

# Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies

Journal home page: [www.jamdsr.com](http://www.jamdsr.com)

doi: 10.21276/jamdsr

UGC approved journal no. 63854

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Index Copernicus value = 76.77

## Original Article

### Evaluation of carotid intima-media thickness in controlled versus uncontrolled type 2 diabetes mellitus patients - A clinical study

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#### ABSTRACT:

**Background:** Diabetes mellitus refers to a group of common metabolic disorders that share the phenotype of hyperglycemia. The present study was conducted to assess carotid intima-media thickness in patients of controlled versus uncontrolled type 2 diabetes mellitus. **Materials & Methods:** The present study was conducted on 40 controlled diabetics (Group I) and 40 in uncontrolled diabetics (Group II). All patients were subjected to complete physical examination followed by a routine hemogram, complete urine examination, urine for microalbuminuria, fasting plasma glucose (FPG), glycated hemoglobin (HbA1C), lipid profile, electrocardiography, high-resolution B-mode ultrasonography for CIMT measurement. Trained sonographers performed the B-mode ultrasound examination with a linear array transducer of 7.5–12 MHz on the selected subjects in supine position with the head slightly extended and turned to the opposite direction of the CCA being studied. **Results:** The mean duration of diabetes was 4.1 years in group I and 4.82 years in group II, HbA1c level was 6.2 % in group I and 7.5 % in group II, FBG was 122.4 mg/dl, 154.6 mg/dl, SBP was 124.6 mmHg in group I and 128.2 mmHg, DBP was 82.6 mmHg in group I and 128.2 mmHg in group II, total cholesterol was 186.4 mg/dl in group I and 192.6 mg/dl in group II. LDL was 96.2 mg/dl in group I and 106.4 mg/dl in group II, HDL in group I was 46.1 mg/dl and 52.6 mg/dl in group II, VLDL was 40.6 mg/dl in group I and 45.4 mg/dl in group II, triglyceride was 172.5 mg/dl in group I and 192.2 mg/dl in group II. The difference was significant ( $P < 0.05$ ). The mean carotid intima medial thickness (CIMT) in controlled diabetics (group I) was 0.82 mm and in uncontrolled diabetics (Group II) was 1.04 mm. The difference found to be significant ( $P < 0.05$ ). **Conclusion:** Authors found that uncontrolled diabetics have increased carotid intima-media thickness. This significantly correlated with other risk factors for cardiovascular diseases.

**Key words:** Atherosclerosis, carotid intima-media, cardiovascular diseases

Received: 12 June 2018

Accepted: 28 June 2018

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**This article may be cited as:** Saraswat S. Evaluation of carotid intima-media thickness in controlled versus uncontrolled type 2 diabetes mellitus patients - A clinical study. J Adv Med Dent Scie Res 2018;6(7):162-165.

#### INTRODUCTION

Diabetes mellitus refers to a group of common metabolic disorders that share the phenotype of hyperglycemia. Diabetes related complications affect many organ systems and are responsible for the majority of morbidity and mortality associated with the disease.<sup>1</sup> Diabetes-related complications can be divided into vascular and nonvascular complications and are similar for type 1 and type 2 DM. The vascular complications of diabetes mellitus are further subdivided into microvascular (retinopathy, neuropathy, nephropathy) and macrovascular complications

(coronary heart disease, peripheral arterial disease, cerebrovascular disease). The risk of coronary disorders or stroke in diabetic patients is three times that in individuals without this condition.<sup>2</sup>

Diabetes mellitus is a major risk factor of atherosclerosis. Atherosclerosis was identified in Egyptian mummies from as early as 1500 BC.<sup>7</sup> Initial atherosclerosis include adhesion of blood leukocytes to the activated endothelial monolayer, directed migration of bound leukocytes into intima, maturation of monocytes (the most numerous of the leukocytes

recruited) into macrophages, and their uptake of lipid, yielding foam cells.<sup>3</sup>

Atherosclerosis is the underlying disease process leading to ischemic heart disease, cerebrovascular accidents and peripheral vascular diseases.<sup>3</sup> It is the leading cause of morbidity and mortality all over the world. It is a slowly progressive disease with multiple risk factors. Modifiable risk factors include diabetes mellitus, fatty diet, hypercholesterolemia, hypertension and smoking.<sup>4</sup> Non modifiable risk factors are male gender, race and family history. Increase in common carotid intima-media thickness and carotid stenosis secondary to carotid plaque are markers of atherosclerosis. Its early detection helps to identify individuals at risk. High-resolution B-mode imaging of the carotid artery intima-media thickness has been shown to reflect histopathologically verified atherosclerosis and is therefore widely used to detect and quantify noninvasive measurements of atherosclerosis.<sup>5</sup> The present study was conducted to assess carotid intima-media thickness in patients of controlled versus uncontrolled type 2 diabetes mellitus.

## MATERIALS & METHODS

The present study was conducted in the department of General Medicine. It comprised of 40 controlled diabetes and 40 in uncontrolled diabetes. Study was

approved from institutional ethical committee. All patients were informed regarding the study and written consent was obtained.

Data such as name, age, gender was recorded. Patients were divided into two groups. Group I were controlled diabetes and group II were uncontrolled diabetes. A thorough medical history including duration of diabetes, history of hypertension, smoking, and alcohol intake was obtained. All patients were subjected to complete physical examination followed by a routine hemogram, complete urine examination, urine for microalbuminuria, fasting plasma glucose (FPG), glycated hemoglobin (HbA1C), lipid profile, electrocardiography, high-resolution B-mode ultrasonography for CIMT measurement.

Trained sonographers performed the B-mode ultrasound examination with a linear array transducer of 7.5–12 MHz on the selected subjects in supine position with the head slightly extended and turned to the opposite direction of the CCA being studied. Both sides were imaged at three places, i.e. at the proximal part, mid part and the bulb. The means of the three maximum right and three maximum left far wall measurements were calculated for each CCA. Results were tabulated and subjected to statistical analysis. P value less than 0.05 was considered significant.

## RESULTS

**Table I Distribution of patients**

Groups	Male	Female
Group I (Controlled diabetes)	18	22
Group II (Uncontrolled diabetes)	18	20
Total	36	44

Table I shows that group I had 18 males and 22 females and group II had 18 males and 20 females.

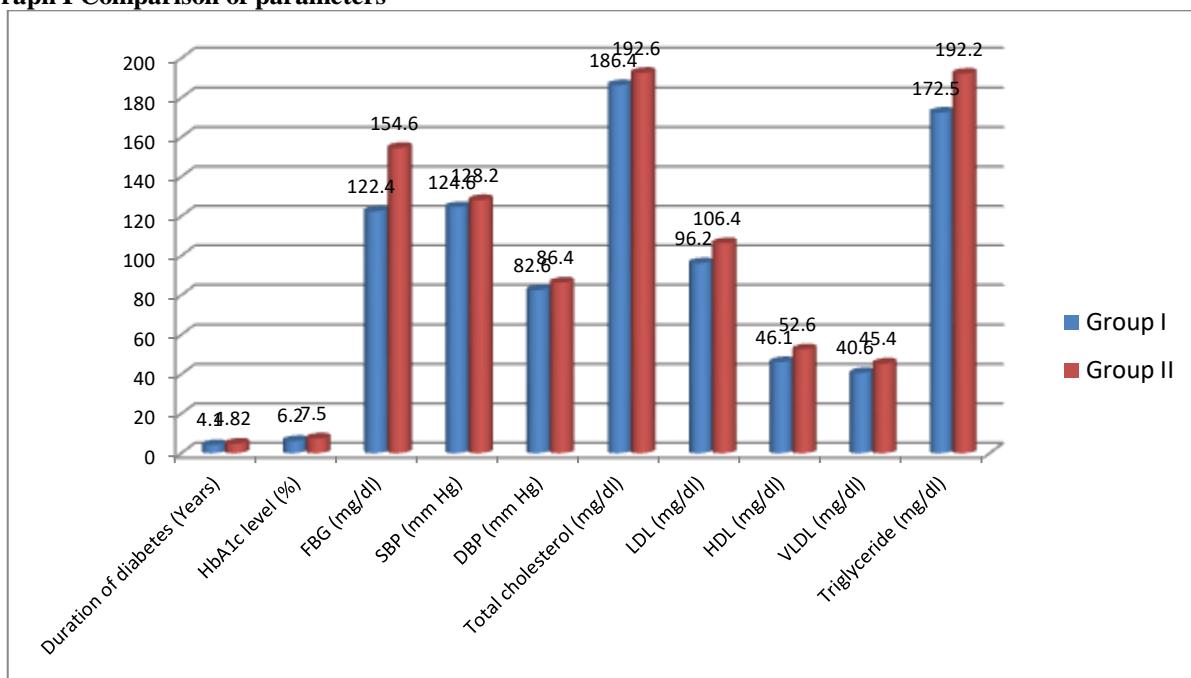
**Table II Comparison of parameters**

Parameters	Group I	Group II	P value
Duration of diabetes (Years)	4.1	4.82	0.51
HbA1c level (%)	6.2	7.5	0.01
FBG (mg/dl)	122.4	154.6	0.02
SBP (mm Hg)	124.6	128.2	0.12
DBP (mm Hg)	82.6	86.4	0.14
Total cholesterol (mg/dl)	186.4	192.6	0.98
LDL (mg/dl)	96.2	106.4	0.72
HDL (mg/dl)	46.1	52.6	0.56
VLDL (mg/dl)	40.6	45.4	0.72
Triglyceride (mg/dl)	172.5	192.2	0.06

Table II, graph I shows that mean duration of diabetes was 4.1 years in group I and 4.82 years in group II, HbA1c level was 6.2 % in group I and 7.5 % in group II, FBG was 122.4 mg/dl, 154.6 mg/dl, SBP was 124.6 mmHg in group I and 128.2 mmHg, DBP was 82.6 mmHg in group I and 86.4 mmHg in group II, total cholesterol was 186.4 mg/dl

in group I and 192.6 mg/dl in group II. LDL was 96.2 mg/dl in group I and 106.4 mg/dl in group II, HDL in group I was 46.1 mg/dl and 52.6 mg/dl in group II, VLDL was 40.6 mg/dl in group I and 45.4 mg/dl in group II, triglyceride was 172.5 mg/dl in group I and 192.2 mg/dl in group II. The difference was significant ( $P < 0.05$ ).

#### Graph I Comparison of parameters



**Table III** Carotid intima medial thickness (CIMT) in both groups

Groups	Mean (mm)	P value
Group I	0.82	0.001
Group II	1.04	

Table III shows that mean carotid intima medial thickness (CIMT) in controlled diabetics (group I) was 0.82 mm and in uncontrolled diabetics (Group II) was 1.04 mm. The difference found to be significant ( $P < 0.05$ ).

#### DISCUSSION

Patients with diabetes mellitus suffer unduly from premature and severe atherosclerosis. The Framingham study<sup>1</sup> pointed out that diabetic individuals have higher serum concentrations of lipids and more hypertension, obesity, and thus are more prone to advanced atherosclerosis and its sequelae, namely coronary artery disease (CAD), cerebrovascular disease, aortic atherosclerosis, and peripheral vascular disease.<sup>6</sup> Coronary angiography (CAG) has been considered as the gold standard for the assessment of the degree of coronary atherosclerosis. But angiographic assessment of the coronary arteries is expensive, needs tertiary care hospitals and expertise and is not without risk.<sup>7</sup> Since atherosclerosis is a generalized phenomenon and is more or less present equally in the coronary, cerebral, and the carotid arteries; so, ultrasonographic assessment of easily accessible arteries has been advocated as a surrogate marker for less accessible vessels, such as coronary and cerebral arterial systems.<sup>8</sup> The present

study was conducted to assess carotid intima-media thickness in patients of controlled versus uncontrolled type 2 diabetes mellitus.

In present study, group I had 18 males and 22 females and group II had 18 males and 20 females. Group I was controlled and group II was uncontrolled diabetics. Agarwal et al<sup>9</sup> found a higher CIMT in diabetics who had CAD, even when the CAD was not clinically overt, leading to the conclusion that CIMT is a reliable surrogate marker for subclinical CAD in diabetic patients. They found the CIMT in the overall study group to be  $0.840 \pm 0.2$  mm, which is quite similar to the CIMT of our study group ( $0.85 \pm 0.3$  mm).

We found that mean duration of diabetes was 4.1 years in group I and 4.82 years in group II, HbA1c level was 6.2 % I group I and 7.5 % in group II, FBG was 122.4 mg/dl, 154.6 mg/dl, SBP was 124.6 mmHg in group I and 128.2 mmHg, DBP was 82.6 mmHg in group I and 86.4 mmHg in group II, total cholesterol was 186.4 mg/dl in group I and 192.6 mg/dl in group II. LDL was

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Kota et al<sup>10</sup> conducted a study in which forty-six diabetic patients of both sexes with systolic blood pressure < 130 mm Hg and diastolic blood pressure < 85 mm Hg were subjected to high resolution B-mode ultrasonography of the common and internal carotid arteries. Patients were grouped into those without metabolic syndrome (Group I) and with nonblood pressure component metabolic syndrome (Group II). Significantly high mean thickness was observed in the common carotid intima media ( $0.824 \pm 0.155$  mm) but not in the internal carotid arteries in group II patients compared to group I patients ( $0.708 \pm 0.113$  mm). Group II also had a significant number of patients with increased lesion intima media thickness ( $\geq 1.1$  mm). We found that mean carotid intima medial thickness (CIMT) in controlled diabetics (group I) was 0.82 mm and in uncontrolled diabetics (Group II) was 1.04 mm. The difference found to be significant ( $P < 0.05$ ). Pujia et al<sup>11</sup> conducted a study in which fifty-four NIDDM subjects and 54 sex- and age-matched control subjects underwent CHD risk factors assessment and echo-Doppler examination of carotid arteries. IMT was measured by computer technique in the common carotid artery (CCA). Presence of plaques and/or stenosis (carotid atherosclerosis [CA]) was also evaluated by a single-blinded reader. NIDDM subjects had larger IMT, higher levels of triglycerides, and lower concentrations of high-density lipoprotein (HDL) cholesterol compared with control subjects. IMT was positively correlated to age and systolic blood pressure and inversely to HDL cholesterol in both groups. The prevalence of CA was 46% in NIDDM subjects and 18% in control subjects. In multiple regression analysis, IMT was the only variable significantly associated to CA.

Ultrasound imaging, which can provide information on intimal-medial thickness (IMT), plaque presence and type, calcification, and wall diameter, offers the ability to examine pre-symptomatic lesions, assess atherosclerotic burden and hence the risk of cardiovascular events. Non-invasive screening procedures/investigations are valuable in identifying diabetic patients at risk for CAD. It is well established that uncontrolled diabetics have increased thickness of the intima media layer of the common carotid arteries

correlate well with ischemic stroke in the setting of T2DM.<sup>12</sup>

## CONCLUSION

Authors found that uncontrolled diabetics have increased carotid intima-media thickness. This significantly correlated with other risk factors for cardiovascular diseases.

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