

Analysis/Spectrum of admitted cases of lower extremity arterial disease (LEAD) in University Hospital of Nepal.

Robin Man karmacharya¹, Satish Vaidya¹, Amit Kumar Singh¹, Prasesh Dhakal¹, Sushil Dahal¹, Prabha Shrestha¹, Sohail Bade¹, Niroj Bhandari¹

¹Department of Surgery (Cardio Thoracic and Vascular), Dhulikhel Hospital, Kathmandu University Hospital, Dhulikhel, Nepal

CORRESPONDENCE

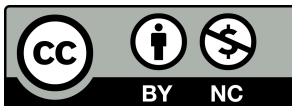
Dr. Robin Man Karmacharya,
Cardio Thoracic and Vascular Unit,
Kathmandu University Hospital,
Dhulikhel, Nepal
Email-reachrobin773@hotmail.com

ARTICLE INFO

Article History
Submitted: 25 December 2020
Accepted: 19 January, 2021
Published: 8 February, 2021

Source of support: None
Conflict of Interest: None

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ABSTRACT

Introduction: Peripheral arterial disease is a condition due to partial or complete occlusion of arteries excluding that of heart and brain. Lower extremity arterial disease is specific to lower limbs. Some of the patients are asymptomatic while a majority present with claudication, rest pain, ulceration or even gangrene.

Methods: We took all admitted cases of lower extremity arterial disease from January, 2015 to December 2018. ABI was used as the first clinical tool for the diagnosis of PAD in patients with history or physical examination findings suggestive of PAD as per AHA guidelines. Outpatient arterial Doppler ultrasonography complemented by lower limb CT angiogram was used as a confirmatory tool for the diagnosis and also to assess anatomical location and severity of stenosis.

Results: Total of 54 cases of lower extremity arterial diseases were identified with a mean age of 59.2 years (S.D. 11.4). Right lower limb was involved in 35(50%). Mean age was 58 years(SD 13.1). Mean duration of symptom was 3.4 years (SD 3.3). Claudication was present in all the patients. 32(45.7%) had ulcers. Toe(44.3%) was most commonly involved. Decreased local temperature(91.4%) and color change(87.1%) were major symptoms. 35(50%) of the patients had gangrene. Mean peak systolic velocity was lowest in the peroneal artery. 16.6% patients got additional peripheral bypass surgery.

Conclusion: Claudication, decreased local temperature and color change were very common findings of lower extremity arterial disease. Gangrene was present in half of the patients.

Keywords: Lower extremity arterial disease; Peripheral arterial disease; Ulceration.

INTRODUCTION

Peripheral Arterial Disease (PAD) is a condition where there is partial or complete occlusion of arteries, excluding arteries of the brain and heart. PAD is usually part of severe systemic atherosclerosis causing high morbidity and mortality.¹ Lower extremity arterial disease(LEAD) is specific to PAD in lower extremities and can be asymptomatic or presents with claudication, pain at rest, skin ulceration to critical limb threatening ischemia and gangrene.²⁻⁵ Knowing the appropriate stage and subjecting the patients for appropriate treatment is essential for best outcome in this condition. Commonly used classification systems to qualify the level of PAD are the Fontaine and Rutherford-Becker grading system and Wifi classification which predicts patients who are at risk of amputation.^{6,7,8} Non invasive diagnostic modalities like measurement of Ankle Brachial Index (ABI), Doppler ultrasonography, CT angiogram are recommended to diagnose PAD and also

know the spectrum of PAD.⁹ For medical management, patient are usually prescribed with statins like Atorvastatin, antiplatelet agent like Aspirin and Cilastazole.^{10,11} Major Adverse Limb Events (MALE) in LEAD was found to be 2% in one major trial.¹² MALE includes acute or chronic limb ischemia leading to major vascular amputations.

There is scarcity of studies on PAD in Nepal. Prevalence of PAD in patients undergoing dialysis has been studied which was 30%.¹³ Another study showed the prevalence of PAD as 18.5% in more than 40 years personnel visiting out patient department.¹⁴ In a study done at India, prevalence of PAD was 26.7% in more than 60 years population.¹⁵ There are only few centers in Nepal addressing LEAD including operative management. Analysis of LEAD at a University Hospital with a vascular surgical team will unravel the true spectrum of this disease. This study is done to know

different parameters such as history, examination finding, imaging finding and outcome of admitted cases of LEAD at University hospital from 2015 January to 2018 December.

METHODS

This was a descriptive study including all the patients admitted in Dhulikhel Hospital with the diagnosis of LEAD in the year January 2015 to December 2018. Data was obtained through the hospital records of the patients. Detail records were collected on the variables such as age, sex, major complaints, duration of the symptoms, site of the lesion, smoking status, history of amputation, further management performed etc were recorded. Confirmation of LEAD is done by outpatient arterial Doppler ultrasonography and also complemented by lower limb CT angiogram.¹⁶

In this study, ABI was used as a first clinical tool for the diagnosis of PAD in patients with history or physical examination findings suggestive of PAD as per AHA guidelines. Outpatient arterial Doppler ultrasonography complemented by lower limb CT angiogram was used as a confirmatory tool for the diagnosis and also to assess anatomical location and severity of stenosis for patients in whom revascularization was planned. ABI is also indicated as first-line noninvasive test for screening and diagnosis of LEAD by ESC.¹⁷ The American Diabetes Association Consensus Statement recommends that a screening ankle-brachial index (ABI) should be performed in diabetes patients with symptoms or signs of PAD.^{18,19}

Regarding Doppler ultrasonography, flow type, peak systolic velocity was obtained in standard technique at femoral artery, popliteal artery, Anterior Tibial Artery and Posterior Tibial Artery. Note on the medical management and surgical treatment was also done. ABI can be measured manually, using Doppler Ultrasonography or using an automated oscillometric device.²⁰⁻²¹ We used Doppler Ultrasonography for assessment of Blood pressure for calculation of ABI. For doppler ultrasonography Acuson P300 machine by Siemens was used with linear probe of 7.5-10MHz using appropriate gain and depth.

The normal peripheral arterial waveform is triphasic, the first positive deflection is forward systolic flow, the negative deflection or dip is the diastolic reversed flow and the third small positive deflection is late diastolic forward flow due to wall recoil, it correlates with wall elasticity. The normal peak systolic velocity (PSV) in peripheral lower limb arteries varies from 45–180 cm/s whereas severe arterial disease manifests as a PSV in excess of 200 cm/s,

monophasic waveform and spectral broadening of the Doppler waveform.²² Doppler signal is acquired at an angle of 60 degrees or as small as possible, and velocity spectra are recorded proximal to and at the site of maximum flow disturbance.²³

Collected data were analysed using SPSS 13. For sample size calculation we used 2% prevalence of Major Adverse Limb Event.¹³ Hence $p=0.02$, $q=0.98$, Sample size = $4*0.02*0.98/(0.05)^2 = 31$. Descriptive statistics was used to calculate demographic information, presence of risk factors, health history and presence of various symptoms among the participants and were presented in frequency and percentage. Scalar variables will be expressed as mean, standard deviation and range.

RESULTS

Total of 54 cases of lower extremity arterial diseases were identified during the study period. Mean age of the patient was 59.2 years (S.D. 11.4, Range 28-81 years). Right lower limb was involved in 35 (%) while left was involved in 35 (%). Of these 70 limbs, bilateral involvement was present in 16 patients (%). For ease in data analysis and presentation, further analysis is done in 70 limbs. Mean age was 58 years (SD 13.1, Range 36- 81 years). Mean duration of symptom was 3.4 years (SD 3.3, Range 1-15 years). Male:Female ratio was 6:1. Claudication was present in all the patients. Mean claudication distance was 162.8 meters (SD 185.8, Range 0-500meters). In 34 patients (48.6%) rest pain was present. In 32 patients (45.7%) ulceration was present. Table 1 shows location of most proximal ulceration. Most common ulceration was present in toes followed by feet.

Table 1: Location of most proximal ulceration

Location of ulcer	Number	Percentage
Toes	21	30
Feet	8	11.4
Calf	3	4.3
Total	32	45.7

In terms of history of amputation due to peripheral arterial disease, in 20 patients (28.6%) there was history of amputation. Most common amputation was in toes (12 patients, 17.1%) followed by feet in 8 patients (11.5%). Mean duration since amputation was 4 months (SD: 3 months, Range 1month - 1 year). None of the patient developed morbidities like myocardial infarction, cerebrovascular event during the admission.

Regarding smoking status, 64 patients (91.4%) were smoker. Of the smoker patients, mean pack years was

27.2 (SD 11.6, Range 6-49). All the cases where there was a history of amputation were smoker. In terms of most distal involved area, most common location was toes (44.3%) followed by feet (27.1%), calf (18.6%) and ankle (10%). In terms of major risk factors, diabetes was present in 31 patients (44.3%), hypertension in 26 patients (37.1%), dyslipidemia in 37 patients (52.9%) and family history of peripheral arterial disease in 3 patients (4.3%).

In terms of major symptoms, decreased temperature was present in 64 patients (91.4%), color change was present in 61 patients (87.1%), sensory loss was present in 3 patients (4.3%), motor loss was not present in any cases (not taking consideration of distal muscles in amputation cases), atrophic signs in calf was present in 13 patients (18.6%), gangrene was present in 35 patients (50%). Co-existing upperlimb involvement was present in 3 patients (4.3%). Table 2 shows status of pulse in lower limb. In femoral artery pulse was palpable in 92.9% of cases. This however decreased to 57.1% palpable pulse in popliteal artery. Pulse in popliteal artery was feeble in 24.3%. In crural vessels, posterior tibial artery was palpable more compared to anterior tibial.

Table 2: Status of pulse in lower limb

Location	Pulse	Number	Percentage
1 Femoral	Palpable	65	92.9
	Feeble	0	0
	Not palpable	5	7.1
2 Popliteal	Palpable	40	57.1
	Feeble	17	24.3
	Not palpable	13	18.6
3 Anterior Tibial	Palpable	5	7.1
	Feeble	5	7.1
	Not palpable	60	85.7
4 Posterior Tibial	Palpable	11	15.7
	Feeble	16	22.9
	Not palpable	43	61.4
5 Dorsalis Pedis	Palpable	2	2.9
	Feeble	0	0
	Not Palpable	68	97.1

Table 3 shows percentage of different waveform in different arteries along with mean peak systolic velocity. Maximum percentage of no flow was noted in peroneal artery and the mean peak systolic velocity is also

minimum in peroneal artery. Maximum percentage of triphasic waveform was noted in femoral artery and the mean peak systolic velocity was also highest in femoral artery. Regarding ABI measurement, mean ABI was 0.37 (S.D. 0.28, Minimum 0, Maximum 0.80). There were 30 patients (42.9%) with ABI less than 0.5 and 40 patients with ABI more than or equal to 0.5 (57.1%).

In terms of surgical management, 9 patients (16.6%) underwent peripheral bypass surgery. Of them, two underwent femorofemoral bypass, two underwent patch plasty in femoral artery, three underwent femoropopliteal bypass, two underwent femoro-crural bypass. Of these cases, 8 patients had bypass patency during followup of more than six months. In one patient (femoro crural bypass) there was long segment thrombosis with bypass failure during followup at two weeks but patient had some clinical improvement and did not opt for re-intervention.

DISCUSSION

We analyzed the cases of lower extremity arterial disease presenting at our hospital. A study found prevalence of peripheral arterial disease in India to be 26.7% in age group 60-79 years and similar prevalence is expected to be in Nepal.¹⁵ In a study done in the USA, the prevalence of PAD in more than 65 years age group was 20%.²⁴ However, a review article comparing prevalence of PAD in South Asia with that in Western countries, pointed to significantly lower prevalence in South Asia.²⁵ Mean age in our series was 59.2 years. In another study done in the USA, the mean age in men was 69 years and that in women was 72years.²⁶

In one major trial to find Major Adverse Limb Event (MALE) in LEAD cases male:female ratio was 2.6:1.¹² We had even higher male:female ratio (6:1) probably due to higher health seeking behaviour in male patients in our context. Generally, 10% of patients with PAD experience intermittent claudication, 50% of patients experience a spectrum of symptoms other than intermittent claudication and 40% are asymptomatic.²⁷ In the Edinburgh Artery Study, the prevalence of asymptomatic PAD in the general population was 8% which is still a large fraction of the population which hence emphasizes the need of reliance on signs of PAD rather than symptoms for its diagnosis.²⁸ In our study, 34 patients (48.6%) experienced rest pain.

Smoking, hypertension, hyperlipidemia, physical inactivity, obesity and diabetes are the major modifiable risk factors for peripheral arterial disease.^{10,29,30} Our study shows much coherent findings where, the major risk factors

present were smoking (91.4%), dyslipidemia (52.9%), diabetes (44.3%), hypertension (37.1%), and family history of peripheral arterial disease (4.3%). Examination for PAD mainly focuses on palpation of pulses in lower extremities and finding any audible bruits on auscultation. Signs of any dependent rubor and elevation pallor may suggest an advanced stage of PAD. Some other common signs for PAD may be arterial ulceration, shiny skin, muscular atrophy and hair loss.²⁷ The PARTNERS program had found that 50% of cases of peripheral arterial disease may have a normal peripheral pulse.³¹

In this study, the mean ABI was 0.37 (S.D. 0.28, Minimum 0, Maximum 0.80). There were 30 patients (42.9%) with ABI less than 0.5 and 40 patients with ABI more than or equal to 0.5 (57.1%). If measured among patients seen in routine clinical practice or the population in general, the specificity of the ABI was in the 97% range, but the sensitivity was lower, closer to 80% in part due to some patients with PAD with stiff ankle arteries and false-negative ABIs.²⁹ A study from Sri Lanka found that at the level of ABPI ≤ 0.85 the sensitivity of detecting PAD was 82.6% and specificity was 100%. ABPI ≤ 0.89 was observed as the best cutoff value to identify those with PAD.³² ABPI ≤ 0.9 is the cutoff value recommended by ACC/AHA guidelines to diagnose PAD. [33]The clinical utility of ankle-brachial index (ABI) is not clear in subjects with less severe or calcified vessel.³⁴ Although the gold standard is Catheter angiography for diagnosis of PAD, another tool in our arsenal is Color Doppler Ultrasonography. Doppler spectral analysis can determine the highest PSV (PSV at the lesion) as well as the PSV in the area adjacent to the normal-looking segment (PSV proximal).²³ PSV was found to correlate with stenosis as evident on angiographic measurement.^{35,36}

In a study by Kyu Yeon Hur et. al. among 324 Type II Diabetes Mellitus patients, 18 (5.6%) had an abnormally low ABI (≤ 0.90) and the other 306 (94.4%) had ABI 0.91 to 1.40. However, color Doppler ultrasonography demonstrated that 93 (28.7%) had PAD and among them only 16 (17.2%) had an abnormally low ABI, and 77 (82.8%) had ABI 0.91 to 1.40. Among the 306 patients with ABI 0.91 to 1.40, 34 (11.1%) had grade III (50% to 99% stenosis) lesions, and 43 (14.1%) had grade IV (100% stenosis) lesions on color Doppler ultrasonography. These results suggest that the ABI has the potential to underestimate the presence of PAD.³⁴ In this study, the maximum percentage of triphasic waveform was noted in femoral artery and the mean peak systolic velocity was also highest in femoral artery. Mean ABI was 0.37 (S.D. 0.28, Minimum 0, Maximum 0.80). There were 30 patients (42.9%) with ABI less than 0.5 and

40 patients with ABI more than or equal to 0.5 (57.1%). In another study, Peak systolic velocities (PSV) were recorded as falling into one of the following four ranges: absent flow, < 180 cm/s, 180 to 249 cm/s, or 250 cm/s or greater. Percent stenosis was calculated using North American Symptomatic Carotid Endarterectomy Trial (NASCET) criteria and recorded in four ranges: completely occluded, 0 to 39.9%, 40 to 69.9%, or 70 to 99.9%. DUS and angiograms were considered to be in agreement if PSV and stenosis ranges correlated (absent flow and complete occlusion, < 180 cm/s and 0 to 39.9%, 180 to 249 cm/s and 40 to 69.9%, ≥ 250 cm/s and ≥ 70 to 99.9%). DUS was found to demonstrate a sensitivity of 79.7%, specificity of 79.2%, positive predictive value of 88.2%, and negative predictive value of 66.7% for lesions $\geq 70\%$. The 66.7% of the false-negative lesions with the lowest velocities were below the knee joint.³⁷ Lower extremity ulcers is among the common complication of peripheral arterial disease, accounting for about 10 to 30% of all leg ulcers. The ulcers are typically painful and can be present on toes, pressure points such as the heel, malleoli or the anterior shin.³⁸

A study by Kobayashi et al in 177 individuals found wound location most commonly at toe followed by Heel.^{39,40} Heel and extensive wounds were found difficult to heal.^{39,40} Further, delayed heel ulcer are directly linked to major amputation.³⁹ Our study showed ulceration most commonly in toe followed by feet. According to one population based study, the incidence of amputation in PAD accounts for about 2% per year.⁴¹ The rate of amputation also depends upon disease severity with higher risk at initial hospitalization (3.1%, 26.7%, and 55.0% for Rutherford 4, 5, and 6, respectively) and also with long term follow up with (12.1%, 35.3%, and 67.3% for Rutherford 4, 5, and 6, respectively). Presence of comorbid condition also affects the outcome with diabetes as a major risk factor with higher amputation rate.⁴² The SVS Wifl classification is another tools that uses three major categories: wound, ischemia, and foot infection to stratifies risk of wound healing, amputation and likely benefit from revascularization.⁸ In our study, 20 patients (28.6%) underwent amputation.

CONCLUSION

Lower extremity arterial disease is a common vascular condition that might need admission followed by medical and surgical treatment. In selected cases surgical management in the form of peripheral bypass surgery will help in addressing the condition.

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