Original Article

The Possible Relationship Between Ankle Brachial Index and Microalbuminuria in Patients with Type 2 Diabetes Mellitus; A Cross-Sectional Study Conducted in Peshawar Pakistan

Baghdad khan[1], Redha Shahjehan[1], Nizamuddin[2], Gul Hasssan[3], Amjad Mustafa[4] and Shamaila Zahid[5]

ABSTRACT

Objective: To determine the possible relationship between ankle-brachial index and microalbuminuria, in patients with Type-2 DM.

Study Design: Cross-sectional study

Place and Duration of Study: This study was conducted at the Medicine Department of a Tertiary Care Hospital (Khyber Teaching Hospital) Peshawar from January 2018 to July 2018.

Materials and Methods: In this study total 69 patients with a history of type 2 diabetes mellitus (T2DM), with microalbuminuria (urine albumin 30 to 300 milligram/24 hours) were enrolled from 20-01-2018 to 20-07-2018. All peripheral pulses were palpated. Sphygmomanometer cuff was used to measure the systolic blood pressure by wrapping the cuff around each of the two ankles and arms respectively. This was done after a 10-minute rest in lying position. The ankle-brachial index was calculated as highest ankle systolic pressure divided by highest brachial systolic pressure in each patient.

Results: Among 69 patients, 29 (42%) patients were in age group 41-50 years while 40 (58%) patients were in age group 51-60 years. Mean age was 58 ± 3.78 years. Among them, 32 (46%) were male and 37 (54%) were female. among 69 patients, ankle-brachial index was analyzed, showing as 7 (10%) patients had ankle-brachial index range >1.4, 47 (68%) patients had ankle-brachial index range 0.9 -1.4 and 15 (22%) patients had ankle-brachial index range 0.4-0.9. Mean ankle-brachial index was 1.1 SD ± 0.2. Microalbuminuria among 69 patients was analyzed as 26 (38%) patients had microalbuminuria range 1-30 mg while 43 (62%) patients had microalbuminuria range 30-300 mg. Mean microalbuminuria was 150 mg ± 8.32.

Conclusion: Our study concludes that there is a strong correlation of ankle-brachial index and microalbuminuria in patients presenting with type 2 diabetes mellitus.

Key Words: Ankle-brachial index, microalbuminuria, type 2 diabetes mellitus

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INTRODUCTION

Diabetes Mellitus (DM) is one the major endocrine disorder historically known. In 2017, the total population suffering from DM was 414.9 million, while in Pakistan, according to a survey conducted in 2018, reported the known prevalence of diabetes to be 23.6%[1] which was previously reported in a range between 7.6% to 11% among adults[2].

DM leads to micro and macro vascular complications that badly affect the overall quality of life of the suffered patients. DM is one of the strongest risk factors in cardiovascular disorders, renal, liver, eye, dementia, Alzheimer and many others.[3]

In diabetic nephropathy, Microalbuminuria is the 1st clinical sign. The prevalence of microalbuminuria, as per literature review is 20% to 25% in both newly diagnosed as well as in established patients with DM. Albumin 30 to 300 milligram per 24 hours urine collection is defined as microalbuminuria[4,5]. DM is also one of the risk factors in the development of

1. Department of Medicine, Khyber Teaching Hospital, Peshawar.
2. Department of Pharmacology, Khyber Medical College, Peshawar.
3. Department of Pharmacology, Kabir Medical College Peshawar.
4. Department of Pharmacology, KMU Institute of Medical Sciences Kohat.
5. Department of Pharmacy, Northwest General Hospital and Research Center, Peshawar.

Correspondence: Dr Nizamuddin, Assistant Professor of pharmacology, Khyber Medical College Peshawar.
Contact No: 0300-5909433
Email: drnizam99@yahoo.com

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atherosclerosis, which leads to peripheral arterial disease and ultimately the cardiovascular disease risk upsurges. The prevalence of atherosclerosis ranges from 9.5% to 13.6% in patients with DM. It is also known that early detection of peripheral arterial disease (PAD), can the complications related to PAD might me controlled[4]. Compared to angiography, the ankle-brachial index (ABI) is very simple and cost effective technique[6]. It is 95% sensitive and 99% specific against angiography confirmed PAD[2]. Endothelial dysfunction can be assessed by both ankle-brachial index and microalbuminuria[7,8]. ABI was classified as non-compressible, calcified vessel with ABI more than 1.3, normal with ABI of 0.9 to 1.3[7], mild to moderate peripheral arterial disease with ABI between 0.41 to 0.9 and critical leg ischemia with ABI less than 0.4[9-11].

The aim of our study is to evaluate the value of ABI in the prediction of microalbuminuria in type 2 diabetics. ABI is non-invasive early detection of renal, peripheral and cardiovascular complications in diabetic patient. By early detection, the renal, peripheral and cardiovascular events could also be prevented. This study will provide us with the new and rapid local method which we can use for diagnosing the type 2 diabetes mellitus and the results of this study will be projected to other local healthcare professionals so that further research and future guidelines can be generated.

MATERIALS AND METHODS

To meet the objective of the study, a cross sectional study was designed and conducted in the department of medicine, Khyber Teaching Hospital, Peshawar. The duration of the study was six months starting from 20/1/2018 to 20/7/2018.

Data collection procedure: Sample size was 69, using 0.38 correlation coefficient, 95% confidence level and 90% power of test. Non-probability (consecutive) sampling. According to WHO formula for sample size calculation. Permission from ethical committee was taken. Recruitment was done after obtaining informed written consent. Data on age, sex, history of cardiovascular or cerebral accidents or pelvic malignancies. Patient who was diagnosed as diabetic by having fasting blood glucose greater than 126mg/dl while random blood glucose greater than 200mg/dl by laboratory tests. Once appropriate patient found than his microalbuminuria with albumin of 30 to 300 milligram/24hrs. urine collection was obtained. All peripheral pulses were palpated. Sphygmomanometer cuff was used to measure the systolic blood pressure by wrapping the cuff around each of the two ankles and arms respectively. This was done after a 10-minute rest in lying position. The ankle-brachial index was calculated as "the highest ankle systolic pressure divided by highest brachial systolic pressure in each patient". Strict exclusion criteria were followed to control all the confounder and make the study results fair.

Data Analysis: The data was analyzed using SPSS version 22. Descriptive statistics was applied on demographics of the patients. The Pearson Correlation coefficient (r) was calculated formally between microalbuminuria and ankle-brachial index. Effect modifiers like age, gender was addressed through stratification. Post stratification Pearson coefficient correlation (r) was calculated.

RESULTS

This study enrolls total 69 patients. Twenty-nine (42%) patients were in the age ranged 41-50 years and 40 (58%) patients were in age ranged 51-60 years. The mean age was 58 ± 3.78 years. In our study, 32(46%) patients were male while 37(54%) patients were female. All the values are summarized in table 1.

Table 2 summarizes the frequencies and percentages of patient's ankle-brachial index. 7 (10%) patients had ankle-brachial index range >1.4, 47(68%) patients had ankle-brachial index range 0.9 -1.4 and 15(22%) patients had ankle-brachial index range 0.4- 0.9. Mean ankle-brachial index was 1.1 SD ± 0.2.

The frequencies and percentages of microalbuminuria among study patients is given in table 3 in which 26(38%) patients had microalbuminuria range 1-30 mg while 43(62%) patients had microalbuminuria range 30-300 mg. Mean microalbuminuria was 150 mg ± 8.32.

Pearson correlation was applied to find any statistical correlation, present between ankle brachial index and microalbuminuria and other related parameters. The results of all these parameters are summed in table 4 below.

Table No. 1: Characteristics of study population

Variable	Category	Frequency	Percentage
Age (years)	41-50	29	42%
	51-60	40	58%
	Total	69	100%
Gender	Male	32	46%
	Female	37	54%
	Total	69	100%

Table No.2: Distribution of ankle brachial index

Ankle-brachial index	Frequency	Percentage
> 1.4	7	10%
0.9 to 1.4	47	68%
0. 4 – 0.9	15	22%
Total	69	100%

Mean ankle-brachial index was 1.1 with SD ± 0.2

Table No.3: Microalbuminuria in study patients (n=69)

Microalbuminuria	Frequency	Percentage
≤ 1- 30 mg	26	38%
> 30-300% mg	43	62%
Total	69	100%

Mean microalbuminuria was 150 mg ± 8.32

Table No.4: Correlation of ankle brachial index and microalbuminuria with different parameters

Variables	Mean ± SD	R	Correlation
Ankle-brachial index	1.1 ± 0.2	0.35	positive
Microalbuminuria	150 ± 8.32 mg		
Age group (41-50 years) (n=29)			
Ankle-brachial index	1.0 ± 0.3	0.33	positive
Microalbuminuria	148 ± 8.02 mg		
Age group (51-60 years) (n=40)			
Ankle-brachial index	1.1 ± 0.2	0.36	positive
Microalbuminuria	152 ± 8.78 mg		
Gender (males) (n=32)			
Ankle-brachial index	1.1 ± 0.1	0.34	positive
Microalbuminuria	156 ± 8.89 mg		
Gender (females) (n=37)			
Ankle-brachial index	1.1± 0.2	0.34	positive
Microalbuminuria	154 ± 8.71mg		

DISCUSSION

The finding in our study shows that mean age among the patient studied was 58 ± 3.78 years. Forty six percent patients were male and 54% patients were female. Mean ABI was 1.1 SD ± 0.2. Mean microalbuminuria was 150 mg ± 8.32. Furthermore, 22% of our study population was presented with ABI <0.9. Similar studies was also done in the past in which Resnick and colleagues reported an ABI <0.9 in 4.9% of their patients[12] and Li and coworkers reported it in 32.2% of their participants[13]. The lower average of patients' ABI in this study compared with the higher average ABI in the similar studies is due to selecting patients. In the current study, the average number of patients in all three groups of ABI was approximately the same and with incidental adjustment, the biasing variant of age was omitted, which was not done in other studies. Therefore, the rate of abnormal ABI calculated in this study has a better predictive value.

There was a significant positive correlation between ABI and microalbuminuria (r= 0.35). Our findings was similar to a study done by Makhdoomi K[14] reported strong correlation between ABI with duration of disease, cardiovascular events and admission of patient in cardiac care units.

Conflicting results have been published reporting the effect of gender on ABI, some researchers reported no association while other reported positive correlation. The study conducted by Tseng and colleagues[15] and Polenova and colleagues[16] reported no significant association between gender and ABI. However, in our study we found positive correlation with gender and ABI which is in consistent with the study conducted by Li and associates, where they found significant correlation between an ABI less than 0.9 and female gender[17].

We did not correlate, the significance of ABI with obesity, smoking and/or cardiovascular diseases which is the limitation of our study. However, studies have been conducted in the past of the stated factors. There were studies that did not find any correlation between obesity and ABI <0.9[13,15]. This implies that obesity may not be a risk factor for atherosclerosis. In the studies conducted by Khammash and colleagues[17] and some other studies[13,16] the comparison was between being smoker or not, without regarding the amount of pack year use, which showed significant correlation with abnormal ABI, reported the role of smoking and ABI. In a study conducted by Rafie and colleagues[18], the abnormal ABI was significantly associated with positive exercise test. Similarly, another study reported by Nematipoor and colleagues[19] showed that patients with ABI <0.9 had coronary vessel disease. Furthermore, the ABI decreases with large number of vessel involvement.

CONCLUSION

In our study ABI was significantly correlated with microalbuminuria in patients with DM. Our study needs to be reconfirmed in high cohort of patients to further strengthen our findings.

Author's Contribution:

Concept & Design of Study:	Baghdad Khan
Drafting:	Redha Shahjehan, Nizamuddin
Data Analysis:	Gul Hasssan, Amjad Mustafa, Shamaila Zahid
Revisiting Critically:	Redha Shahjehan, Nizamuddin
Final Approval of version:	Baghdad Khan

Conflict of Interest: The study has no conflict of interest to declare by any author.

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