ORIGINAL RESEARCH

ASSESSMENT AND COMPARISON OF PERIPHERAL VASCULAR DISEASE IN MALE AND FEMALE TYPE 2 DIABETES MELLITUS PATIENT USING ANKLE BRACHIAL INDEX IN GWALIOR CHAMBAL REGION

Shrishty Tomar[1], Jyoti Shrivastava[2], Satyam. S. Jayant[3], Ajit Singh Rajput[4], Yashvardhan Raghuvanshi[1]

[1]Post-graduate Student, Department of Physiology, Gajra Raja Medical College Gwalior, Gwalior, Madhya Pradesh, India.
[2] Assistant Professor, Department of Physiology, Gajra Raja Medical College Gwalior, Gwalior, Madhya Pradesh, India.
[3]Associate Professor, Department of Medicine, Gajra Raja Medical College Gwalior, Gwalior, Madhya Pradesh, India.
[4]Professor & Head, Department of Physiology, Gajra Raja Medical College Gwalior, Gwalior, Madhya Pradesh, India.

Abstract
Background: Diabetes mellitus (DM) is characterized by chronic hyperglycemia and a disorder of carbohydrate, lipid, and protein metabolism caused by a complete or partial insufficiency of insulin secretion and/or insulin action. Diabetes has moved into the top 10 causes of death after a significant increase of 70% since 2000. Peripheral arterial disease in Diabetes mellitus has been constantly found to increase with the age of the patient, duration of the diabetes mellitus and with presence of other complications like diabetic neuropathy. It adds to the list of conventional risk factors for peripheral arterial disease such as physical inactivity, hypertension, smoking, deranged lipid profile. Peripheral arterial disease also leads to a significant morbidity and mortality in the diabetic population due to the development of Diabetic Foot Syndrome. Evaluation of the peripheral vascular disease in male and female patients of type 2 diabetes mellitus of more than 5 years using the ankle brachial index.
Materials and Methods: 160 patients of Type 2 diabetes mellitus of more than 5 years duration were studied cross sectionally for peripheral vascular disease using ABI as a tool. The data was collected from department of medicine, Gajra Raja Medical College and JA group of hospital Gwalior. A comparison between male and female patients was done using unpaired t test. **Result:** In total of 160 patients, 104 were males (65%) and 56 were female (35%). The median age was (49.74±8.47) years (interquartile range (IQR) = 30 - 60 yrs.). According to ABI measurements of the lower limb (LL), a total of 65 patients (40%) had an association with PVD (p<0.01) in which 26 (46%) females had ABI (< 0.9) and males 39 (37%) had ABI (<0.9). **Conclusion:** We found Prevalence of the asymptomatic peripheral vascular disease (ABI≤0.9) 40% in our study. This has to be viewed seriously considering the huge burden of type 2 diabetic population. Females appears to be more prone to develop PVD. The exact mechanism by which females suffer to PVD more is still unknown. There are some potential explanation like role of estrogen in developing PVD. In Diabetic females PVD peak after menopause (age > 50 years). These results suggest that estrogen protects and delays the development of vascular disease. Further studies are required to study the underlying mechanism by which estrogen influences PVD and other vascular complications in DM.

INTRODUCTION

According to the world health organization (WHO) Diabetes is a chronic, metabolic disease characterized by elevated levels of blood glucose (or blood sugar), which leads over time to serious damage to the heart, blood vessels, eyes, kidneys and nerves.

In 2014, 8.5% of adults aged 18 years and older had diabetes. In 2019, diabetes was the direct cause of 1.5 million deaths and 48% of all diabetes deaths occurred before the age of 70. Another 460,000 deaths from kidney disease were caused by diabetes, and elevated blood glucose causes approximately 20% of cardiovascular deaths.[1]

Adults with diabetes have a two - to three-fold increased risk of heart attacks and strokes.[2]

Diabetes has moved into the top 10 causes of death after a significant percentage increase of 70% since 2000. Diabetes is also responsible for the largest increase in deaths among the top 10, with an 80% increase since 2000.[3]

Previous studies like the Chennai Urban Population Study,[4] have also reported the prevalence of Peripheral arterial disease in the diabetic population to be 6.3%. More recent Indian studies show the prevalence of peripheral arterial disease in Diabetes mellitus to be increased.[5-7]

The cited research articles also show the prevalence of peripheral arterial disease in their diabetic populations to be 25.5%, 51%, and 36% respectively.

In this prevalence it includes both symptomatic as well as asymptomatic diabetic patients with peripheral arterial disease. All the above studies defined Peripheral Arterial Disease as an Ankle Brachial Index < 0.9 and also confirmed by the Colour Doppler Ultrasound.

The frequency of Peripheral arterial disease in Diabetes mellitus has been constantly found to increase with the age of the patient, duration of the diabetes mellitus and with presence of other complications like diabetic neuropathy. It is in addition to the conventional risk factors for peripheral arterial disease such as physical inactivity, hypertension, smoking, deranged lipid profile.[8]

Peripheral arterial disease also leads to a significant morbidity and mortality in the diabetic population due to the development of Diabetic Foot Syndrome.[8]

To this end, various studies have been done for assessing the usefulness of various tools for the diagnosis of Peripheral arterial disease before the patient presents with the disease complication. The most widely studied tool is the Ankle Brachial Index which has been proven to have a high sensitivity in diagnosing peripheral arterial disease.

The Ankle-brachial index is measured using the standard size of sphygmomanometer cuffs and a handheld vascular Doppler probe of 8-hertz frequency.

Till date not many studies have been done that are aimed to test the usefulness of pulse oximetry with Ankle-brachial index for detecting peripheral arterial disease in asymptomatic individuals.

This prompted us to do a study that aims to correlate with the severity of peripheral vascular disease as assessed by Ankle-brachial index in a patient with Type 2 Diabetes mellitus and tests its power as an independent tool in detecting peripheral vascular disease and also to study the efficacy of these tools in combination for the early detection of this deadly complication of Diabetes mellitus.

Aims and Objectives

- Evaluation of the peripheral vascular disease in male and female patients of type 2 diabetes mellitus of more than 5 years using the ankle-brachial index
- Comparison of the peripheral vascular disease in male and female patients of type 2 diabetes mellitus of more than 5 years using the ankle-brachial index

MATERIALS AND METHODS

Duration of the Study: 2 years
Sample Size: Total 160 patients of type 2 DM of both sexes.
Study design: Cross sectional study.
Study population: Adults of both sexes from 30-60 years of age having history of type 2 Diabetes Mellitus of more than 5 years duration.
Study period: December 2020 to November 2022

Inclusion Criteria
Adults of both sexes of age 30-60 years
Patient having history of Type 2 Diabetes Mellitus of more than 5 years of duration

Exclusion Criteria
Adults age less than 30 years and more than 60 years age.
Patient of diagnosed Peripheral Vascular Disease of any other causes such as deep vein thrombosis, burger disease, heart failure, hyperlipidaemia
Any pathology due to which patient is unable to lie supine

After taking informed written consent and appropriate history general physical examination was performed

Blood pressure was recorded in all four limbs

Oxygen saturation was recorded with help of Pulse Oximeter from index finger and great toe in both limbs.
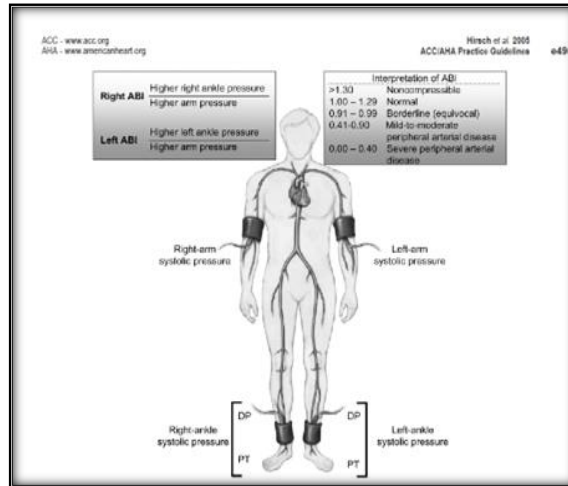
Ankle Brachial Index was calculated by dividing highest systolic pressure of lower limb divided by highest systolic pressure in arm.

ABI $=\dfrac{\text{Higher systolic pressure from both feet}}{\text{Higher systolic pressure from both arm}}$

How to perform the ABI

Step 1: Measure the brachial systolic pressure in both arm.

Step 2: Measure the posterior tibial and dorsalis pedis systolic pressures in both legs

Step 3: Calculate the ABI divide each ankle systolic pressure by the brachial systolic pressure.
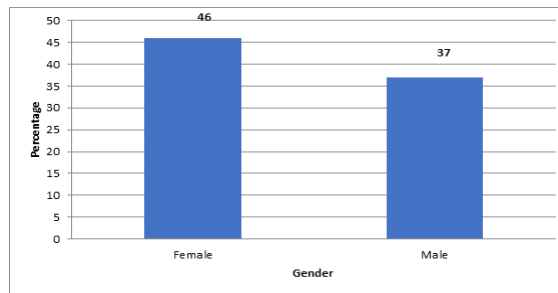
RESULTS

Figure 1: Distribution of cases according to gender in relation to PVD (As assessed by ABI)

This table is showing that out of 160 diabetic cases 26 (46%) females and 39 (37%) males were diagnosed with PVD.
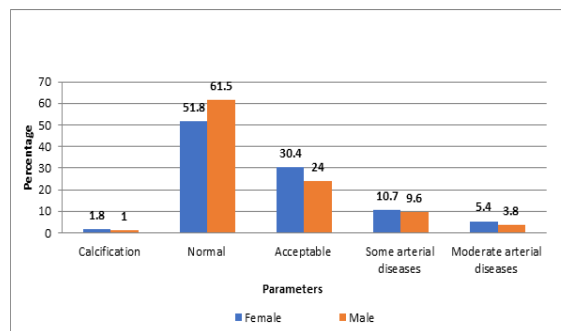
Figure 2: Compare the peripheral vascular disease in male and female patients of type 2 diabetes mellitus

Table 1: Distribution of cases according to gender in relation to PVD (As assessed by ABI)

Gender	No. of cases	PVD	%
Female	56	26	46%
Male	104	39	37%
Total	160	65	40%

Table 2: Compare the peripheral vascular disease in male and female patients of type 2 diabetes mellitus of more than 5 years using the ankle brachial index

S. No.	Parameter	Female [n=56]	Male [n=104]	Total [n=160]	Chi square value	p-value
1	Calcification	1(1.8%)	1(1.0%)	2(1.2%)	1.581	0.812
2	Normal	29(51.8%)	64(61.5%)	93(58.1%)		
3	Acceptable	17(30.4%)	25(24.0%)	42(26.2%)		
4	Some arterial diseases	6(10.7%)	10(9.6%)	16(10.0%)		
5	Moderate arterial diseases	3(5.4%)	4(3.8%)	7(4.4%)		
Total	Count %within sex	56 (100.0%)	104 (100.0%)	160 (100.0%)		

DISCUSSION

Type 2 diabetes mellitus is a highly prevalent disease in the developing countries of South East Asia including India.[9] Peripheral arterial disease (PAD) is one of the most common complications of DM which remains under-diagnosed and under-treated even in western countries.[10-12]

Although asymptomatic it remains a significant risk for both cardiovascular and cerebrovascular morbidity and mortality.[13]

Ankle-brachial index (ABI) is a symptom-independent reliable screening tool for PAD,[14] which should be recommended even at the primary healthcare level,[14-16] but it is not used yet in communities and hospitals.[17]

Unfortunately, the awareness of physicians about the importance of ABI in screening PVD is low. This results in failure to diagnose PVD at an early stage

Implementation of ABI preventive measures will help reduce incidences of lower extremity amputation and reduce the elevated general cardiovascular risk.

On dividing the cases of PVD according to gender we found 46 % (26 out of 56 cases) PVD prevalence in female diabetics and 37% (36 out of 104 cases) PVD prevalence in male diabetics so there is a high prevalence of PVD in female diabetics in comparison to male diabetics in our study. [Table 1]

We also compared ABI and pulse oximetry values between male and female patients with type 2 diabetes mellitus of more than 5 years. We categorized them in the following headings -Normal, Acceptable, Some arterial disease, Moderate arterial disease, and Calcification. We found that females were 51.8 % (n=29) and males were 61.5%(n=64) in the normal group, in the Acceptable group we found females were 30.4 %(n=17) and males were 24% (n=25), in some arterial disease group females were 10.7% (n=6) and males were 9.6% (n=10), in moderate arterial diseases group females were 5.4 % (n=3) and males were 3.8% (n=4) and in the Calcification group one female (1.8%) and one male (1.0%) were found. [Table 2]

Another study done by Surender Kumar S et al. (year 2017) in Rajasthan,[18] they also found that PVD was more common in women with diabetes mellitus as compared to men [Table 2].

Similar findings in gender distribution were also seen in epidemiological studies done in the year 2012 by Agarwal et al,[19] and in the year 1995 by Mohan et al.[20]

R. K. Sharma et al,[21] (year2019) done study in Amritsar they found that prevalence of PAD in 15 patients out of 100 (15%) with women having a slightly higher prevalence (17.5%), as compared to men (13.3%).

So, females appear to be more prone to develop PVD. The exact mechanism by which females suffer from PVD is still unknown. There are some potential explanations for the role of estrogen in preventing the occurrence of PVD in diabetic patients. In Diabetic females PVD peaks after menopause (age > 50 years). This suggests that estrogen protects and delays the development of vascular disease in females during reproductive years.

Estrogen controls cholesterols to some extent, It is cardioprotective by maintaining a high level of high-density lipoprotein (HDL)and lowering the low-density lipoprotein (LDL) and triglyceride.[22]

There is a 66% reduction in estrogen production at menopause. So in the postmenopausal stage estrogen deficiency predisposes to atherosclerosis, ischemic heart disease & myocardial infarction.[22]

Sex differences in our study may also be due to the lack of awareness of self-care, lower education, or lack of enough access to health care, especially among older women.

CONCLUSION

In our study, the prevalence of asymptomatic (subclinical) peripheral vascular disease (ABI < 0.9) is 40%. This has to be viewed seriously considering the huge type 2 diabetic population.

As, a significant proportion of type 2 diabetic subjects are affected by PVD due importance should be given to active screening by using ABI and prevention and management of complications among type 2 diabetes patients.

Our study found females have a high prevalence as compared to males. Sex differences in our study may be due to a lack of awareness of self-care, lower education, or lack of enough access to health care, especially among older women. We identified the need for further research with diabetes mellitus patients of longer duration.

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