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Research Article

STUDY TO KNOW THE ASSOCIATION BETWEEN ANKLE BRACHIAL INDEX AND MICRO-ALBUMINURIA IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

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Abstract:

Objective: Diabetes Mellitus (DM) is one the major endocrine disorder historically known. DM leads to micro and macro vascular complications that badly affect the overall quality of life of the suffered patients. Aim of this study was to determine the possible relationship between ankle-brachial index and micro-albuminuria, in patients with Type-2 DM.

Study Design: This was a Cross-sectional study

Place and Duration of Study: This study was conducted at the Medicine Department of a Jinnah Hospital Lahore for the duration of six months from January 2020 to July 2020.

Materials and Methods: In this study total 69 patients with a history of type 2 diabetes mellitus (T2DM), with micro-albuminuria (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 $1.1 \text{ SD} \pm 0.2$. Micro-albuminuria among 69 patients was analyzed as 26 (38%) patients had micro-albuminuria range 1-30 mg while 43 (62%) patients had micro-albuminuria range 30-300 mg. Mean micro-albuminuria was $150 \text{ mg} \pm 8.32$.

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

Key Words: Ankle-brachial index, micro-albuminuria, 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 adults². 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 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 be controlled⁴. Compared to angiography, the ankle-brachial index (ABI) is very simple and cost effective technique⁶. It is 95% sensitive and 99% specific against angiography confirmed PAD². 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 1.3⁷, mild to moderate peripheral arterial disease with ABI between 0.41 to 0.9 and critical leg ischemia with ABI less than 0.4⁹⁻¹¹.

The aim of our study is to evaluate the value of ABI in the prediction of micro-albuminuria 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:

This study was conducted at the Medicine Department of a Jinnah Hospital Lahore for the duration of six months from January 2020 to July 2020.

Data collection procedure:

Sample size was 69, using 0.38 correlation coefficient, 95% confidence level and 90% power of test. Non-probability (consecutive) sampling technique was used in this study 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 and history of cardiovascular or cerebral accidents or pelvic malignancies was collected. 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 micro-albuminuria 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 micro-albuminuria 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 $1.1 \text{ SD} \pm 0.2$.

The frequencies and percentages of micro-albuminuria among study patients is given in table 3

in which 26(38%) patients had micro-albuminuria range 1-30 mg while 43(62%) patients had micro-albuminuria range 30-300 mg. Mean micro-albuminuria was 150 mg \pm 8.32. Pearson correlation was applied to find any statistical

correlation, present between ankle brachial index and micro-albuminuria 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 \pm 0.2

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

Micro-albuminuria	Frequency	Percentage
\leq 1- 30 mg	26	38%
> 30-300% mg	43	62%
Total	69	100%

Mean micro-albuminuria was 150 mg \pm 8.32

Table No.4: Correlation of ankle brachial index and micro-albuminuria with different parameters

Variables	Mean \pm SD	R	Correlation
Ankle-brachial index	1.1 \pm 0.2	0.35	positive
Micro-albuminuria	150 \pm 8.32 mg		
Age group (41-50 years) (n=29)			
Ankle-brachial index	1.0 \pm 0.3	0.33	positive
Micro-albuminuria	148 \pm 8.02 mg		
Age group (51-60 years) (n=40)			
Ankle-brachial index	1.1 \pm 0.2	0.36	positive
Micro-albuminuria	152 \pm 8.78 mg		
Gender (males) (n=32)			
Ankle-brachial index	1.1 \pm 0.1	0.34	positive
Micro-albuminuria	156 \pm 8.89 mg		
Gender (females) (n=37)			
Ankle-brachial index	1.1 \pm 0.2	0.34	positive
Micro-albuminuria	154 \pm 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 $1.1 \text{ SD} \pm 0.2$. Mean micro-albuminuria was $150 \text{ mg} \pm 8.32$. 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 patients¹² and Li and coworkers reported it in 32.2% of their participants¹³. 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 micro-albuminuria ($r= 0.35$). Our finding 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 colleagues¹⁵ and Polenova and colleagues¹⁶ 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 gender¹⁷.

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 colleagues¹⁷ 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 colleagues¹⁸, the abnormal ABI was significantly associated with positive exercise test. Similarly, another study reported by Nematipoor and colleagues¹⁹ 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 micro-albuminuria in patients with DM. Our study needs to be reconfirmed in high cohort of patients to further strengthen our findings.

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