ORIGINAL ARTICLE

ROLE OF ANKLE BRACHIAL INDEX IN THE DIAGNOSIS OF PERIPHERAL ARTERIAL DISEASE

Muhammad Ishaq, Ghulam Jillani Khan, Sibgha Zulfiqar

Department of Physiology, Bannu Medical College, Bannu, Khyber Medical College, Peshawar and Shaikh Zayed, Federal Postgraduate Medical Institute, Lahore, Pakistan

ABSTRACT

Background: Peripheral arterial disease is common in diabetics. Its early diagnosis is crucial to minimize the associated risks. The objective of this study was to evaluate the role of ankle brachial index in the diagnosis of peripheral arterial disease in type 2 diabetics. **Methods:** A total of 150 type 2 diabetes mellitus patients were divided into two groups of complicated and uncomplicated with 75 patients in each category. Blood pressure of both arms and ankles were recorded for calculation of ABI and blood samples collected for blood sugar and HbA_{1C} on first day and after a night fast for blood sugar, cholesterol and triglycerides on another day. Height and weight were determined for calculation of body mass index. **Results:** Applying the ABI to both groups, 12 patients were diagnosed having PAD in uncomplicated group while 22 in complicated group with PAD. The numbers of patients in complicated group with PAD were almost double as that of uncomplicated group which signifies that patients of type 2 diabetes mellitus with complications are more prone to develop PAD than those without complications. **Conclusion:** Ankle brachial index can be effectively used for detection and evaluation of PAD in primary care clinics to anticipate and reduce the risk of vascular events in future.

KEY WORDS: Ankle Brachial Index, Peripheral arterial disease, Type 2 diabetes mellitus.

INTRODUCTION

Peripheral Arterial Disease (PAD) is a highly prevalent atherosclerotic syndrome that affects approximately 8-12 million individual in the USA and is associated with significant morbidity and mortality.[1-5] The disease was designated "arteriosclerosis obliterans" by the WHO in 1958 and defined as accumulation in the intima of arteries of the focal of lipid, carbohydrate, blood products, fibrous tissue and calcium and associated with medial changes that produce obstruction to blood flow. Patient with peripheral atherosclerosis may be asymptomatic or present with intermittent claudication, ischemic pain or gangrene.[6,7]

The clinical diagnosis of atherosclerotic involvement of one or more arterial segments in the limbs is usually detected by ankle brachial systolic blood pressure ratio, the ABI (normal value 0.9-1.3) and approximately 10% of diabetic individuals over the age of 75 years have symptomatic PAD (ABI<0.9), 5% have intermittent claudication and 1% have critical leg ischemia.[8,9] Disease progression occurs more frequently in diabetics and in patient who smoke tobacco.[10,11]

The ankle brachial index (ABI), a non-invasive laboratory diagnosis of PAD, provides a higher estimate of disease prevalence, since it has a high sensitivity for detecting angiographically defined peripheral arterial occlusive disease.[12-14] A low ankle brachial index (ABI) is highly predictive not only of the presence of peripheral arterial occlusive disease but also of subsequent cardiovascular mortality.[15-17] PAD is a strong age dependent condition that contributes significantly to morbidity and health care expenditure in the elderly. Symptomatic disease directly affects functional capacity and quality of life by restricting ambulation, whereas, asymptomatic disease is also important because it may increase the risk of future compromised ambulation.[18] Therefore, an early diagnosis of the disease is crucial to minimize the risks associated with the disease.

The present study was designed with the objective to evaluate the role of ABI in the diagnosis of PAD in type 2 diabetes mellitus patients.

MATERIAL AND METHODS

This cross-sectional descriptive study was conducted at Department of Physiology, Shaikh Zayed Federal Post-graduate Medical Institute, Lahore, from 2008 to 2010. A total of 150 subjects with age $\geq$40 years were selected from the Diabetic Clinic, Cardiology Unit and Biochemistry Department of the Institute. The subjects were divided into uncomplicated and complicated type 2 diabetes mellitus patients on the basis of the presence or absence of microalbuminuria. Patients on

insulin therapy, with severe systemic disease or having major surgery in the past 3 months were excluded from the study. After approval from ethical committee, the patient's consent was obtained from each patient. The blood pressure at both arms and both ankles of each patient was recorded with the help of an ordinary sphygmomanometer. The higher of the two systolic pressures of each leg was divided by the higher of the two arm pressures to get the right and left ABI. The weight was recorded in light clothes without shoes, and body mass index was calculated. Blood samples were collected at two occasions i.e. on day one for random blood sugar and glycosylated hemoglobin (HbA_{1C}) and after a night fast for determination of blood sugar, cholesterol and triglycerides.

The data was analyzed on SPSS version 16.0 for statistical calculations.

RESULTS

The age distribution of patients and results of the study are summarized in Table 1 & 2.

The data shows that when ABI was applied to uncomplicated group, 5 (6.67%) patients were having ABI < 0.9 and 12 (16.0%) > 1.3, in diagnosed patients of PAD while the rest, 58 (77.33 %) patients having ABI within normal range (0.9-1.3), were without PAD. When the mean ABI value of patients with ABI < 0.9 were compared with the mean ABI value of patients having ABI within normal range, the difference was highly significant statistically.

However, when ABI was applied to complicated group, 9 (12%) patients having ABI < 0.9 and 14 patients (16%) having ABI > 1.3, were diagnosed patients of PAD while the rest, 52 patients (69.33%) had ABI within the normal range (0.9-1.3), were without PAD. When the mean ABI value of patients with ABI < 0.9 were compared with the mean ABI value of patients having ABI within normal range, the difference was not significant statistically. But when the mean ABI value of patients with ABI > 1.3 were compared with the mean ABI value of patients with ABI within normal range, the difference was highly significant statistically.

DISCUSSION

Peripheral arterial disease is a common manifestation of atherosclerosis present in at least 25% of individuals over the age of 70 years.[19] Due to the risk for major coronary events, there always has been a need to adopt a means which is simple, cheap and less laborious to early establish the diagnosis of the disease.[20] The present study revealed that the risk of developing PAD in type 2 diabetes mellitus patients both in males and females in Lahore Pakistan is existing with severity but it was also discovered that the patients of type 2 diabetes mellitus with complications are more prone to develop the disease as compared to those without complications.

Advancing age is another risk factor in epidemiological studies. Although it was not the main objective of the study but the study revealed that

Table 1: Age distribution of patients.

Age (years)	Group A (n = 75)		Group B (n = 75)	
	Number	Percentage	Number	Percentage
40 – 50	41	54.67	30	40
51 – 60	18	24	23	30.67
61 – 70	10	13.33	18	24
71 – 80	6	8	4	5.33

Table-2: Association of ABI with both groups of type 2 diabetes mellitus.

Groups	Without PAD	Having PAD	
	ABI range = 0.9-1.3	ABI range <0.9	ABI range >1.3
Uncomplicated Group (n= 75)	58 (77.33%) Mean ABI=1.08	5 (6.67%) Mean ABI=0.86	12 (16%) Mean ABI=1.75
Complicated Group (n= 75)	52 (69.33%) Mean ABI=1.07	9 (12%) Mean ABI=0.84	14 (18.67%) Mean ABI=1.60
Total	110	14	26

correlation existed between ABI and age which is an indicator that people with advanced age are likely to develop the peripheral arterial disease (PAD). This fact of the study is also in line with the cardiovascular health study which suggest the lower extremities arterial disease.[21]

Risk factors of PAD include physical inactivity, family history of premature coronary heart disease (CHD), socioeconomic status, mental depression, ethnicity and physical features e.g. obesity etc. Diabetes mellitus may accelerate atherosclerosis and portend a pattern of intra popliteal artery occlusive disease. The patho-physiology of diabetic vascular disease in the extremities is complex affecting large conduit vessels, micro vessels and skeletal muscles.[22]

Peripheral vascular disease (PVD) is a risk marker for coronary disease, cerebrovascular disease, aneursymal disease, diabetes, hypertension and many other conditions. PVD have a four to six fold increase in cardiovascular mortality over healthy age matched individuals. The ABI helps to define the severity of the disease and successfully screen for hemodynamically significant disease.[23] Our study suggests that ABI is more effective in the diagnosis of PAD in patients with uncomplicated diabetes mellitus in the range ABI < 0.9 but more effective in patients with complicated diabetes mellitus in the range ABI > 1.3.

It has been reported that the presentations of PAD dramatically increase with advancing age in both sexes If the risk remains stable, an estimated seven million individual of age 40 years and over will have PAD by years 2022.[24] We also found similar findings in our study .Our study results are further strengthened by Framingham Heart Study. The frequency of low ABI is 32% and symptoms of intermittent claudication is 3.3%. The patho-physiology of vascular disease in diabetes is complex and affects the distal and small vessels.[25]

Our study indicated no association with gender which is in line with the result of cardio vascular health study and cardio vascular heart study which suggest that risk factor association with ABI is similar in men and women[26] Our results are further strengthened by the result of Edinburgh artery study which showed association with diabetes, systolic hypertension and cholesterol. The result further provide strong support from the study of Sharoneason which suggest that risk factor associated with PAD are diabetes mellitus, hypertension, older age and dyslipidemia . Walter found 23.5% prevalence of PAD among patient of type 2 diabetes.[27,28]

As, ABI has shown strong association with PAD but, however the diagnosis of PAD solely through ABI has some limitations as well. A study demonstrated that nearly half of patients referred to the outpatient vascular laboratory because of suspected arterial disease had a normal resting ABI.[29] We agree with these findings and also suggest that under suspected circumstances other measures must be incorporated to confirm the diagnosis but we also recommend that under the scenario of our primary care units this method is probably the best one not only to diagnose the disease early but also to minimize the labor and expenses in adopting other measures for diagnosis of this ailment.

Although the data was small but the numbers of patients with PAD in complicated group (both in ABI below or above normal range patients) were more than in uncomplicated group which signifies that the patients of type 2 diabetes mellitus with complications are more prone to develop PAD than patients of type 2 diabetes mellitus without complications.

CONCLUSION

On the basis of this study we suggest that ABI can be effectively used for detection and evaluation of PAD in routine examination in primary care clinics to anticipate and reduce the risk of vascular anomalies in future.

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Corresponding author:

Dr. Muhammad Ishaq

Assistant Professor

Physiology Department

Bannu Medical College

Bannu, Pakistan

E-mail: ishaqdoct@gmail.com