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Assessment of risk factors causing peripheral arterial disease with the use of ankle brachial pressure index in asymptomatic patients

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Abstract
Background: Peripheral arterial diseases (PAD) are trigged by various risk factors. The present study aims to assess the various risk factors causing peripheral arterial disease with the use of ankle brachial pressure index in asymptomatic patients.
Materials and Methods: This prospective study was done in the department of General Surgery, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Tamil Nadu for one year. Total 377 patients were included in the study. All the patients were explained the study procedure and informed consent was obtained. Demographic and clinical data were recorded. Systolic Blood pressure of both arms were measured using sphygmomanometer and hand held Doppler. SBP of posterior Tibial artery at the ankle of both lower limbs was detected using the sphygmomanometer and hand held Doppler. ABPI is detected by dividing higher of the two ankle pressures by the higher of the two brachial artery pressure. The data was expressed in number, percentage, mean and standard deviation. Based on the ABPI risk factors were assessed.
Results: Maximum number of patients were aged between 60-69 years. Males more than females. It was observed that diabetes, hypertension, smoking and dyslipidemia patients have ABPI score less than 0.9 compared to other patients.
Conclusion: Patients with history of smoking, hypertension, diabetes and dyslipidemia can easily develop the peripheral arterial disease.

Keywords: Ankle brachial index, hypertension, diabetes, smoking, dyslipidemia, systolic blood pressure

Introduction
Peripheral arterial disease (PAD) is one of the leading cause of morbidity and mortality in the world. PAD results in impaired quality of life and it will increase the burden of health care system [1, 2]. PAD causes significant disability and loss of function. As the atherosclerosis process continues it will lead to complications like myocardial infarction and cerebrovascular attacks. Peripheral vascular disease is asymptomatic in about 40% [3]. Ankle brachial index is an efficient method of diagnosing presence and severity of PAD [4]. ABI showed 95% of sensitivity with 100% specificity for the detection of PAD in asymptomatic patients. More than 1 is considered normal ABI. Patients have less than 0.9 ABI indicates significant, although perhaps asymptomatic, underlying peripheral vascular disease. Patients with claudication typically have an ABI in the 0.5 to 0.7 range, and those with rest pain are in the 0.3 to 0.5 range [5, 6]. Those with gangrene have an ABI of <0.3. Hence ABI a very useful bedside test before invasive investigations, to estimate fairly the clinical prognosis of the patient. People with history of smoking, hypertension, diabetes and abnormal lipid profile are prone to develop the peripheral arterial diseases due to reduced ABI [7]. The present study is aimed to assess the risk factors that induce peripheral arterial disease using Ankle brachial index.

Materials and Methods
Study settings
The study was done in the Department of General Surgery, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Kanyakumari (Dist), Tamil Nadu. The study period is March 2016-2017.

Inclusion criteria

- Patients age above 30 years
- Males and females
- Patients do not have any symptoms of PVD during the study period
- Who are willing to sign on informed consent form

Exclusion criteria

- Patients already diagnosed with PVD
- Pregnancy
- Patients less than 30 years
- Undergone recent vascular surgery

Procedure

This study included 377 patients based on the inclusion and exclusion criteria. All the patients demographic, co-morbid and clinical data were obtained after signing the informed consent form. Study population was subjected to estimation of ankle brachial pressure index

Measurement of Ankle Brachial Index (ABI)

ABI was made in the supine position after 5 min of rest. A pneumatic cuff was placed around the ankle and the pressure was measured at both the dorsalispedis and posterior tibial arteries using a hand-held continuous-wave Doppler probe. The same technique was also used in both arms for measuring brachial artery pressure. The higher of the two ankle pressures is divided by the higher of the brachial artery pressure. In subjects with normal lower limb arterial circulation, the systolic pressure at the ankle is usually 10-15 mmHg higher than that recorded from the arm because of pulse wave velocity, resulting in an ABI >1.10. Major international medical societies recommend calculating the ABI by dividing the highest pressure in the leg by the highest pressure in the arm [8-10].

Statistical analysis

The data was expressed in number, percentage, mean and standard deviation. Statistical Package for Social Sciences (SPSS) trial version 20.0 was used for analysis, Chi-square and Kruskul Wallis test used for analysis. P value less than 0.05 ($p< 0.05$) considered statically significant at 95% confidence interval.

Results

Maximum number of patients were between 60-69 years (n=100) and minimum is 80-89 years (n=3). 57.03% patients were males and 42.97% was females (Table-1). 236 were non-smokers and 141 were smokers. 190 patients have diabetes, 148 patients have hypertension and 128 have dyslipidemia. Smoking, hypertension and dyslipidemia showed significant ($p< 0.05$) differences compared yes number with no (Table-2). 0.74 was minimum, 1.08 was maximum with 0.93 mean are the ABI of the study population. It was observed that 142 (37.70%) patients have ABI less than 0.9 which showed significant ($p< 0.05$) difference with more or equal to 0.9 number 235 (62.30) (Table-3). Maximum number of males (103) showed ABI index less than 0.9 compared to females (39) (Table-4). 58.90% smokers showed the ABI index less than 0.9 compared to more or equal to 0.9 (41.10%). It is highly significant difference with p value less than 0.001 (Graph-1). In the study 148 were hypertensive patients, in that 70 patients showed ABI less than 0.9 which is significant ($p< 0.05$) (Graph-2). Out of 190 diabetes patients 119 showed ABI less than 0.9 compared to others. The difference between ABI between less than 0.9 and more or equal to 0.9 is significant (0.01) (Graph-3). 128 patients are suffering with dyslipidemia. 59 patients showed ABI less than 0.9 others have more or equal to 0.9 (69) the difference is significant ($p< 0.02$) (Graph-4).

Discussion

This study was done to measure the Ankle- Brachial Index (ABI) screening for peripheral vascular disease in asymptomatic patients coming to the General surgery OPD at Sree Mookambika Institute of Medical sciences (SMIMS) and to identify the associated risk factors in PAD. In the study, out of the 377 patients studied majority of the patients were found to be male 215 (57%). Females 162 (43%). In our study, gender was found to be a significant risk factor for PAD. It can be observed that amongst the 215 males, 103 males had an ABI of less than 0.9 which had a statistical significance of 0.001. Studies by de Vinuesa *et al.* [11]., and Guerrero *et al.* [12], showed an increased prevalence of PVD in males, which co-relates to our study. Mostaza *et al.*, [13] found an increased prevalence in females. The HEMO [14] study does not find a significant statistical association between male sex and prevalence of PAD. The studies by Rantanen T *et al.* [15], showed a five- fold increase in the risk of PAD among patients with a history of smoking. The HEMO study found that smoking was associated with peripheral vascular disease among patients. Studies by Gurrero *et al.* also revealed that a previous clinical record of diabetes increased the risk of developing PAD. Mohan *et al.* found out that the prevalence of PAD in diabetes increases with the duration of diabetes, wherein the prevalence of PAD in diabetics was 2% at diagnosis and 4% at 10 years duration and 8% at 20 years duration. The incidence of PAD in the hypertensive population in the ARIC study was 43%. This disagrees with the HEMO study wherein hypertension was not an independent risk factor for PAD in patients with decreased ABI. The Edinburgh artery study reported a higher prevalence of PVD in association, with higher serum cholesterol and lower HDL cholesterol in multiple logistic regression analysis. The cardiovascular health study reached similar conclusions among its sample of 5084 subjects aged 65 years or older with PVD defined as an, ABI less than 0.9 [16]. In this study it was observed that patients with co-morbid conditions showed ABI less than 0.9 compared to others.

Table 1: Demographic data of the study population

Demographic data	Number	Percentage (%)
Age (Years)		
30-39	17	04.50
40-49	99	26.30
50-59	99	26.30
60-69	100	26.50
70-79	59	15.60
80-89	3	0.80
Gender		
Male	215	57.03
Female	162	42.97

Table 2: Distribution of patients based on the co-morbid conditions

Co-morbid condition	Yes		No	
	Number	Percentage (%)	Number	Percentage (%)
Smoking	141	37.40	236*	62.60
Diabetes mellitus	190	50.40	187	49.60
Hypertension	148	39.30	229*	60.70
Dyslipidemia	128	34.00	249*	66.00

(*$p< 0.05$ significant compared yes with no)

Table 3: Distribution of patients according to ankle brachial index

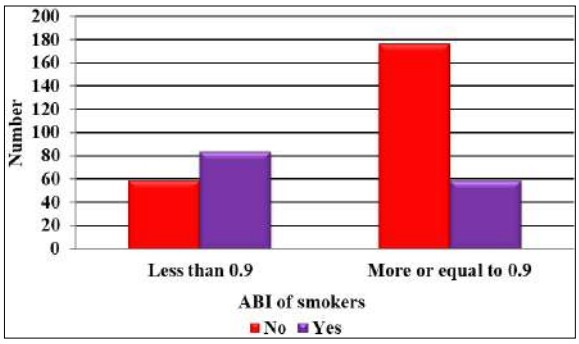
Ankle branchial index	Value	
Minimum	0.74	
Maximum	1.08	
Mean	0.93	
Standard deviation	0.09	
Less than 0.9	142	37.70%
More or equal to 0.9	235*	62.30%*

(*p< 0.05 significant compared less than 0.9 with more or equal to 0.9)

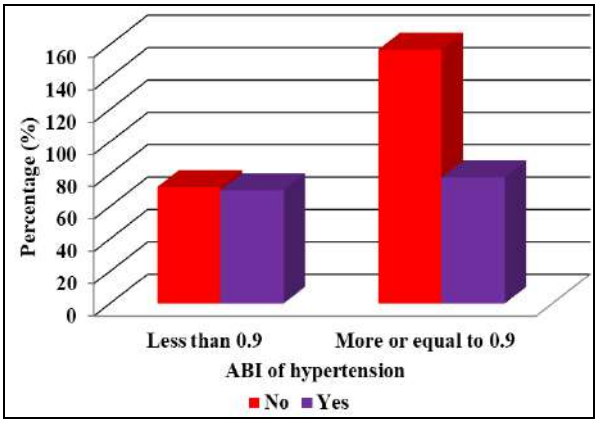
Table 4: Distribution of patients based on the ankle brachial index based on the gender

Gender	Ankle brachial index			
	Less than 0.9		More or equal to 0.9	
	Number	Percentage (%)	Number	Percentage (%)
Male	103	47.90	112*	52.10
Female	39#	24.10	123*,#	75.90

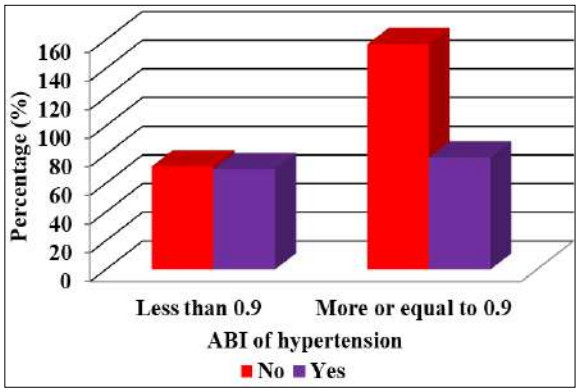
(*p< 0.05 significant compared between the less than 0.9 with more or equal to 0.9,
#p< 0.05 significant compared male with female)



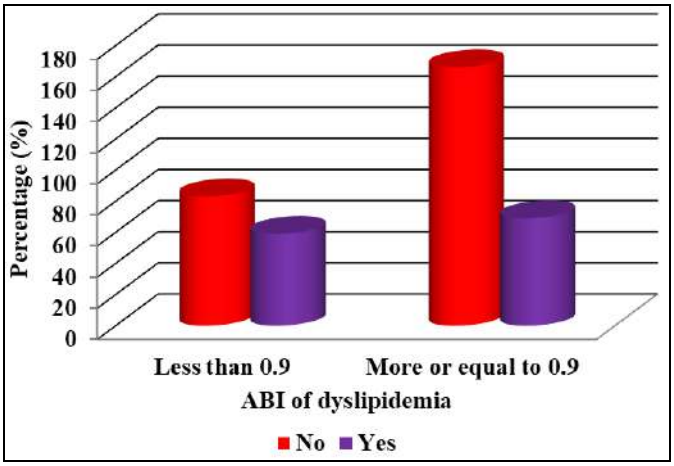
Graph 1: Distribution of patients based on the ankle brachial index by smoking



Graph 2: Distribution of patients based on the ankle brachial index by hypertension



Graph 3: Distribution of patients based on the ankle brachial index by diabetes



Graph 4: Distribution of patients based on the ankle brachial index by dyslipidemia

Conclusion

The study results concluded that co-morbid conditions like smoking, diabetes, hypertension and dyslipidemia increase the risk of peripheral arterial disease. Prevention of co-morbid disease progression will reduce the risk to develop the peripheral arterial disease.

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