RESEARCH ARTICLE

COMPARATIVE STUDY OF ANKLE BRACHIAL INDEX IN CONTROLLED AND UNCONTROLLED DIABETICS

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ABSTRACT

Background: Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both. Macro-vascular complications include cerebro-vascular disease, ischemic heart disease and Peripheral arterial disease. Peripheral arterial disease (PAD) is a disorder characterized by decreased blood flow to the limbs, due to an obstruction or narrowing of the vessels tributaries. The ankle brachial index (ABI) is the accepted non-invasive gold standard for both diagnosing PAD and the assessment of disease severity. Objective: To compare Ankle Brachial Index in controlled vs. uncontrolled diabetics. Methods: 23 patients (Age: 55 ± 5.4 years) in controlled group and 30 patients (Age: 56 ± 4 years) in uncontrolled group were chosen by nonrandomized convenient sampling and divided according to their HbA1c. Ankle-brachial index was measured using hand-held Doppler DS80 and sphygmomanometer. Results: The mean ABI of controlled group and uncontrolled group is 1.05 ± 0.13 and 1.02 ± 0.12 respectively. There is no significant difference of ABI in ABI of controlled diabetics and uncontrolled diabetics.

Key words: Diabetes mellitus, Peripheral Arterial Disease, Ankle Brachial Index, Hand held Doppler.

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INTRODUCTION

According to International Diabetes federation there were 425 million people having diabetes in the world and there were over 72 million cases of diabetes in India in 2017 (https://www.idf.org/our-network/regions-members/south-east-asia/members/94-india.html). Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both. Several pathogenic processes are involved in the development of diabetes. These range from autoimmune destruction of β-cells of the pancreas with consequent insulin deficiency to abnormalities that result in resistance to insulin action. The complications caused by diabetes can be divided into micro-vascular and macro-vascular complications. Micro-vascular complications include retinopathy, nephropathy and neuropathy and Macro-vascular complications include cerebro-vascular disease, ischemic heart disease and Peripheral arterial disease (Marshall and Flyvbjerg, 2006). Peripheral arterial disease (PAD) is a disorder characterized by decreased blood flow to the limbs, due to an obstruction or narrowing of the vessels tributaries (Stoekenbroek et al., 2015).

Lower extremity PAD ranges in severity from asymptomatic to critical limb ischemia with the tissue loss (Natsuaki et al., 2014). PAD has been widely accepted as the significant risk factor for death and lower limb amputation in diabetes (Xu et al., 2010). PAD has a negative impact on quality of life for people with diabetes and is associated with an increased risk of lower-extremity amputation (Aerden et al., 2011). Glycated hemoglobin (HbA1c) gives an indication of chronic glycemia rather than being a test of glycemia at a single point in time. It gives an integrated index of glycemia over the entire 120 day lifespan of the red blood cell, but within this period of 120 days, recent glycemia has the largest influence on the HbA1c value, with 50% of HbA1c formed in the month prior to sampling and 25% in the month before that. It therefore seems logical that such a test would be appropriate in diagnosing a disease characterized by chronic hyperglycemia and a gradual progression to complications. It is a relatively convenient test, not requiring the patient to fast and only using a single blood sample (Owora, 2018). HbA1c can be used for assessing the risk of complications of diabetes as well as for monitoring glycemic control. The WHO consultation has also concluded that HbA1c can be used to diagnose diabetes (Flykowsi, 2013). The ankle brachial index (ABI) is the accepted non-invasive gold standard for both diagnosing PAD and the assessment of disease severity. The ABI is a reproducible and reasonably accurate, non-invasive measurement for the detection of PAD and the determination of disease severity.

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(Aboyans et al., 2008). The ABI is the most simple and inexpensive test, its reliability is excellent, and the validity in leg arteries is high (sensitivity = 90% and specificity = 98%) (Selvin et al., 2004). The diagnostic criteria for PAD based on the ABI are interpreted as follows (Gerhard-Herman et al., 2016). If the ABI values are known in controlled diabetics and uncontrolled diabetics, then we can aware the people of community and avoid the risk of amputation and secondary complications of PAD. So, the objective of the study was to find out ABI in controlled diabetics, uncontrolled diabetics and compare their values with each other.

MATERIAL AND METHODS

Study Design: Cross sectional study
Study Setting: Hospital & Community setting
Study sampling method: Nonrandom convenient sampling method
Sample size: n = 53 patients of Type II Diabetes Mellitus
Group: 1: 30 = uncontrolled diabetics
Group: 2: 23 = controlled diabetics

Data collection tools
- Handheld Doppler (Minidop)D580 8Mhz calibrated mercury (31 cm long×11 cm wide)
- Sphygmomanometer (Diamond)

Inclusion Criteria
- Both genders
- Age: 40-60 years
- Duration of Diabetes: 5 years or more
- Has done HbA1c test in recent past

Exclusion Criteria
- Foot ulcer
- Presence of any co-morbidities
- Uncooperative patients
- Open injury in hand or foot
- Recent fracture in hand or foot
- Smokers

Procedure

We performed ABI in a quiet, warm environment to prevent vasoconstriction of the arteries. The ABI results were obtained when the patient were relaxed, comfortable. The procedure was explained to the each of the participant and written informed consent was taken. Placement of pressure cuffs and access to pulse sites by Doppler was carried out. Participants were in a supine position. One small pillow was placed behind the patient’s head for comfort. Pressure cuffs was placed approximately 2-3 cm above the cubital fossa on the arms and medial malleolus at the ankle.

We have ensured that the patient had rest for a minimum of 10 minutes prior to the test to allow pressures to normalize. The arm was relaxed and was supported at heart level. The brachial pulse was palpated to determine location to obtain an audible pulse. The tip of the Doppler probe was placed at a 45° angle pointed towards the participant’s head until an audible pulse signal was obtained. The pressure cuff was inflated 20-30 mmHg above the point where the pulse was no longer audible. The pressure cuff was deflated at a rate of 2-3 mmHg per second, reading at which the first pulse signal was heard and have recorded that systolic value. The cuff on the participant’s lower leg was placed approximately 2-3 cm above the medial malleolus. Measurement of both dorsalis pedis and posterior tibial pulses in each leg was done. The pressure cuff was inflated 20-30 mmHg above the point where the pulse was no longer audible. The pressure cuff was deflated at a rate of 2-3 mmHg per second, reading at which the first pulse signal was heard and have recorded that systolic value.

Higher of the right ankle pressure (Dorsalis Pedis / Posterior Tibial)
Right ABI =

Higher arm Pressure (right or left arm)

Higher of the right ankle pressure (Dorsalis Pedis / Posterior Tibial)
Left ABI =

Higher arm Pressure (right or left arm)

The lower of these numbers is the participant’s overall ABI.

Data analysis

Data analysis was done using Microsoft Excel 2007. Demographics were compiled for mean, standard deviation and frequency distribution. Unpaired t test was applied for comparing the ABI results of controlled diabetics with uncontrolled diabetics with level of significance p = 0.05.

RESULTS

Table 1. Diagnostic criteria for pad based on ABI

<table>
<thead>
<tr>
<th>ABI Values</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.91–1.30</td>
<td>Normal</td>
</tr>
<tr>
<td>0.70–0.90</td>
<td>Mild obstruction</td>
</tr>
<tr>
<td>0.40–0.69</td>
<td>Moderate obstruction</td>
</tr>
<tr>
<td>&lt;0.40</td>
<td>Severe obstruction</td>
</tr>
<tr>
<td>&gt;1.30</td>
<td>Poorly compressible</td>
</tr>
</tbody>
</table>

Table 2. AGE Group wise distribution

<table>
<thead>
<tr>
<th>Age Group (in years)</th>
<th>Uncontrolled Diabetics [n (%)]</th>
<th>Controlled Diabetics [n (%)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-45</td>
<td>2(6.67%)</td>
<td>2(8.69%)</td>
</tr>
<tr>
<td>46-50</td>
<td>2(6.67%)</td>
<td>2(8.69%)</td>
</tr>
<tr>
<td>51-55</td>
<td>6(20.01%)</td>
<td>7(30.43%)</td>
</tr>
<tr>
<td>56-60</td>
<td>20(66.67%)</td>
<td>12(52.17%)</td>
</tr>
<tr>
<td>Total [n (%)]</td>
<td>30 (100%)</td>
<td>23 (100%)</td>
</tr>
<tr>
<td>Mean ± S.D.</td>
<td>56 ± 4 years</td>
<td>55 ± 5.4 years</td>
</tr>
</tbody>
</table>

Table 3. Gender wise distribution

<table>
<thead>
<tr>
<th>Gender</th>
<th>Uncontrolled Diabetics</th>
<th>Controlled Diabetics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>17</td>
<td>14</td>
</tr>
<tr>
<td>Female</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>23</td>
</tr>
</tbody>
</table>

Table 4. Mean ABI of controlled and uncontrolled diabetics

<table>
<thead>
<tr>
<th>Type of Diabetics</th>
<th>Controlled</th>
<th>Uncontrolled</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABI: Mean ± SD</td>
<td>1.05 ± 0.13</td>
<td>1.02 ± 0.12</td>
</tr>
</tbody>
</table>
uncontrolled diabetics may be related to lifestyle habits, reason for the not significant difference between uncontrolled diabetics and found no statistical significance 1.05. We compared ABI of controlled diabetics vs. (n=30) is 1.02 and in controll
We found the mean of ABI in uncontrolled diabetics patients
brachial index in controlled and uncontrolled diabetic patients.
The findings of our study focus on the comparison of ankle

DISCUSSION
The findings of our study focus on the comparison of ankle brachial index in controlled and uncontrolled diabetic patients. We found the mean of ABI in uncontrolled diabetics patients (n=30) is 1.02 and in controlled diabetics patient (n=23) is 1.05. We compared ABI of controlled diabetics vs. uncontrolled diabetics and found no statistical significance with t value 0.90 with significance level p > 0.19. The probable reason for the not significant difference between controlled and uncontrolled diabetics may be related to lifestyle habits, dietary patterns, exercise habits etc... those we have not asked during our study to each of our participants but confounders for the ABI. The other reason for not significant results would be ABI of all the participants in the range of 1.05 ± 0.13 for controlled diabetics and 1.02 ± 0.12 for uncontrolled diabetics which are in the normal ABI levels. 2016 AHA/ACC guideline on the management of patients with lower extremity peripheral artery diseases have recommended the use of resting ABI by using Doppler probe and sphygmomanometer and have found that individuals with diabetes and high ABI levels were at higher risk for CVD death than those with normal ABI levels (0.9-1.30) (Aboyans et al., 2008). The study by Owara AH at al shows that pulse ABI had a sensitivity of 62% and a specificity of 90% in diagnosing PAD. Even though the Doppler method cannot be replaced by pulse palpation method, there was a significant positive correlation between the two methods. However, there is limitation of Doppler devices in most of the resource poor settings. In contrast, the pulse palpation method requires only a blood pressure apparatus with a suitable cuff and is a cheaper and readily available alternative. Hence pulse ABI can be utilized to predict the ABI in resource poor setting (Owora, 2018). The patterns of the daily living like eating habits, walking etc... were not asked, to the participants, which might have affected the study. We recommend to have similar study with larger population with consideration of drug dosage, exercise habits and other confounding factors should be taken in future.

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Declaration
Funding: NIL
Conflict of Interest: NIL

Conclusion: There may not be significant difference in ABI values in controlled and uncontrolled diabetics.

REFERENCES


