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Original Article

Surgery Section

Utility of Palpatory Ankle Brachial Pressure Index as a Screening Tool for Asymptomatic Peripheral Vascular Occlusive Disease in Type II Diabetes Mellitus Patients in a Rural Hospital

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ABSTRACT

Introduction: Peripheral Artery Disease (PAD) or Peripheral Vascular Occlusive Disease (PVOD) is one of the significant macrovascular complications of diabetes mellitus, hypertension, and chronic smokers. The Ankle Brachial Pressure Index (ABPI) is an easy, non-invasive, and often underutilised tool for diagnosis of PVOD, which is often underdiagnosed in rural health care settings.

Aim: To estimate the ABPI and determine the proportion of asymptomatic PAD, sensitivity, and specificity of ABPI in patients with type II diabetes mellitus is a rural secondary care hospital.

Materials and Methods: A cross-sectional descriptive study was done on 112 patients presenting to a rural secondary care hospital affiliated to a medical college in Mangalore, Karnataka, India, with type II diabetes mellitus between October 2018 to February 2019. A pre-structured proforma was used to collect data on variables. ABPI measurements were expressed in terms of median and Interquartile range. Age, sex, co-morbidity pattern was shown in terms of percentages and proportions. Data was entered in MS Excel and analysed using SPSS software version 20.0. Receptor Operating Characteristic (ROC) curve was used to determine the sensitivity and specificity of ABPI as a screening tool for PVOD.

Results: Of the 112 patients examined, median Ankle Systolic Blood Pressure was 140.0 mmHg (130.0-150.0), and median Brachial Blood Pressure was 139.0 mmHg (130.0-153.5), and the mean ABPI was 1.00±0.15. The number of patients with type II diabetes mellitus with asymptomatic PAD (ABPI <0.9) was 30 (26.8%). However, the sensitivity and specificity of ABPI in the diagnosis of PVOD of type II diabetes mellitus patients was not found to be statistically significant (95% Confidence intervals- 0.390 to 0.660).

Conclusion: Palpatory ABPI has limited utility as a screening tool for PVOD in patients with type II diabetes mellitus. Palpatory ABPI alone is inadequate to diagnose PVOD in high-risk patients.

Keywords: Ankle systolic blood pressure, Brachial blood pressure, Peripheral arterial disease, Secondary care hospital

INTRODUCTION

PVOD or PAD is a frequently occurring macrovascular complication in those patients suffering from Type II Diabetes Mellitus [1]. Atherosclerosis is accelerated in such patients; hence, they are prone to develop significant vascular occlusion causing critical ischaemia and gangrene, adding to the existing morbidity and mortality associated with type II diabetes mellitus [2]. It is observed that PVOD is influenced by the presence of diabetic neuropathy, duration of diabetes mellitus, and glycaemic control [3]. Diabetic foot ulcers occur as a result of diminished arterial supply often seen as a macrovascular complication [4]. Due to the variation in presentation of patient's lower limb arterial occlusion; there is a growing need for a reliable, non-invasive screening test [5,6]. The need for early diagnosis of PVOD is more applicable for rural areas, owing to the lack of modern equipment and infrastructure to identify the same.

Ankle Brachial Pressure Index (ABPI) is a method routinely used to aid in the diagnosis of PVOD, which is conventionally performed using a handheld Doppler [7]. A modified method of the ABPI by palpatory method has been described in the literature [8].

The utility of the same in rural settings where there is more often an absence or unavailability of the Doppler would be most helpful. This study was undertaken to estimate the ABPI via the palpatory method and determine the proportion of PAD, sensitivity, and specificity of ABPI in patients with type II diabetes mellitus in a rural secondary care hospital.

MATERIALS AND METHODS

A cross-sectional descriptive study was conducted from October 2018 to February 2019. The study population comprised of 112 patients presenting to the medicine and surgery OPD of a secondary care hospital. The sample size was based on a study [9] where the proportion of asymptomatic peripheral vascular disease was observed in 36% of the individuals with type II diabetes mellitus. The minimum sample size was 106, assuming a total of 150 patients would be visiting the outpatient departments during the study period.

The study was conducted on type II diabetes mellitus patients attending the outpatient departments of General Surgery and Medicine in a rural secondary care hospital affiliated to a medical college in Mangalore, Karnataka, India. The protocol for the same was placed before the Institutional Ethics committee (IEC/111/18) and was approved. The consent to conduct the study was obtained from the hospital authorities.

After receiving informed consent, peripheral pulsations were checked in dorsalis pedis and brachial artery. Patients with type II diabetes mellitus, with or without systemic hypertension, ulcer, and other associated macrovascular complications of type II diabetes mellitus, such as neuropathy, nephropathy, and retinopathy were included in the study. Patient with chronic kidney disease, symptomatic peripheral vascular disease/gangrenous changes, and those with symptoms suggestive of pre-existing or established PVOD were excluded, after clinical assessment by looking for well palpable peripheral pulses as the aim was to determine the utility in the diagnosis of asymptomatic PVOD using palpatory ABPI.

Ankle and brachial pressures were measured using the palpatory method with a standard sphygmomanometer. The ankle and brachial blood pressures were measured at 5-minute duration, and the average of the two values was taken into consideration. ABPI was taken as indicative of PVOD if less than or equal to 0.9, 0.9-0.99 as borderline and more than or equivalent to 1.00 was considered normal, with cut-off values [10].

STATISTICAL ANALYSIS

Demographic details of the inclusion population, duration of diabetes mellitus, and underlying co-morbidities were entered in a pretested semi-structured questionnaire data which was then entered into a spreadsheet of MS Excel. The statistical analysis was performed using SPSS software v20. ABPI measurements were expressed in terms of median and Interquartile range. Age, sex, co-morbidity pattern was shown in terms of percentages and proportions. ROC curve was plotted, and area under the curve measured for sensitivity and specificity of ABPI as a screening tool for PVOD in type II diabetes mellitus patients.

RESULTS

A total of 112 patients that were evaluated, 66 (58.9%) of the population consisted of males. About 32.1% (36) of the study population was in the age group of 61-70 years of age, as shown in [Table/Fig-1].

Characteristics		Frequency n (%)
Age group	<40 years	3 (2.7)
	41-50 years	21 (18.8)
	51-60 years	33 (29.5)
	61-70 years	36 (32.1)
	>70 years	19 (17.0)
Duration of diabetes	<1 year	18 (16.1)
	1-5 years	41 (36.6)
	5-10 years	27 (24.1)
	>10 years	26 (23.2)
Comorbidities	Hypertension	56 (50.0%)
	Ulcer over leg	37 (33.0%)
	Neuropathy	16 (14.3%)
	Nephropathy	5 (4.5%)
	Retinopathy	2 (1.8%)
Characteristic		Median (Interquartile range)
Random Blood sugar (mg/dL)		184.0 (148.0-233.25)
Blood pressure (mm Hg)	Ankle Systolic Blood Pressure	140.0 (130.0-150.0)
	Brachial Blood Pressure	139.0 (130.0-153.5)
	Mean ABPI	1.00±0.15

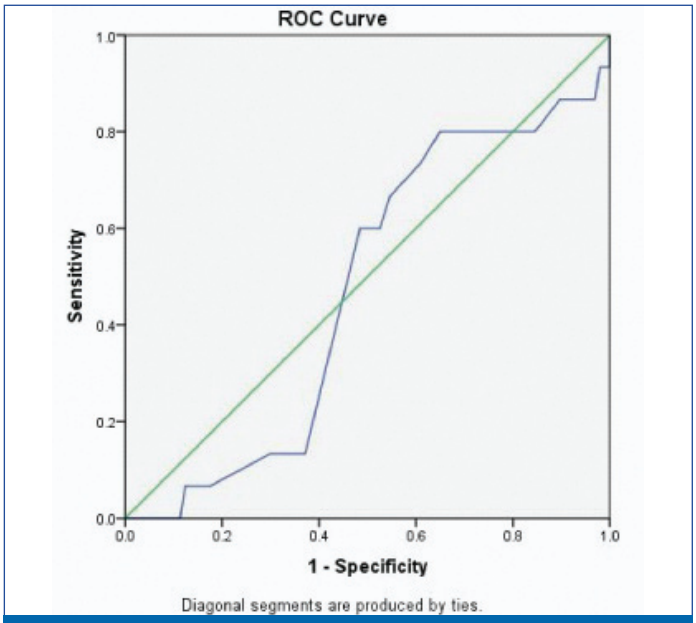
[Table/Fig-1]: Characteristics of the study population (N=112).

The median age of the patients was 60.0 (51.25-66.75) years. The median duration of diabetes was 6.0 (3.0-12.75) years, of which, majority of the patients were found to have type II diabetes of minimum one-year period as seen in [Table/Fig-1]. The most common association was hypertension seen in 56 (50.0%) of the patients, followed by ulcer over legs in 37 (33.0%) patients. The median random blood sugar was 184 (148.0-233.25) mg/dL, which was well within the accepted cut-off 200 mg/dL. The median ankle pressure was found to be 140.0 (130.0-150.0) mmHg, and the median brachial pressure was found to be 139.0 (130.0-153.5) mmHg, which is normal. Patients were found to have a mean ABPI of 1.00±0.015, which is within the standard cut-off ranges for PVOD [10-12]. Of the 112 patients, 30 (26.8%) were found to have abnormal ABPI suggestive of PVOD, which was less than 1/3rd of the study population, as seen in [Table/Fig-2].

ABPI	Frequency (%)
≤0.9	30 (26.8)
0.91-0.99	26 (23.2)
≥1.0	56 (50.0)
Total	112 (100.0)

[Table/Fig-2]: ABPI classification in the study population.

The area under the curve for diagnoses of PVOD using ABPI based on the duration of diabetes mellitus is seen in [Table/Fig-3]. The sensitivity and specificity of ABPI in the diagnosis of PVOD did not reach the level of statistical significance with 95% Confidence intervals of 0.390 to 0.660. The area under the curve was 0.525, thus showing poor discriminatory value in the diagnosis of PVOD concerning the duration of type II diabetes mellitus.



[Table/Fig-3]: ROC curve which shows that AUC did not achieve statistical significance.

DISCUSSION

The present study is one of the few studies conducted in India on palpatory ABPI measurement in rural health care settings as a screening tool for PVOD in rural care facility, which represents the majority of the population. In the study, we found that palpatory ABPI alone is a sensitive or specific screening tool for asymptomatic PVOD.

A study conducted by Shukla V et al., showed that the incidence of PAD was 36% in asymptomatic diabetic patients, with a good correlation with the duration of diabetes [9]. In a study conducted by Patel D et al., it was found that the presence of type II diabetes mellitus was statistically significant with the diagnosis of PAD [11]. Sarangi S et al., found that the ABPI (<0.9) was present in 18% of the individuals with coronary artery disease [10].

ABPI, especially the palpatory method, is one such method which can be applied in a rural setup. In a study conducted by Migliacci R et al., it was found that ABPI by the palpatory method is a relatively sensitive and specific investigation in a primary care setup [8]. However, a study conducted by Mercado J et al., found that the sensitivity of the palpatory method of ABPI ranged from 63.15-73.68%, and the specificity ranged from 94.06 to 98.02% [12]. The study conducted by Xu D et al., found that the specificity ranged from 15-79.0%, and the accuracy ranged from 83.3-99.0% [13]. In the study conducted by Ranasinghe L et al., found that the sensitivity of ABPI was 62%, and the specificity was 90% [14]. In another study conducted by Baxter GM et al., measurement of ABPI without Doppler (abnormal ABPI <1.0) had a sensitivity of 100% and specificity of 40% (when compared to angiography) [15]. However, in the present study, we could not find the specificity and sensitivity

of the ABPI as it did not reach a level of significance, where the cut-offs for the sensitivity of the tool could be found without significant compromise of the specificity.

From this study, we can observe that palpatory ABPI by itself may be insufficient as a screening tool for PVOD in high-risk cases in such areas, requiring further confirmation.

LIMITATION

Palpatory ABPI relies on the subjective evaluation of the examiner of the peripheral pulses. Presence of oedema, ulcers, and obesity, etc., which is seen to be commonly encountered in patients with type II diabetes mellitus, could have impaired the ABPI measured.

CONCLUSION

Palpatory ABPI has reduced discriminatory power for detecting PVOD in people with diabetes. However, the same has to be done by different investigators on the same population to confirm the readings, and on larger sample size and in various institutions, while being corroborated with Doppler/angiography to give a definitive result.

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