

## Correlation of Clinical Findings with Doppler Study in Lower Limb Ischemia

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### Abstract

*Aims and objectives:* Color Doppler Ultrasound Scan is a non-invasive and cheap tool than other Radiological Investigations for Screening, Diagnosis and follow-up of Vascular Diseases. In this study performed at Basaveshwara Teaching and General Hospital, Kalaburagi, Karnataka, we correlated the Clinical data with the findings of Color Doppler Ultrasound of the Lower Limb Arteries in Chronic Lower Limb Ischemic cases with Claudication.

*Patients and methods:* Fifty Patients admitted under Department of General Surgery at Basaveshwara Teaching and General Hospital, Kalaburagi, between November 2017 and May 2019, with Claudication Pain of Lower Limb and associated symptom were studied. All examinations were done clinically and then compared with the Color Doppler Ultrasound using 7.5 MHz linear transducer connected to Digital Ultrasound Imaging System.

*Results:* Fifty Patients were studied out of which 43 were male and 7 were female with a ratio of 6.14:1. The minimum age was 48 years and maximum age was 92 years. Number of patients were highest in the group of 51–65 years, i.e. 58%, with a mean age of 59.3 years. Thirty-nine patients were Smokers, which were statistically significant. Most common clinical presentation of the patients was gangrene with claudication pain (42%), Gangrene alone in 76%

of the patients. The most common cause of lower limb ischaemia in our study was Atherosclerosis constituting 84% of all the etiology for the provided above age groups, followed by Thromboangiitis Obliterans. Femoro-Popliteal and below the knee arteries were commonly involved by these abnormalities while diabetes and hypertension were frequently associated clinical problems of these Patients.

*Conclusion:* Doppler ultrasound has a high diagnostic yield in depicting abnormalities in Patients with clinical features of peripheral arterial disease.

**Keywords:** Doppler ultrasound; Peripheral arteries; Diabetes.

### Introduction

Lower limb ischemia is a common presenting problem in the surgical practice, of which, Atherosclerosis and TAO are two important causes. Peripheral arterial disease (PAD) of lower limbs, refers to the obstruction or deterioration of Arteries (other than those supplying the heart and the brain) which results in limb ischemia and may manifest as Claudication, rest pain, local tissue loss (ulceration) in select cases.<sup>1,2</sup> Patients diagnosed as having PAD, including those who are asymptomatic, have an increased risk of mortality.<sup>1</sup> The incidence of symptomatic PAD increases with age, approximately 0.3% per year for men aged 40–55 and it goes up to 1% per year, above 75 years.

Risk factors being smoking, the single most important modifiable cause of PVD internationally, which increases the risk by 10 times, dyslipidemia,

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sedentary lifestyle and hypertension, associated with increased risk of developing PVD and DM.<sup>3,4</sup>

The common denominator among these processes is the impairment of circulation and resultant ischemia to the tissue involved. Highly prevalent in our society, arterial occlusive disease, in its myriad iterations, constitutes the leading cause of death.<sup>1,4</sup> In addition to death from MI or stroke, significant disability and loss of function from PAD results in an enormous cost in impaired quality of life for our aging population and a direct financial concern to our health care systems.

Techniques available for the diagnosis of peripheral arterial disease includes invasive procedure like CT angiography, which is considered the standard of reference<sup>5</sup> and other non-invasive methods like Doppler study, segmental pressures, pressure volume tests (Plethysmography) and duplex sonography. Doppler imaging is accepted as a valuable diagnostic technique.<sup>6</sup> It is the only noninvasive test which does not require contrast enhancement, preparation of patient before study or any radiation exposure. It allows the evaluation, the quantification and the follow-up of the arterial diseases by carrying out a precise vascular mapping and can guide the radiological or surgical intervention if necessary.<sup>7</sup> Thus, color Doppler imaging is proving to be a safe, popular, repeatable, noninvasive procedure for investigating lower limb ischemia, especially relevant to developing countries like ours in providing cost-effective solution to the general population. With this in mind, this study is done to correlate the clinical findings with the color Doppler in lower limb ischemia.

## Materials and Methods

This study was done under Department of General Surgery, at Basaveshwara Teaching and General Hospital, Kalaburagi, between November 2017 and

May 2019, with claudication pain of lower limb and associated symptom following ethical clearance. A thorough history of development of disease with risk factors and clinical examination was done in both lower limbs arterial systems mainly by palpation of dorsalis pedis artery, popliteal artery and femoral artery. Thereafter, radiological examination of the relevant limb was done with the patient lying supine or prone (depending on the specific artery) using 7.5 MHz linear transducer connected to digital ultrasound imaging system. Occasionally, 3.5 MHz convex transducer of the same machine was used (to optimise the depth) in obese patients and those with severe subcutaneous oedema. Color with or without power Doppler scans were done on the arteries to document the presence and direction of blood flow. The scan was considered normal if the artery showed normal consistent typical triphasic appearance of the waveform. The artery was considered to be totally occluded if there was no demonstrable blood flow with Color Doppler ultrasound. The examination was also extended to the external iliac arteries. In addition, complimentary corresponding venous examinations were conducted on each limb to detect asymptomatic incidental abnormalities such as deep venous thrombosis. All examinations were performed (by, at least, a consultant radiologist) with patients lying calmly on the examination table. Data analysis was conducted using statistical package for social sciences version 20.0.

## Results

Total number of patients in the present study was fifty. ( $n = 50$ ). In this study the minimum age was 48 and maximum age was 92. Number of patients were highest in the group of 51–65 years, i.e. 58%. Mean age of presentation was 59.3 years. Median age was 65 years (Fig. 1).

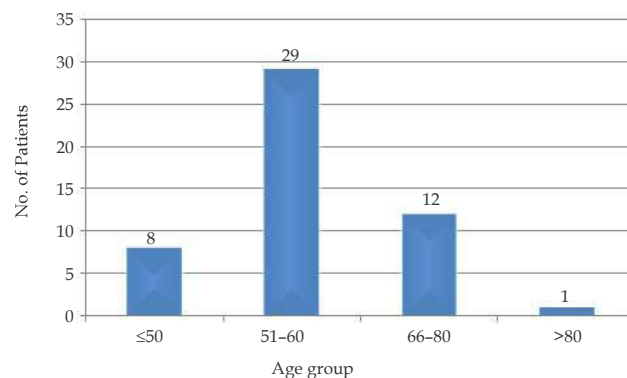


Fig. 1: Distribution of patients according to age.

Out of 50 Patients 39 were smokers and 11 were non-smokers, which showed that Lower Limb ischemia is more common in smokers than in non-

smokers. This relation was found to be statistically significant (Fig. 2).

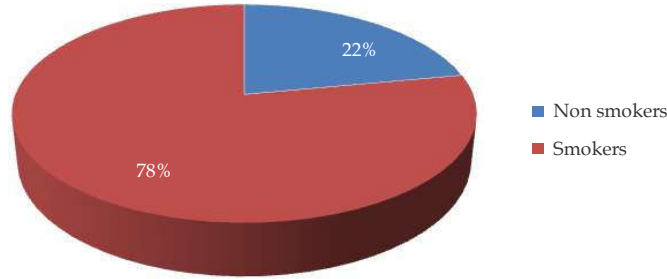


Fig. 2: Distribution of patients according to history of smoking.

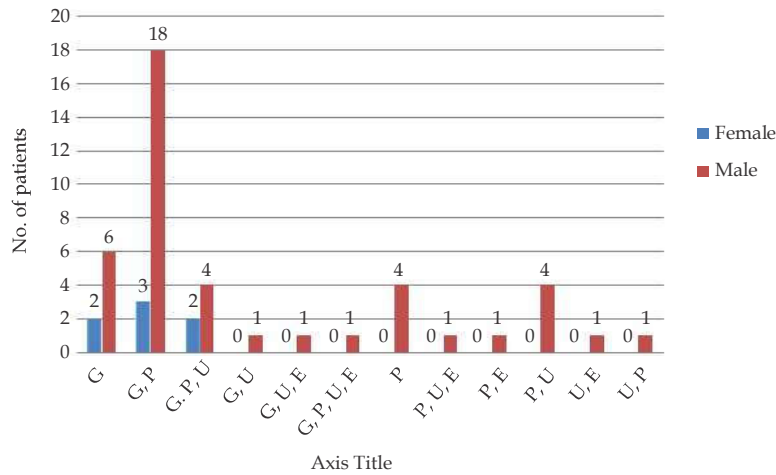


Fig. 3: Distribution of patients according to chief complaints and sex.

Most common clinical presentation of the patients was gangrene with claudication pain (42%). The single most common presenting complaint was gangrene of the limb which was seen in 76% of

the patients, of which 68% came with gangrene associated with pain, ulceration and/or edema (Fig. 3).

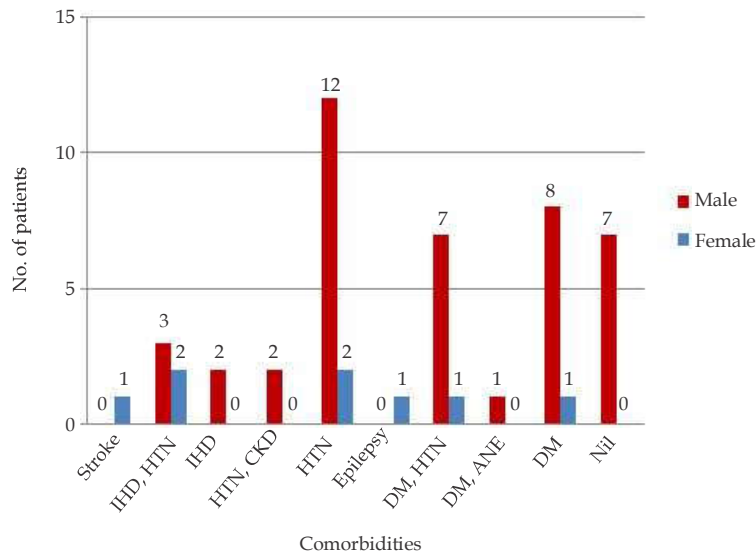


Fig. 4: Distribution of patients according to Comorbidities.

Out of 50 patients, most common comorbidity was hypertension, found in 28% of the patient. The next common presentation was diabetes mellitus,

found in 18% of the patients. A further 16% had both diabetes mellitus and hypertension (Fig. 4).

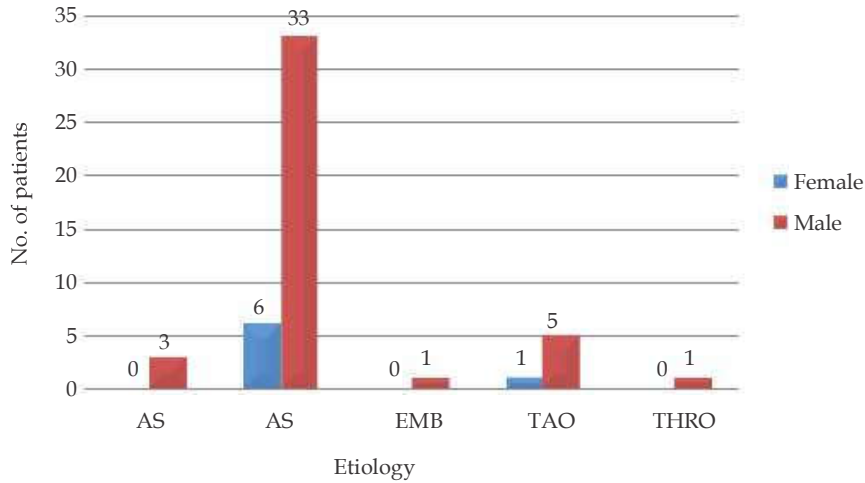


Fig. 5: Distribution of patients according to etiology.

The most common cause of lower limb ischaemia in our study was atherosclerosis constituting 84% of all the etiology for the provided above age groups and then the thromboangiitis obliterans (Fig. 5).

on Doppler study of dorsalis pedis. Doppler study picked up flow in 50% of the patients which had absent pulse on clinical examination. This result was statistically significant (Fig. 6).

In the case of dorsalis pedis artery, out of the 50 patients, clinical examination showed absent pulse in 40 patients, of which 18 patients showed monophasic flow, 4 patients showed biphasic flow and the rest 18 patients showed absent flow even

Clinical examination showed feeble pulse in the rest of the 10 patients which was duly reinforced by the Doppler study as all 10 patients having a monophasic flow (Fig. 7).

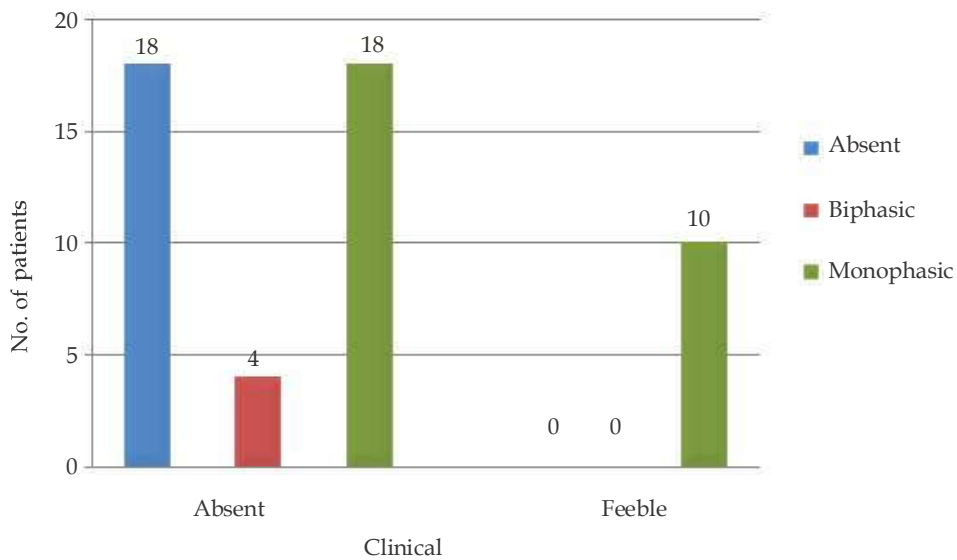


Fig. 6: Comparison of clinical diagnosis and Doppler of dorsalis pedis artery.

In the case of popliteal artery, 21 patients had a feeble pulse on clinical examination, of which

the Doppler study showed that 11 patients had a monophasic flow and 7 patients had biphasic flow.

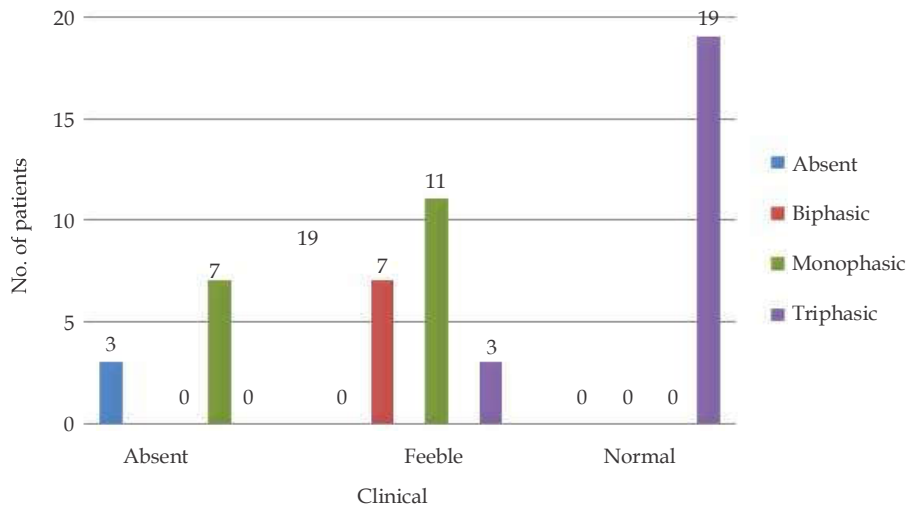


Fig. 7: Comparison of clinical diagnosis and Doppler of popliteal artery.

In the case of femoral artery, 13 patients had a feeble pulse on clinical examination, of which the Doppler study showed that 4 patients had a

monophasic flow, 6 patients had biphasic flow and 3 had triphasic flow with a significant *p*-value (Fig. 8).

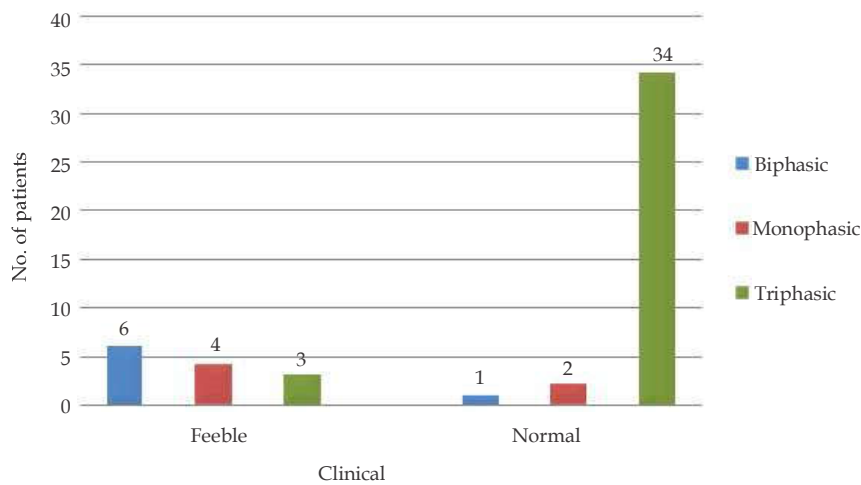


Fig. 8: Comparison of clinical diagnosis and Doppler of femoral artery.

**Discussion**

The mean age of 59.3 years in this study corresponds to the typical patients with peripheral arterial Disease. This is as demonstrated by Shaheen and Sohail<sup>8</sup> in their review of 100 diabetics with peripheral arterial disease. Ascher et al.<sup>9</sup> also documented the mean age of 55 years in their review of 68 patients with acute lower limb arterial ischemia in Pakistan.

As per the study conducted by Ismail et al.,<sup>10</sup> diabetic foot disease, intermittent claudication,

gangrene and limb swellings were the most common comorbidities in patients who presented lower limb ischemia, constituting 32.1%, 20.5%, 16.7% and 15.4%, respectively as compared to our study showing gangrene of the limb which was seen in 76% of the patients, of which 68% came with gangrene associated with pain, ulceration and/or edema.

In our study, atherosclerosis accounted for 84% of the patients. This finding is similar to the study by Hong FF et al.,<sup>13</sup> in 2019, where atherosclerosis was found to be a causative factor in 90% of the

patients. Next most common cause was TAO in 12% of the total patients.

Smoking and tobacco consumption are frequently present in patients with lower limb ischemia and act as an additional risk factor. In our study, 78% patients were smokers and the rest 22% were non smokers. This was similar to the findings in the study by Willigendael et al.,<sup>11</sup> where the prevalence of symptomatic PAD was increased 2.3-fold in current smokers as opposed to non smokers.

As shown in our results, the frequency of disease involvement of femoral artery was 12%, popliteal was 42%, and below-knee artery, i.e. dorsalis pedis artery 36%. This pattern is similar to the report of Guo et al.<sup>12</sup> on 162 diabetics with arterial lesions. They found frequencies of below knee arteries (92/127, 67.2%) was higher than that in iliac artery (8/33, 24.2%), popliteal artery (53/157, 33.8%) and femoral artery (11/78, 14.1%).

This study compared the findings of clinical examination and Doppler study of the patients with chronic lower limb ischemia, whereas most of the previous studies were done to compare the Doppler study with other imaging modalities such as impedance plethysmography, DSA and CT angiography, etc.

## Conclusion

This preliminary review of 50 patients showed high frequency of femoro-popliteal and Tibial arterial system involvement in chronic lower limb ischemia. In addition to atherosclerosis, history of smoking with diabetes and hypertension in older age groups were more prone for the ischemia of the lower limb. Though subjective, our study showed high diagnostic yield of color Doppler ultrasound in depicting flow pattern in patients when compared to the clinical feeble and/or absent arterial pulses of involved lower limb of the patients with features of peripheral arterial disease.

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