Original article:

Sensitivity analysis of Toe Brachial Index vs Ankle Brachial Pulse Index in Peripheral vascular disease

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Abstract:

Introduction: The prevalence of Peripheral Vascular Disease is strikingly higher in a younger diabetic population, affecting one in three diabetics older than 50 years

Methodology: Diabetic disease cases admitted in B.L.D.E.U's Shri B. M. Patil Medical College, Hospital & Research Centre / attending surgical OPD during period of Oct 2014 to July 2016.

All cases of Diabetes admitted in B.L.D.E.U's Shri B. M. Patil Medical College, Hospital & Research Centre / attending surgical OPD will be included in the study.

Results: In this study, Toe Brachial Index (TBI) was compared with Ankle Brachial Pulse Index (ABPI) to ascertain which one would be a better diagnostic test for the diagnosis of PVD in patients of Diabetes. The study was performed using Hand held Doppler and the results were confirmed using Colour Doppler.

Conclusion : Toe Brachial Index is a more Sensitive & Accurate diagnostic modality when compared to Ankle Brachial Pulse Index for the diagnosis of PVD in patients with diabetes and is therefore a better screening tool for the diagnosis of PVD in diabetics.

Introduction

The prevalence of Peripheral Vascular Disease is strikingly higher in a younger diabetic population, affecting one in three diabetics older than 50 years[1]. A continuous-wave ultrasound signal is transmitted from the probe at an artery and the reflected beam is picked up by a receiver within the probe itself. The change in frequency in the reflected beam compared with that of the transmitted beam is due to the Doppler shift, resulting from the reflection of the beam by moving blood cells. The frequency change may be converted into an audio signal that is typically pulsatile. Doppler ultrasound equipment can be used in conjunction with a sphygmomanometer to assess systolic pressure in small vessels.

This is possible even when the arterial pulse cannot be palpated. Ankle pressures <50 mmHg or toe pressures <30 mmHg are indicative of critical limb ischemia. The toe pressure is normally 30 mmHg less than the ankle pressure, and a toe-brachial index of <0.70 is abnormal. False-positive results with

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the toe-brachial index are unusual. The main limitation of this technique is that it may be impossible to measure pressures in the first and second toes due to preexisting ulceration 2,3.

With this present study was planned to study sensitivity analysis of Toe Brachial Index **vs** Ankle Brachial Pulse Index in Peripheral vascular disease.

Methodology

Source of data:

Diabetic disease cases admitted in B.L.D.E.U's Shri B. M. Patil Medical College, Hospital & Research Centre / attending surgical OPD.

Method of collection of data:

Diabetic disease cases admitted in B.L.D.E.U's Shri B. M. Patil Medical College, Hospital & Research Centre / attending surgical OPD during period of Oct 2014 to July 2016.

Inclusion Criteria

All cases of Diabetes admitted in B.L.D.E.U's Shri B. M. Patil Medical College, Hospital & Research Centre / attending surgical OPD will be included in the study.

Exclusion Criteria

1. Patients with peripheral vascular disease with no evidence of diabetes.
2. Patients with bilateral amputations of great toe or bilateral lower limb amputation.

Results

Table 1: Distribution of cases according to ABPI and TBI

ABPI	TBI				Total	p value
	+ve (<0.7)		-ve (≥0.7)			
	N	%	N	%	N	
+ve (<1.0)	9	100.0%	0	0.0%	9	
-ve (≥1.0)	59	83.1%	12	16.9%	71	0.181
Total	68	85.0%	12	15.0%	80	
Agreement between TBI and ABPI= (9+12)/80 = 26.3%						

Agreement table between TBI & ABPI showing number of cases diagnosed by ABPI & TBI.

Table 2 : Sensitivity analysis of TBI vs ABPI

	TBI	ABPI
Sensitivity	85.0%	11.3%
Specificity	NA	NA
PPV	100.0%	100.0%
NPV	0.0%	0.0%
Accuracy	85.0%	11.3%

Sensitivity & Accuracy of TBI to diagnose PVD in diabetics is more than ABPI.

Statistical analysis

All characteristics were summarized descriptively. For continuous variables, the summary statistics of N, mean, standard deviation (SD) were used. For categorical data, the number and percentage were used in the data summaries. Chi-square (χ^2)/ Freeman-Halton Fisher exact test was employed to determine the significance of differences between groups for categorical data. Sensitivity- specificity analysis was done to check relative efficiency. If the p-value was < 0.05, then the results will be considered to be significant. Data were analyzed using SPSS software v.23.0.

Discussion

In this study, Toe Brachial Index (TBI) was compared with Ankle Brachial Pulse Index (ABPI) to ascertain which one would be a better diagnostic test for the diagnosis of PVD in patients of Diabetes. The study was performed using Hand held Doppler and the results were confirmed using Colour Doppler. The hand held Doppler is a portable device, now widely used by general surgeons as well as vascular surgeons to assess the blood flow to a limb.

In this study, the mean age of presentation of patients was 53 years with maximum number of patients in the age group of 56 to 65 years. The number of newly diagnosed diabetics (70%) also greatly outnumbered the previously diagnosed or known diabetics (30%). This shows that late diagnosis of diabetes was due to late presentation of the patients to the hospital and that more number of complications were to be expected, including peripheral vascular disease.

The most common presentation of diabetics who were later diagnosed with peripheral vascular disease was Ulcer Over the Foot (26 patients; 32.5%) and 21 of those patients underwent below knee amputation. Revision amputation with above knee amputation was required in 6 of these patients, signifying a virulent form of the disease. ABPI was normal in all these patients signifying the low sensitivity in patients with late presentation, most probably due to medial sclerosis that affects the peripheral arteries in long standing/ untreated diabetics. The mean HbA1c was 9, signifying a poor control of diabetes in 85% (68 patients) of cases with Peripheral Vascular Disease. Overall, 37 patients (46.2%) underwent below knee amputations signifying the high morbidity associated with late diagnosis of peripheral vascular disease in diabetes.[4,5]

Amongst 80 cases, only 9 (11.2%) of diabetics were diagnosed with PVD accurately using ABPI when compared to TBI which was able to diagnose PVD in 68 patients (85%) of diabetes in the study group. This signifies the high sensitivity & accuracy of TBI (85%) when compared to ABPI (11.3%), thereby making it an ideal screening test for diabetes.

Conclusion

Toe Brachial Index is a more Sensitive & Accurate diagnostic modality when compared to Ankle Brachial Pulse Index for the diagnosis of PVD in patients with diabetes and is therefore a better screening tool for the diagnosis of PVD in diabetics.

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