

## A Study of Ankle Brachial Index And Asymptomatic Coronary Artery Disease in Type-2 Diabetes Mellitus Patients

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**Abstract:** - Diabetes mellitus, a chronic metabolic disease, causes accelerated generalized atherosclerosis, micro and macro vascular complications like coronary artery disease, peripheral artery disease causing significant morbidity and mortality, asymptomatic in many cases. Early detection and management is pivotal in reducing morbidity & mortality. Hence a prospective observational study was carried out in 67 patients of type 2 DM over a period of 14 months at Mahatma Gandhi Hospital, Jodhpur with aim of detecting asymptomatic coronary artery disease (CAD) & peripheral arterial disease (PAD), and to find co relation (if any) between the two. Patients with type 2 diabetes mellitus (DM) according to WHO criteria were included. All patients who were known cases of cardiac illness, chronic kidney disease, and chronic smokers were excluded.

Ankle Brachial Index (ABI) was calculated by measuring systolic blood pressure in ankle brachial vessels located using hand held Doppler device and deriving the ratio. A multi stage Treadmill Test (TMT) according to Bruce protocol was carried out. Out of 67 patients included in our study, 26.9 % had PAD with slight female preponderance ( $p < 0.05$ ) Asymptomatic CAD was found in 20.9% of the patients. The prevalence of asymptomatic CAD was 38.9% in PAD patients compared to 14.3% in non PAD patients which was statistically significant ( $p < 0.05$ ) A direct co relation of PAD, CAD with age, duration of diabetes, poor glycemic control, dyslipidemia was observed. We infer that early detection of macro vascular complications such as CAD & PAD can be done using simple, non invasive techniques such as TMT, ABI in asymptomatic patients to reduce morbidity and mortality.

**Keywords:** atherosclerosis, HbA1c, peripheral arterial disease, treadmill test

### I. Introduction

Diabetes mellitus, one of the most prevalent endocrine diseases has macro vascular complications such as coronary artery disease, cerebro vascular disease and peripheral arterial disease. New recommendations by the ADA and American Heart Association recommends that diabetes be considered a coronary artery disease risk equivalent rather than a risk factor<sup>1</sup>. Unlike other complications, PAD has received little attention in the Indian medical literature. Majority of affected population have asymptomatic disease. Peripheral arterial disease, whether symptomatic or asymptomatic, is a risk factor for non-fatal and fatal coronary disease and cerebrovascular events.

Type 2 diabetes typically occurs in the setting of the metabolic syndrome, which also includes abdominal obesity, hypertension, hyperlipidemia, and increased coagulability.

The central mechanism in PAD and CAD being accelerated atherosclerosis is caused by endothelial dysfunction and dyslipidemia.

The risk of chronic complications increases as a function of the duration and degree of hyperglycemia; they usually do not become apparent until the second decade of hyperglycemia<sup>1</sup>.

Therefore early diagnosis of these complications is critical to reduce morbidity and mortality. There are numerous non-invasive test available for myocardial ischemia detection: exercise stress test, Holter ECG monitoring, stress myocardial perfusion imaging, stress echocardiography, carotid-intimae-media thickness evaluation via high resolution ultrasound or coronary artery calcium scoring via computed tomography and computed tomography coronary angiography. Exercise stress test also called TMT is a commonly used easily available test at most of the tertiary care centres which can be used as initial evaluation to detect asymptomatic cases. Rajagopalan et al, conducted a study using stress testing, asymptomatic CAD were present in 18% of asymptomatic diabetic patients without known CAD.<sup>2</sup> Kim et al study found that 31 of the 213 (14.6%) asymptomatic patients of type 2 DM had positive TMT results.<sup>3</sup>

The ABI, ankle brachial index is the preferred initial screening test to help diagnose and grade the obstruction of peripheral arterial disease (PAD). It is a surrogate marker of atherosclerosis and recent studies indicate its utility as a predictor of future cardiovascular disease and all-cause mortality.<sup>4</sup>

Agrawal AK et al studied the prevalence of asymptomatic CAD was 52.38% in PAD patients and 24% in non-PAD patients ( $p= 0.007$ )<sup>5</sup> Sarangi S et al studied that Among PAD-positive cases, CAD was present in 46.88%. Only 20% of PAD-negative cases had CAD. A strong correlation was found to occur between PAD and CAD ( $P = 0.001$ ; statistically significant).<sup>6</sup>

There are not many studies, barring a few, correlating complications of diabetes- peripheral artery disease and coronary artery disease. Therefore a study was designed to evaluate asymptomatic CAD and PAD in type 2 diabetes mellitus patients using TMT and ABI respectively and to find co relation, (if any).

## II. Aims Of Study

To study Ankle brachial index in type-2 diabetes mellitus patients. To detect asymptomatic coronary artery disease in type-2 diabetes mellitus patient by treadmill test. To correlate ankle brachial index (Peripheral artery disease) with treadmill test in type-2 diabetes patients.(if any)

## III. Material & Methods

**Design:** - Prospective study

**Setting:** - Dr. Sampurnanand Medical college & Associated Hospitals, Jodhpur (Raj.) INDIA

**Material:** 67 Cases of type 2 diabetes mellitus were taken.

**Inclusion Criteria-**

- Type 2 diabetes mellitus patients on treatment for at least 6 months diagnosed according to WHO criteria

**Exclusion Criteria-**

- Known case of CAD ,valvular heart disease/cardiovascular disorder
- Diabetes with complications-CKD , cerebrovascular disease
- Haemoglobin <10 g/dl
- Chronic smoker

## IV. Methodology

A detailed history was obtained from each patient. This includes age, sex, smoking, alcohol intake, diabetes mellitus – duration, treatment; hypertension – duration, treatment; symptoms of coronary artery disease; family history of diabetes, coronary artery disease, hypertension or cerebrovascular accident.

All patients under study were examined physically with attention to blood pressure, body mass index (weight (kg) / height (meter) <sup>2</sup>) and central obesity (defined as a waist hip ratio of > 0.85 in females and > 0.95 in males). Individual was subjected to baseline investigations include complete hemogram, blood sugar, renal and hepatic functional tests, serum lipid profile, complete urine examination, chest x-ray PA view and resting 12-lead electrocardiogram.HbA1c levels were estimated using HPLC.

- ABI-was measured using Life drop model L 150 R hand held Doppler device 5,8 MHz transducer probe
- 2 readings of systolic BP of vessel located by Doppler device in bilateral upper and lower limbs
- $ABI = \frac{\text{Systolic BP (brachial)}}{\text{Systolic BP (Posterior tibial/Dorsalis pedis)}}$  Interpretation-Normal -0.9-1.3
- $ABI \leq 0.9, > 1.3$ -Abnormal
- Multi stage treadmill exercise test –Bruce protocol with ACC/AHA guidelines for contraindications and termination of stress testing
- Interpretation-
- Positive-
  1. Horizontal/down sloping ST segment  $\geq 1$ mm,0.08 sec after J point
  - 2.Rapidly up sloping ST depression  $\geq 2$ mm,slope $> 1$ mV/s
  - 3.Slowly up sloping ST depression  $\geq 1.5$  mm,slope $< 1$ mV/s
- Equivocal-ST depression < 1 mm/LBBB/PVC < 6beats/min
- Inconclusive <85% of MPRR

## Observations&Results

A total 41 (61.2%) male and 26 (38.8%) female subjects were included in the study.

- Out of 67 subjects about 55.2% of subjects had  $BMI \geq 25.0$ Kg/m<sup>2</sup> while the mean duration of diabetes was  $6.8 \pm 4.3$  years with range from 1 to 20 years. 40.3% of subjects had diabetes less than 5 year duration. 14.9% subjects had good control of diabetes, 52.3% had average control while 32.8% had poor control of diabetes.

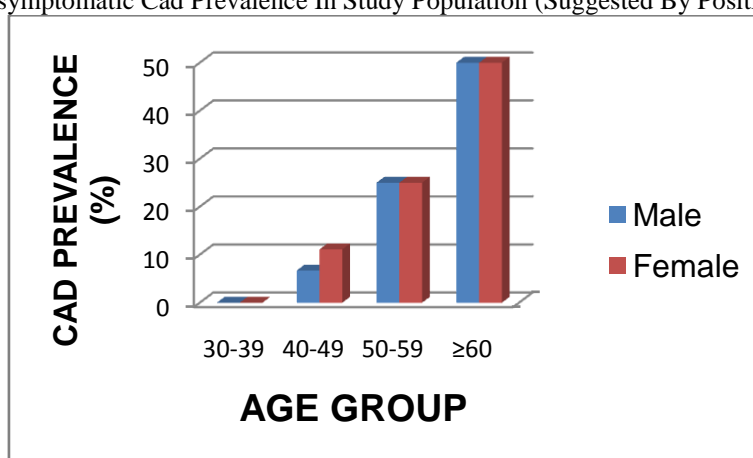
### 1. Pad Prevalence In Study Population(Suggested By Abi)

Age (years)	Male		Female		Total	
	n	PAD (% Prev)	n	PAD (%)	n	PAD (% Prev)

				Prev)		
30-39	2	1 (50.0)	3	1 (33.3)	5	2 (40.0)
40-49	15	1 (6.6)	9	2 (22.2)	24	3 (12.5)
50-59	16	2 (12.5)	12	5 (41.7)	28	7 (25.0)
≥60	8	5 (62.5)	2	1 (50.0)	10	6 (60.0)
total	41	9 (21.9)	26	9 (34.6)	67	18 (26.9)

Out of 67 subjects, a total of 18 (26.9%) were found positive for peripheral arterial disease. Patient in age group ≥60 year had 60% prevalence of PAD (6 out of 10). The difference is statistically significant compared to other age group (p<0.05). The prevalence in females (34.6%) was higher than in males (21.9%). The difference was statistically non-significant (p>0.05).

**II. Asymptomatic Cad Prevalence In Study Population (Suggested By Positive Tmt)**



Out of 67 subjects, a total 14(20.9%) tested positive for asymptomatic CAD. The prevalence in males (21.9%) was higher than in females (18.4%). The difference was statistically non significant (p >0.05). None of the subjects in age group 30-39 year tested positive for CAD. Prevalence was highest in subject of ≥60 years age (50.0%). The difference was statistically significant.

**III. Correlation Of Pad (Abnormal Abi) And Asymptomatic Cad (Tmt+Ve) In Study Population**

Asymptomatic CAD (TMT)	PAD n=18	Non-PAD n=49	Total n=67
Positive	7 (38.9)	7 (14.3)	14
Negative	11 (61.1)	42 (85.7)	53

There was a strong relation proved in our study. Among PAD subjects, 38.9% of subjects had diagnosed asymptomatic CAD via treadmill test as compared to 14.3 % of non-PAD subjects. The difference was statistically significant (x<sup>2</sup>=4.82, DF=1, p<0.05)

**V. Conclusion**

Atherosclerosis is the most common cause of mortality and morbidity in type 2 diabetes mellitus. It is a generalized process that affects coronary, cerebral and peripheral arteries of lower extremities. In our study Peripheral Artery Disease (PAD) was detected in 26.9% diabetic patients (18 patients out of 67) and Asymptomatic CAD was detected in 20.9% patients (14 out of 67 patients). In our study, out of 18 patients with PAD, asymptomatic CAD was detected in 7 patients which is statistically significant (p<0.05). A direct correlation of PAD and CAD with Age, duration of diabetes, poor glycemic control and dyslipidemia was observed in the study.

However, no statistically significant correlation was found with BMI, Hypertension, and S.HDL level. Probably the sample size was not sufficient to reflect this. We conclude, therefore that macrovascular complications as detected by ankle brachial index and treadmill test were present in asymptomatic diabetics. An early detection of CAD and PAD will help in planning out strategies in future management of these patients. Treadmill test and Ankle brachial index are simple, non invasive and widely available tools to detect macrovascular diseases in day to day assessment of diabetic patients.

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