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## Assessment of carotid intima-media thickness in patients of controlled and uncontrolled type 2 diabetes mellitus

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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 determine carotid intima-media thickness in patients of controlled and uncontrolled type 2 diabetes mellitus.

**Materials and Methods:** The present study was conducted on 150 type 2 diabetes mellitus patients (75 in controlled diabetes and 75 in uncontrolled diabetes group) of both genders. All patients underwent carotid doppler of common carotid artery determined by higher resolution B mode ultrasonography using Philips Affinity 70 machine. The total of 3 values was averaged to give mean common carotid intima-media thickness value for each patient.

**Results:** Group I had 40 males and 35 females whereas group II had 45 males and 30 females. The mean diameter of right CCA in group I was 6.4 mm and in group II was 7.3 mm, in left CCA was 6.5 mm and in group II was 6.8 mm, right ICA was 4.5 mm in group I and 4.7 mm in group II and left ICA was 4.6 mm in group I and 4.5 mm in group II. The mean IMT of right CCA in group I was 0.72 mm and in group II was 0.84 mm, in left CCA was 0.74 mm and in group II was 0.87 mm, right ICA was 0.43 mm in group I and 0.48 mm in group II and left ICA was 0.45 mm in group I and 0.54 mm in group II.

**Conclusion:** Authors found increase diameter and thickness of intima media in uncontrolled diabetics as compared to controlled diabetics.

**Keywords:** carotid artery, intima media, diabetes

### Introduction

Diabetes mellitus refers to a group of common metabolic disorders that share the phenotype of hyperglycemia <sup>[1]</sup>. Based on current trends, the International Diabetes Federation projects that 592 million individuals will have diabetes by the year 2035 <sup>[2]</sup>. Up to 80% of individuals with diabetes live in low-income or medium-income countries <sup>[2]</sup>. Worldwide, most individuals with diabetes are between the ages of 40 and 59 years. Diabetes is a major cause of mortality, but several studies indicate that diabetes is likely underreported as a cause of death. In 2013, it was estimated that \$548 billion or 11% of health care expenditures worldwide were spent on individuals with diabetes <sup>[3]</sup>.

Diabetes related complications affect many organ systems and are responsible for the majority of morbidity and mortality associated with the disease. 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) <sup>[4]</sup>. The risk of coronary disorders or stroke in diabetic patients is three times that in individuals without this condition.

Diabetes mellitus is a major risk factor of atherosclerosis. Initial atherosclerosis includes adhesion of blood leukocytes to the activated endothelial monolayer, directed migration of bound leukocytes into intima, maturation of monocytes into macrophages, and their uptake of lipid, yielding foam cells <sup>[5]</sup>. The present study was conducted to determine carotid intima-media thickness in patients of controlled and uncontrolled type 2 diabetes mellitus.

### Materials and Methods

The present study was conducted in department of Internal Medicine. It comprised of 150 type 2 diabetes mellitus patients (75 in controlled diabetes and 75 in uncontrolled diabetes

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group) of both genders. All patients were informed and written consent was taken. The approval was obtained from institutional ethical committee.

General information such as name, age, gender etc. was recorded. Controlled diabetics were those patients with history of controlled blood sugar levels supported by HbA1c level of equal to or less than 7 and uncontrolled had HbA1c level of more than 7.

All patients underwent carotid doppler of common carotid artery determined by higher resolution B mode ultrasonography using Philips Affinity 70 machine. The total of 3 values was averaged to give mean common carotid intima-media thickness value for each patient. Plaques and stenosis of common carotid artery were also noted. The data

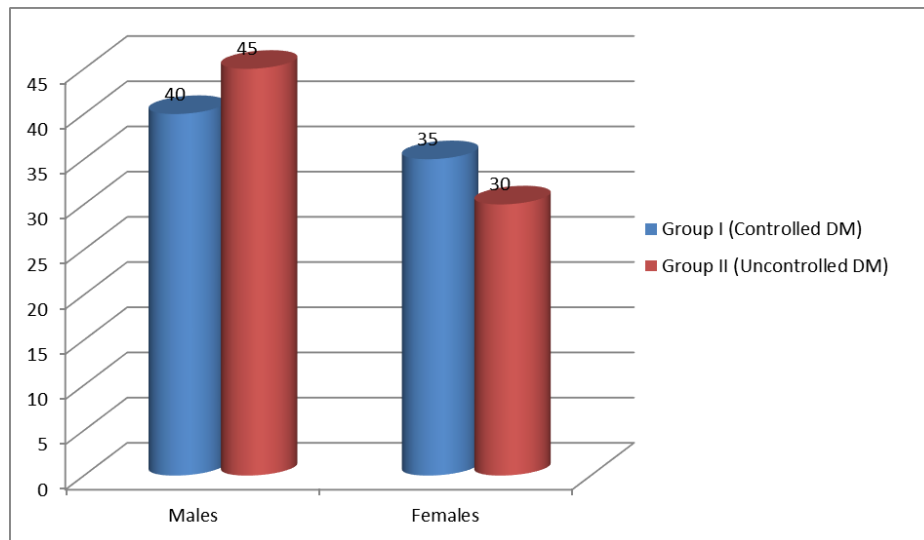
collected was analyzed statistically. P value less than 0.05 was considered significant.

**Results**

**Table I:** Distribution of patients

Groups	Group I (Controlled DM)	Group II (Uncontrolled DM)
Males	40	45
Females	35	30

Table I, graph I shows that group I had 40 males and 35 females whereas group II had 45 males and 30 females.

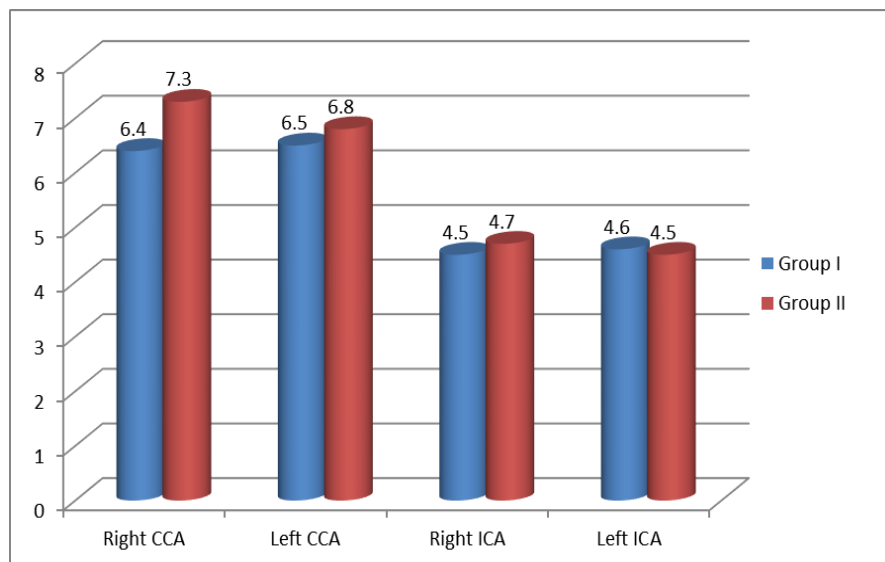


**Graph I:** Distribution of patients

**Table II:** Mean diameter from common and internal carotid artery measurements

Diameter (mm)	Group I	Group II	P value
Right CCA	6.4	7.3	0.01
Left CCA	6.5	6.8	0.02
Right ICA	4.5	4.7	0.04
Left ICA	4.6	4.5	0.05

Table II, graph II shows that mean diameter of right CCA in group I was 6.4 mm and in group II was 7.3 mm, in left CCA was 6.5 mm and in group II was 6.8 mm, right ICA was 4.5 mm in group I and 4.7 mm in group II and left ICA was 4.6 mm in group I and 4.5 mm in group II. The difference was significant ( $P < 0.05$ ).

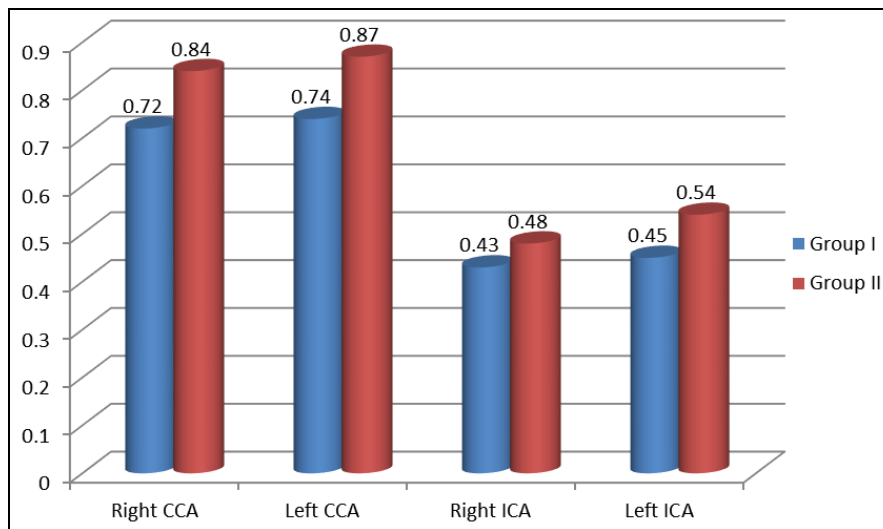


**Graph II:** Mean diameter from common and internal carotid artery measurements

**Table III:** Mean IMT (mm) from common and internal carotid artery measurements

IMT (mm)	Group I	Group II	P value
Right CCA	0.72	0.84	0.01
Left CCA	0.74	0.87	0.01
Right ICA	0.43	0.48	0.05
Left ICA	0.45	0.54	0.02

Table III, graph III shows that mean IMT of right CCA in group I was 0.72 mm and in group II was 0.84 mm, in left CCA was 0.74 mm and in group II was 0.87 mm, right ICA was 0.43 mm in group I and 0.48 mm in group II and left ICA was 0.45 mm in group I and 0.54 mm in group II. The difference was significant ( $P < 0.05$ ).



**Graph III:** Mean IMT (mm) from common and internal carotid artery measurements

**Discussion**

Atherosclerosis is the underlying disease process leading to ischemic heart disease, cerebrovascular accidents and peripheral vascular diseases. 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 [6]. 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 [7]. The asymptomatic carotid atherosclerosis study (ACAS) and the asymptomatic carotid surgery trial (ACST) demonstrated a positive effect of carotid endarterectomy in asymptomatic patients with carotid stenosis of 60%, with a prerequisite surgical complications rate under 3% [8]. The present study was conducted to determine carotid intima-media thickness in patients of controlled and uncontrolled type 2 diabetes mellitus.

In this study, group I had 40 males and 35 females whereas group II had 45 males and 30 females. Malthesh *et al.* [9] study group was divided into a non-CAD group (n=40), and a CAD group (n=71). The mean carotid IMT of the group as a whole, was  $0.840 \pm 0.2$  mm. The mean carotid IMT was significantly higher ( $p < 0.0001$ ) in type 2 diabetics with CAD (both overt and silent) than in those without CAD. In diabetics with CAD, the systolic blood pressure, diastolic blood pressure and triglycerides were found to be predictors of high mean carotid IMT. On subgroup analysis of the cases with silent ischaemia, the variables affecting carotid

IMT were serum creatinine, total cholesterol, microalbuminuria/proteinuria, serum triglyceride levels, and diastolic blood pressure. A high carotid IMT is a surrogate and reliable marker of higher risk of CAD amongst type 2 DM.

We found that mean diameter of right CCA in group I was 6.4 mm and in group II was 7.3 mm, in left CCA was 6.5 mm and in group II was 6.8 mm, right ICA was 4.5 mm in group I and 4.7 mm in group II and left ICA was 4.6 mm in group I and 4.5 mm in group II. The mean IMT of right CCA in group I was 0.72 mm and in group II was 0.84 mm, in left CCA was 0.74 mm and in group II was 0.87 mm, right ICA was 0.43 mm in group I and 0.48 mm in group II and left ICA was 0.45 mm in group I and 0.54 mm in group II.

Touboul *et al.* [10] found that the carotid intima-media thickness shows a positive correlation with fasting plasma glucose, postprandial glucose and HbA1c. Multiple linear regression analysis showed a positive association between HbA1c and carotid-intima media thickness, with a 0.016 mm and 0.019 mm increase in mean and maximum carotid-intima media thickness per 1% increase in HbA1c. The results of this study suggest that the fasting plasma glucose and HbA1c are associated with carotid-intima media thickness. The patients who present with a metabolic glucose alteration have more risk of developing carotid target organ damage.

**Conclusion**

Authors found increase diameter and thickness of intima media in uncontrolled diabetics as compared to controlled diabetics.

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