) patients in this study were smokers. All 20 patients were started on medical line of management.

We had a 58 year old gentleman, presenting with history of 4 hours duration with pre gangrenous changes in left 4th and 5th fingers. He also had acute kidney injury thus thrombolysis could not be done. Immediately medical line of management was started and an urgent thromboembolectomy from brachial artery was performed. Post thromboembolectomy pre-gangrenous changes reverted and the limb was salvaged. In another case, a 34 year old lady presented with uncontrolled diabetes mellitus with block in axillary artery, thromboembolectomy through brachial artery was attempted twice but still gangrenous changes progressed.

Thrombolysis could not be done as gangrenous changes had already set in. The patient finally landed up in to above elbow amputation. In present study, 5 patients who had to undergo amputation due to gangrenous changes, thromboembolectomy from the amputation stump was performed.

Table 1: Clinical	parameters at	presentation,	, intervention aı	nd outcome.
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Age	Sex	Duration of symptoms	Clinical features	CT angiography/ AV Doppler	Intervention	Outcome
58 years	Male	4 hours	Pre-gangrenous changes in 4 th and 5 th fingers	Block in left ulnar artery	Salvage thromboembolectomy from brachial artery	Limb salvaged
49 years	Female	10 days	Gangrenous changes in right hand and distal forearm	Block in ulnar and radial artery	Thromboembolectomy from amputation stump	Below elbow amputation
37 years	Male	2 days	Gangrenous changes in right thumb and index finger and proximal forearm	Block in right brachial artery	Thromboembolectomy from amputation stump	Below elbow amputation
34 years	Female	3 days	Pre-gangrenous changes in finger tips	Block in left axillary and brachial artery	Thromboembolectomy from axillary artery (twice)	Above elbow amputation
51 years	Male	4 days	Gangrenous changes up to right elbow	Block in axillary artery	Thromboembolectomy from amputation stump	Above elbow amputation
56 years	Male	5 days	Gangrenous changes just above elbow	Block in axillary artery	Thromboembolectomy from amputation stump	Above elbow amputation
41 years	Female	7 days	Gangrenous changes up to 4 cm below left elbow	Block in axillary and brachial artery	Thromboembolectomy from amputation stump	Above elbow amputation



Figure 1: CT angiogram showing thrombotic occlusion of right proximal radial and ulnar artery.

In the present study it was observed that 40% (8/20) patients responded to medical line of management alone, 5% (1/20) responded to thromboembolectomy along with medical line of management, 35% (7/20) patients underwent amputation, despite medical and surgical management. Surprisingly 25% (5/20) patients were not willing for amputation even though there was no response to either medical line of management or any interventional procedure and amputation was indicated.

None of the patients in this study could be given trial of thrombolysis either due to deranged kidney function test or establishment of gangrenous changes. It was seen that 60% (12/20) patients were referred from either a primary health care center or rural hospital to our tertiary care hospital, after managing the patient in their set up for a few days.



Figure 2: (A) Gangrenous changes over hand and forearm due to block in axillary artery, (B) above elbow amputation stump of the same patient.

Table 2: Management of patients and their outcome.

	Medical management only	Thromboembolectomy	Thrombolysis
Limb salvaged	8	1	0
Amputation	3	4	0
Not willing for amputation	4	0	0
Total	15	5	0

DISCUSSION

In present study it was seen that the mean age of patients presenting with peripheral arterial disease was 49.5 years. In patients having co-morbidities like diabetes mellitus and hypertension peripheral vascular disease was seen in younger age group. This finding co-relates with higher prevalence of peripheral arterial disease in younger population affected by diabetes mellitus.⁸

All the patients presenting to us with peripheral vascular diseases were immediately started on medical line of management as per NICE guidelines.⁹

Catheter-directed thrombolysis (CDT) by an interventional radiologist is becoming more common and is reserved for patients with a salvageable limb (Rutherford class II, IIa, and IIb). Patients with class III (irreversible) symptom are not the candidates for revascularization surgery because there are few chances of recovery of viable tissue and an associated high risk of reperfusion injury. ¹¹

However, all the patients coming to our tertiary care centre already had gangrenous changes Rutherford class IV. Only in 1 patient having Rutherford class II b, the kidney function test was deranged. Thus, thrombolysis could not be done.

As lower limb peripheral arterial disease is much common than upper limb arterial disease very few studies have been conducted on upper limb peripheral arterial disease. However, as per our study, upper limb peripheral vascular disease is not as uncommon as it was thought previously. Also, a significant percentage of patients (60%), were not referred to a tertiary care centre on time.

Only 1 patient who presented to us with acute limb ischaemia within few hours of pre-gangrenous changes, and successfully underwent thromboembolectomy and his limb could be salvaged. Also, 40% patients responded to medical line of management.

An alarming percentage (35%) of patients had to undergo amputation, this is again attributable to late presentation to our set up, when already gangrenous changes were present.

Surprisingly 25% patients were not willing for amputation. This could be due to psychological impact and social stigmata of losing an upper extremity.

CONCLUSION

In conclusion, Upper extremity peripheral arterial disease is much more prevalent than thought previously. Management of peripheral arterial disease should be done by multi specialty team comprising of a general surgeon, interventional radiologist and vascular surgeon. With timely intervention, limb can be salvaged, however without prompt treatment patients land up in amputation, causing additional morbidity and huge psychological impact. A high level of suspicion and early referral to a tertiary care center where multi-modality facilities like interventional radiology and vascular surgeon are available should be done. There is alarming unawareness of the disease in public and medical fraternity, it needs to be addressed through more studies and public awareness programs.

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