

A Clinical Study of Peripheral Vascular Diseases due to Atherosclerosis in Diabetic Foot

Sneha Patil¹, Shivani C. Rampure²

¹Dept. of Pediatrics

²Assistant Professor, Dept. of General Surgery, Mahadevappa Rampure Medical College, Kalaburgi

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Corresponding Author: Dr. Shivani C. Rampure

Conflict of interest: Nil

Abstract:

Background and Objective: It is necessary to do a comprehensive examination of PVD in each and every diabetic patient. In order to reduce morbidity, the information can be used to assist in the preparation of protocols for the efficient care of diabetic patients. In India, the purpose of this study is to identify the prevalence of peripheral vascular disease and to evaluate the connection between that illness and the ankle-brachial index in diabetic patients who have foot ulcers and those who do not have ones.

Methods: A prospective analytical study done on 40 patients with type II diabetes mellitus with suspected PAD admitted in Basaveshwara Hospital from August 2022 to January 2023. Necessary data was recorded including patient age, sex, clinical finding CRP, WBC, ABPI and statistical analysis was done.

Results and Interpretation: In the present study, 0.88 +/- 0.28 was the mean ABPI. Amongst those who underwent Doppler, 19 had triphasic flow, 15 had biphasic and the remaining had monophasic flow. Monophasic flow patients have significantly lower ABPI (p-value < 0.001). The ABPI did not affect the outcome of the patient in the present study.

Conclusion: ABPI was significantly reduced with patients with monophasic flow, but there was no correlation of the same with outcomes.

Keywords: Diabetic Foot Ulcers, Peripheral Artery Diseases, Above Knee Amputation.

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Introduction

Diabetes Mellitus (DM) is a metabolic condition that is characterized by elevated levels of blood glucose. This elevated blood glucose is a consequence of either an absolute or relative insulin shortage, which occurs in situations where there is β -cell malfunction, insulin resistance, or both that are present [1]. Worldwide, it is one of the illnesses that is most prevalent and is expanding at a rapid rate. In India, where there are 77 million people living with diabetes [2], the great majority of them have not yet been identified, diabetes is rapidly becoming a potential epidemic.

Foot ulcers are a symptom of diabetic foot, which is a disorder that affects people who have diabetes [3]. This terrifying condition requires prolonged hospitalization, which may be quite expensive, and there is a possibility that an extremity will need to be amputated [4]. On the other hand, surgical amputation can be avoided by the use of educational and care initiatives [5]. The basic trio of neuropathy, ischemia, and infection is what distinguishes diabetic foot from other foot conditions [4]. It has been stated that the likelihood of a diabetic infected

with a DFU is as high as twenty-five percent. When it comes to people with diabetes, diabetic foot is the most common reason for hospitalization (about thirty percent) [2]. One to twenty-five percent of people who have such DFU require an amputation. It is estimated that DFU is the cause of about 85 percent of all amputations. It has been suggested that there are a number of factors that contribute to the development of DFU, the most important of which is peripheral sensory neuropathy, followed by peripheral vascular disease (PVD).

In patients with peripheral vascular disease (PVD), persistent limb ischemia is invariably caused by atherosclerosis of the peripheral arteries. PVD is one of the most prevalent macrovascular problems that can arise from type II diabetes [6]. In adults under the age of sixty, the prevalence is around three percent, but it jumps to more than twenty percent in those over the age of seventy-five. PVD is a condition that only affects one fourth of persons who have it. Smoking, diabetes mellitus, hypertension, obesity, and a lack of physical exercise are some of the additional risk factors that are associated with

high blood pressure. An illness known as peripheral vascular disease (PVD) affects the arteries that supply the kidneys, intestines, legs, and feet. In patients with diabetes, peripheral vascular disease (PVD) is not only associated with a poorer prognosis, but it is also frequently more severe than in those who do not have diabetes who are equivalent. Patients who suffer from PVD are at an increased risk of myocardial infarction, stroke, and death[9,10]. Diabetes mellitus and its consequences can be effectively managed with the aid of early diagnosis of vascular alterations.

There is an additional influence that the diagnosing method has on the severity of PVD[7]. A diagnostic method that is both proven and reproducible is required in order to get a more accurate evaluation of PVD in diabetic patients. The ankle-brachial index (ABI) is a test that falls within this category. The ratio of the systolic brachial pressure to the ankle pressure is referred to as the ABPI. It has been claimed that it can be computed by dividing the higher systolic pressures observed in the brachial artery by the higher systolic pressures reported in the dorsalis pedis and tibialis posterior arteries at the ankle[11]. Simply said, ABPI is a straight forward and non-invasive method. It was discovered that the ABPI was more accurate and verified against angiographically proven illness. Additionally, it was discovered to have a sensitivity of 95% and a specificity of approximately 100%[12].

It is necessary to do a comprehensive examination of PVD in each and every diabetic patient. In order to reduce morbidity, the information can be used to assist in the preparation of protocols for the efficient care of diabetic patients. In India, the purpose of this study is to identify the prevalence of peripheral vascular disease and to evaluate the connection between that illness and the ankle-brachial index in diabetic patients who have foot ulcers and those who do not have ones.

Materials and Methods

Source of Data: The present study will be conducted in the Department of General Surgery, Basaveshwar. Teaching & General Hospital

attached to Mahadevappa Rampure Medical College, Kalaburagi.

Methods of collection of data

Study Design: The present study is prospective descriptive study.

Place of study: Department of General Surgery, Basaveshwar Teaching and General Hospital, Kalaburagi, attached to Mahadevappa Rampure Medical College, Kalaburagi.

Sample Size: 40.

Sampling Procedure: Study subjects were selected after applying inclusion-exclusion criteria. Information was collected through prepared proforma from each patient. Simple randomized sampling was done. The clinical history, physical examination, blood sugar profile, color Doppler and relevant investigation done in a patient clinically diagnosed with peripheral vascular disease in diabetic foot ulcer would be recorded, the treatment modality will also be recorded. These data will be entered in a pretested proforma.

Duration of Study: 1st August 2022 to 31st January 2024 (18 months).

Inclusion Criteria

1. All diabetic patients with foot ulceration.
2. All diabetic patients with gangrene toes, intermittent claudication, or rest pain in feet.
3. Patients with peripheral vascular disease diagnosed on Doppler study.

Exclusion Criteria

1. Non diabetic ulcers.
2. Malignant ulcer.
3. Diabetes with previous amputations for malignancy or acute trauma.
4. Diabetes with lymphedema or osteomyelitis of foot.
5. Marjolin's ulcer/ Skin malignancies.

Results

This study included 40 patients with diabetic foot ulcer suspected of vasculopathy.

Table 1: Age Parameters

	Age
Mean	44.88
Std. Deviation	11.42
Minimum	26
Maximum	70
95% Confidence interval for mean	41.22 - 48.53

The mean age in the present study was 44.88 +/- 11.42 years.

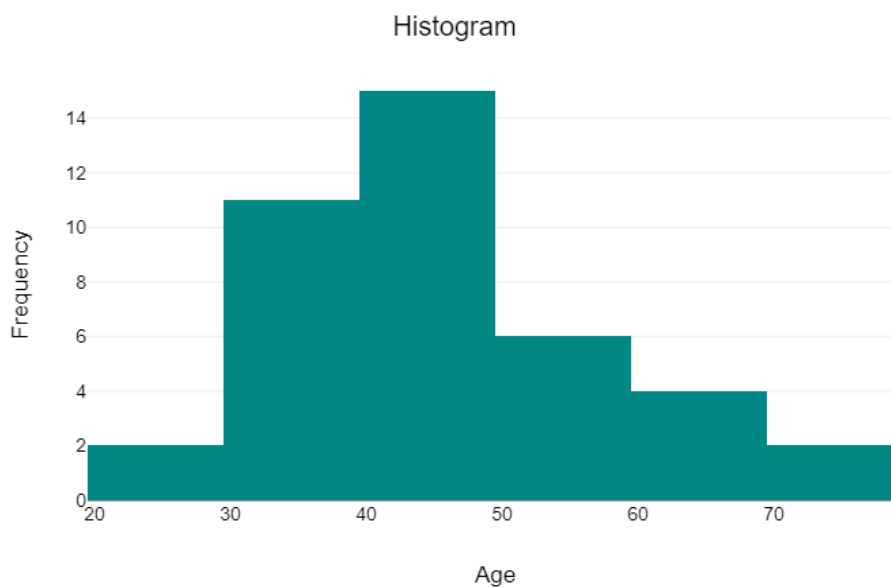


Figure 1: Age Distribution

55% of the study participants were males, with a ratio of 1.1:1

Table 2: Gender Distribution

Sex	Frequency	%
M	22	55%
F	18	45%
Total	40	100%
Invalid	0	0%
Total	40	100%

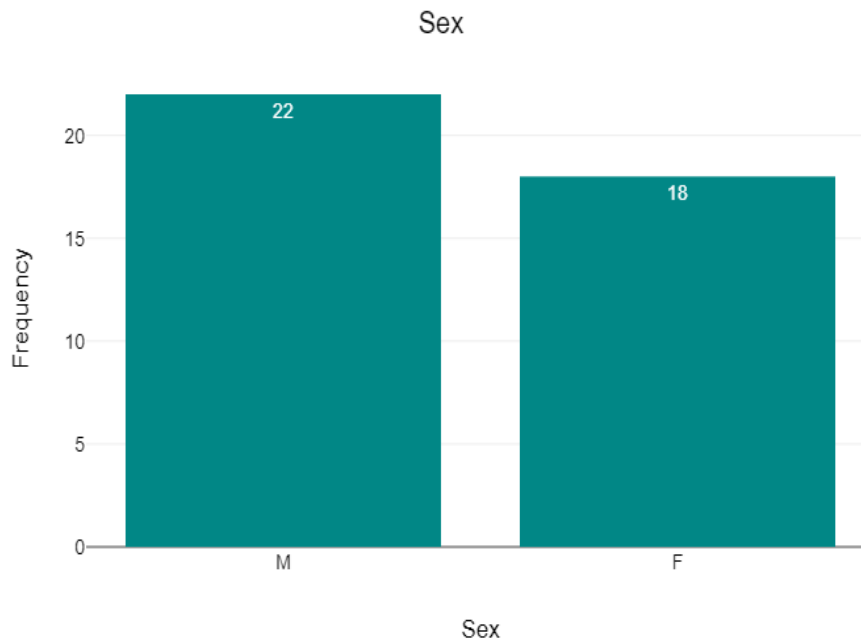


Figure 2: Gender Distribution in the study

Table 3: Age and Gender Distribution

		Frequency	Mean	Std. Deviation
Age	M	22	45.77	11.72
	F	18	43.78	11.27

There is no difference in the age distribution between the genders

The mean duration of ulcer in day was 63.95 +/- 69.49 days, with a minimum of 10 days and maximum of 365 days.

Table 4: Mean Duration of Ulcer in Days

	Duration of Ulcer in days
Mean	63.95
Std. Deviation	69.49
Minimum	10
Maximum	365
95% Confidence interval for mean	41.72 - 86.18

Histogram

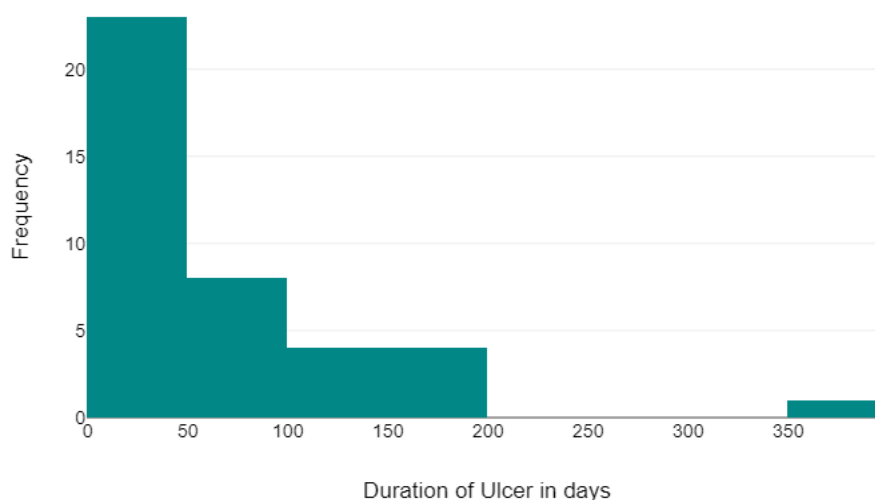


Figure 3: Duration of Ulcer Distribution

Table 5: Location of Ulcer

Location of Ulcer	Frequency	%
Dorsum of right foot	8	20%
Dorsum of left foot	5	12.5%
Left medial malleolus	5	12.5%
Left heel	4	10%
Plantar aspect of left foot	4	10%
Right fifth toe	4	10%
Right medial malleolus	3	7.5%
Right heel	3	7.5%
Right lateral malleolus	1	2.5%
Left lateral malleolus	1	2.5%
Left fifth toe	1	2.5%
Right great toe	1	2.5%
Total	40	100%
Invalid	0	0%
Total	40	100%

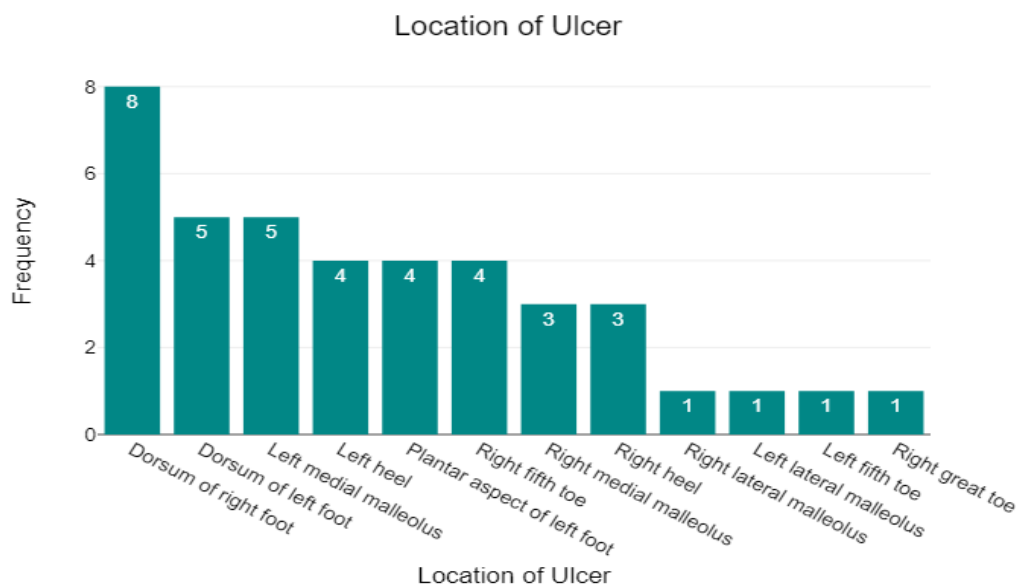


Figure 4: Location of Ulcer

Table 6: Mean Duration of Onset of Diabetes

	Onset of Diabetes (years)
Mean	5.63
Std. Deviation	3.05
Minimum	1
Maximum	12
95% Confidence interval for mean	4.65 - 6.6

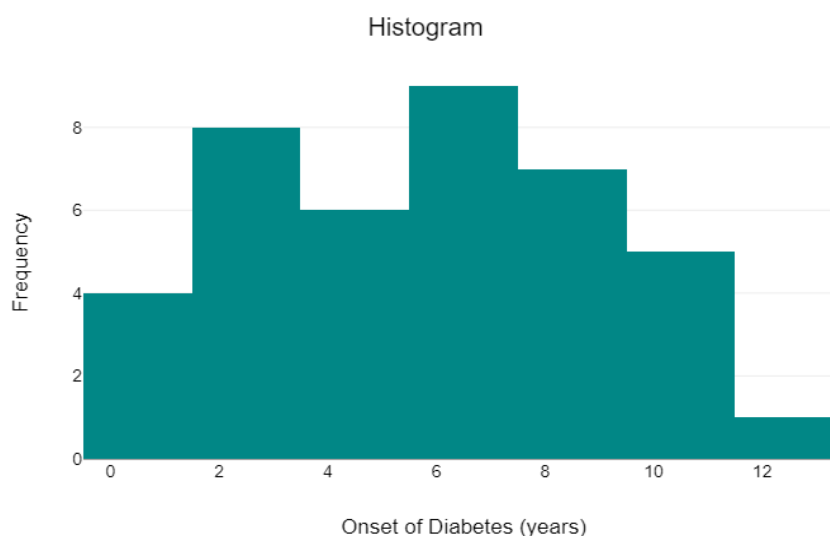


Figure 5: Histogram

Discussion

In the etiopathogenesis of diabetic vasculopathy, recent investigations have suggested that endothelial damage, platelets, monocytes, prostaglandins, lipoproteins, and hyperglycemia all play a role. It is possible for any type of injury, whether it be mechanical or immunological, to result in the disruption of the endothelium barrier.

Age: In the present study, the mean age was 44.88 +/- 11.42 years.

Tyagi et al noted similar findings in their study, Age distribution was shown in the table and here we found the youngest patient was 42 years old, male, and the oldest was a man aged 72 years. 21% of patients fell in 40-50 years of age.

In a study by Rathnaganapathi et al [13], diabetic foot ulcer is more common in the age group of 51-60 years, which was much higher than that of our study.

In a study by Das et al, those without PVD belonged to the ages of 40-49 years, while those with PVD belonged to 50-59 years.

Gender: In the present study, 55% of the study participants were males, with a ratio of 1.1:1.

In a study that was conducted by Jennifer A. Mayfield, the ratio of male to female was found to be practically equal. It's possible that the higher prevalence in males is attributable to associated behaviors like smoking, drunkenness, the type of work they do, and so on.

In Tyagi et al, 69% were males, while the remaining were females. This was different from the findings of our study, with a higher male preponderance.

In Das et al, 71.3% with PVD were males, while 60% without PVD were females.

Unlike the present study, T Rathnaganapathi noted that females were in higher proportion, at 54%.

Duration of DFU And Diabetes: The mean duration of ulcer was 63.95 +/- 69.49 days, with a minimum of 10 days and a maximum of 365 days. The duration of diabetes in the present study was 5.63 +/- 3.05 years. In the current study, patients who had been diagnosed with diabetes for more than five years were more likely to experience problems. The age of the diabetic is the factor that determines the severity of the disease, not the age of the patient experiencing it. The majority of the patients had more than one lesion when they were examined. Above, only significant lesions are taken into consideration.

In a study by Tyagi et al, of 72 patients, 76% of patients were diagnosed, with the disease present for less than 5 years were found to be 76% and 24% of the patients had the disease for greater than 5 years. In the study by Rathnaganapathi et al [13], most of the patients had duration of up to 6-10 years.

Prevalence of PVD: 45% of the patients had history of intermittent claudication, suggestive of PVD.

32% of the patients in the study by Tyagi et al showed presence of peripheral vascular disease (PVD) and majority of the patients (68%) did not have PVD. This was similar to the findings of the present study.

In the study by Das et al, 72 persons with diabetes were enrolled over the study period; 52 patients presented with DFUs, and 20 patients were without DFUs. In this study, the prevalence of PVD in DM subjects was found to be 72.22%, with 52 out of 72 patients showing the presence of PVD.

As reported earlier by Pradeepa R et al. [10], the prevalence of PVD is higher in DM subjects than in non-DM subjects in population-based and clinic-based studies.

Smoking: 20% of the study participants had smoking history. In a study by Tyagi et al, there was no association between smoking and the incidence of PVD.

In a study by Rathnaganapathi et al [13], 31 percent of the diabetic foot ulcer has associated with smoking.

Doppler and ABPI: In the present study, 0.88 +/- 0.28 was the mean ABPI. Amongst those who underwent Doppler, 19 had triphasic flow, 15 had biphasic and the remaining had monophasic flow. Monophasic flow patients have significantly lower ABPI (p-value < 0.001). The ABPI did not affect the outcome of the patient in the present study.

In a study by Das et al, the ABPI was estimated by Duplex scan. In their study, 62.5% patients with PVD shows IMT value more than 1.0 mm, 36.5% patients show IMT value in between 0.7- 1.0 mm and 1.9% patients show IMT value below 0.7 mm. In this study, 5% of patients without PVD showed an IMT value of more than 1.0 mm, 60% of patients showed an IMT value between 0.7- 1.0 mm, and 35% of patients showed an IMT value below 0.7 mm. That means IMT is strongly associated with PVD.

The absence of dorsalis pedis was discovered in a study carried out by Edmunds et al., which was 31.4%, as well as in a study carried out by Ali SM et al., which was 56%, and in the current study, it was discovered to be 40% (14,15). In the experiments that were discussed before, the absence of dorsalis pedis pulses was not consistent. Vasculopathy, cellulitis with edema, and anatomical abnormalities of the dorsalis pedis artery may be the causes of this condition.

In Tyagi et al, the presence of PVD was found in 6 of the 22 female patients with a prevalence rate of 27%.

Rathnaganapathi et al noted that ankle brachial pressure index measured in the diabetic foot ulcer patient 29 % of the patients had ischemic changes in which 12 % of the cases severe ischemia and mild to moderate ischemic changes around 17%.

Outcome Correlation with ABPI: In the present study, those with ABPI less than 0.6 underwent BKA and AKA. Patients with an ABI<0.5 had a 2-fold higher risk of requiring revascularization surgery or major amputation as compared with patients whose ABI was>0.5. In this study, we found one person <0.5, had ABI, he underwent BKA.

Conclusion

The importance of this study lies mainly in the fact that both DFU and PVD affect the quality of life, generating disability in the diabetic patients. Risk factors such as growing age, longer duration of diabetes, smoking increases the risk of amputation of diabetic foot ulcers. When it comes to investigating the arteries in the lower limbs, duplex Doppler imaging is a non-invasive treatment that is safe, cost-effective, repeatable, and non-invasive. As a result, it is the main examination of choice in all cases of lower extremity arterial disease and assists in determining whether or not additional evaluation by angiography is required.

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