Original Article

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ASSESSMENT OF COMMON CAROTID ARTERY INTIMA MEDIA THICKNESS IN DIABETICS COMPARED WITH NON DIABETICS BY B-MODE ULTRASONOGRAPHY

Hassan Junaid Sarwar, Qurat-ul-Ain Tahira*, Khadija Tul Kubra**

Combined Military Hospital Pano Aqil, *KEMO Lahore, **Combined Military Hospital Lahore

ABSTRACT

Objective: To compare the common carotid artery intima media thickness in healthy individuals and in patients of diabetes mellitus.

Study Design: Case-Control Study

Place and duration of study: Radiology Department, Combined Military Hospital Rawalpindi from August 2008 to February 2009.

Patients and Methods: A total of 100 patients were selected in this study. First 50 willing cases of diabetes fulfilling inclusion criteria were included and first 50 controls i.e. one for each case was selected in a manner that every one was matched for universal variables like age and sex.

Results: Average age was 68.0±10.6 and 68.4±10.3 years in cases and controls, respectively. Majority of the patients were male 31 (62.0%) in cases and 30 (60%) in controls. Intima media thickness was 1.02±0.11mm in cases and 0.65±0.12mm in controls with significant difference (P<0.001).

Conclusion: In diabetic subjects carotid intima media thickness is increased as compared to the non diabetic subjects.

Keywords: B-mode ultrasonography, diabetes mellitus, Intima medial thickness.

INTRODUCTION

Diabetes mellitus type 1 is an important risk factor for the development of cardiovascular disease (CVD)[1,2]. Patients with diabetes show a 2- to 10-fold risk for developing atherosclerotic lesions compared with the normal population[1]. Thus, in this patient group, increased morbidity and mortality due to coronary, cerebrovascular, and peripheral arterial disease have been observed[1]. Even if these complications become manifest in the adult diabetic patient, the process of vascular changes starts much earlier. The atherosclerotic processes at the endothelial level begin in childhood and progress rapidly in the presence of risk factors[3].

Common carotid artery intima-media thickness (IMT), as measurable by high-resolution B-mode ultrasonography, is a noninvasive marker of subclinical atherosclerosis[4]. An increased IMT has been correlated to an increased relative risk for myocardial infarction and stroke with poor outcome in adults[5]. Intima-media thickness is defined as a double-line pattern visualized on both walls of the CCAs in a longitudinal echographic image. It is formed by 2 parallel lines, which represent the leading edges of two anatomic boundaries: the lumen-intima and media-adventitia interfaces[6].

Although in many clinical trials, IMT has been proposed both as a quantitative index of atherosclerosis and an end point to determine the success of interventions aimed to lower vascular risk factors, the role of increased IMT as a landmark of atherosclerosis is still controversial[7]. It is universally accepted that cardiovascular and cerebrovascular diseases show a correlation with increased IMT. Thickening of the intima-media complex is indeed accelerated and enhanced when the classic vascular risk factors for atherosclerosis, in particular, elevated blood pressure, are present[8,9].

The rationale of the present, case control study was the measurement of IMT using B–mode ultrasonography to detect subclinical athersclerosis at an early stage to prevent late complications of atherosclerosis. A group of healthy individuals served as control.

Correspondence: Major Hassan Junaid Sarwar, Radiology Dept, CMH Pano Aqil
Email: hassanjunaid@yahoo.com
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PATIENTS AND METHODS

This case control study was carried out at Radiology Department of Combined Military Hospital Rawalpindi from Aug 2008 to Feb 2009. Cases were collected from OPD of radiology and medical department of CMH Rawalpindi. All patients were of either gender more than 40 years of age having diagnosed diabetes mellitus for atleastt more than 5 years. Controls being non diabetics were volunteers for the subject study. Objective of the study was explained to every subject (cases and controls). Verbal consent was also obtained.

First 50 willing cases fulfilling inclusion criteria and first 50 control. i.e. one for each case was selected in a manner that every one is matched for universal variables like age and sex. Patients with history of Hypertension, smoking, hyperlipidemias and ischemic heart disease were not included.

Blood glucose was measured from median cubital vein. The data were collected by a blind observer and verified by a senior colleague.

Toshiba APLIO-50 Doppler system ultrasound machine was used. B-mode ultrasonography was performed on both sides. 7.5MHz linear array was with patients in supine position and elevation of chest by pillow. Patients head was turned to the opposite side of examination. Intima media thickness was assessed in the distal wall, 0.5 to 1.0 cm proximal to carotid bulb of common carotid artery. Only one research associate performed the ultrasound under the supervision of same supervisor.

There was no risk to the patient as ultrasonography is a non-invasive technique. Ultrasonography of all the cases and controls was free of cost. The information was collected through a predesigned proforma.

Data Analysis

Collected data was analyzed through SPSS 10. Descriptive statistics were used to describe the data. Chi-square test was used to compare gender. Independent samples t-test was applied to compare age and intima media thickness between the two groups. p value < 0.05 was taken as significant.

RESULTS

Average age was 68.0±10.6 years and 68.4±10.3years in cases and controls, respectively (Table-1).

Majority of the patients were male i.e. 31 (62.0%) in diabetics and 30 (60%) in controls (Bar Chart).

Results revealed a significant difference between cases and controls in blood sugar fasting (p<0.001) and blood sugar random (p<0.001) (Table-2).

Average intima media thickness was 1.02±0.11) in cases while 0.65±0.12) n controls. This difference in cases and controls was significant (p<0.001)

DISCUSSION

Abnormalities in endothelial and vascular smooth muscle cell function, as well as a propensity to thrombosis, contribute to atherosclerosis and its complications. Endothelial cells, because of their strategic anatomic position between the circulating blood and the vessel wall, regulate vascular function and structure.

In normal endothelial cells, biologically active substances are synthesized and released to maintain vascular homeostasis, ensuring adequate blood flow and nutrient delivery while preventing thrombosis and leukocyte diapedesis[10]. Among the important molecules synthesized by the endothelial cell is nitric oxide (NO), which is constitutively produced by endothelial NO synthase (eNOS) through a 5-electron oxidation of the guanidine-nitrogen terminal of L-arginine[10]. NO causes vasodilation by activating guanylyl cyclase on

Table 1: Group wise description of age

Age	Cases		Controls	
	Number	%	Number	%
41-50	04	08	04	08
51-60	11	22	09	18
61-70	12	24	14	28
> 70	23	46	23	46

Table 2: Comparison of blood sugar level

	Cases	Control	P Value
Fasting	75.70	47.70	< 0.001
Random	120.62	60.68	< 0.001

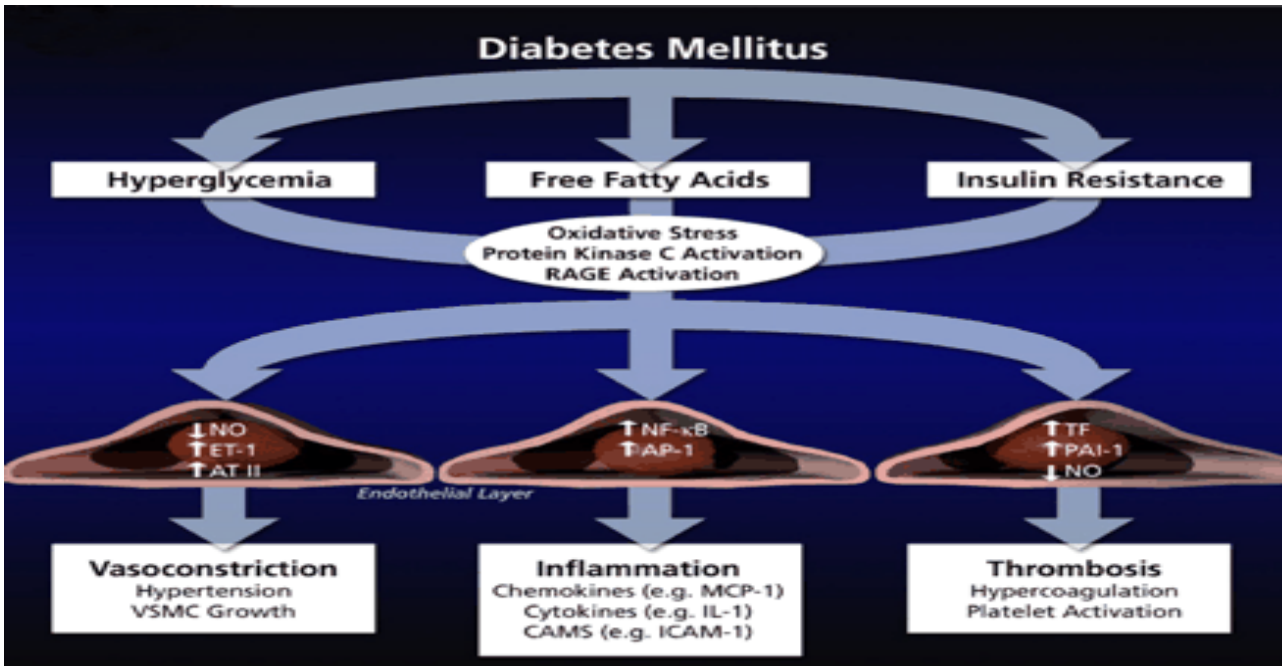

Fig. 1: Metabolic abnormalities in diabetes.

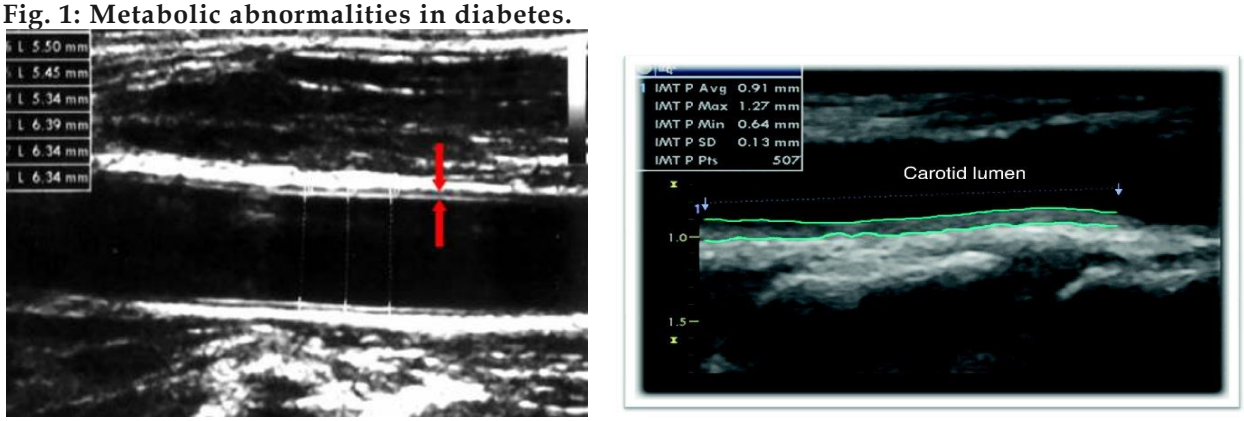

Fig. 2: Normal and Increased Intima Media Thickness

subjacent vascular smooth muscle cells[11-12]. Conversely, the loss of endothelium-derived NO permits increased activity of the proinflammatory transcription factor nuclear factor kappa B (NF-kB), resulting in expression of leukocyte adhesion molecules and production of chemokines and cytokines[13]. Endothelial dysfunction, as represented by impaired endothelium-dependent, NO-mediated relaxation, occurs in cellular and experimental models of diabetes[14]. Similarly, many, but not all, clinical studies have found

that endothelium-dependent vasodilation is abnormal in patients with type 1 or type 2 diabetes[15]. Thus, decreased levels of NO in diabetes may underlie its atherogenic predisposition.

The bioavailability of NO reflects a balance between its production via NOS and its degradation, particularly by oxygen-derived free radicals[16]. Many of the metabolic derangements known to occur in diabetes, including hyperglycemia, excess free fatty acid liberation, and insulin resistance, mediate abnormalities in endothelial cell function by affecting the synthesis or degradation of NO (Fig.1)[17].

According to Semrad et al the thickness of the carotid wall increases with age and is augmented in diabetic subjects[18]. The results showed that the observed difference in IMT can be interpreted as if the diabetics patient were more than 10 years older than the control group.

In a study by Akosah et al the mean age was 51±8 years[19]. In another study the mean±SD age of diabetic patients was 47.4±9.2 years and in non-diabetic patients, the mean age was 44.5±8.1 years[20]. Keser et al described the mean age 38.15±9.44 years[21]. In our inclusion criteria, we had taken patients over the age of 40 years so the average age was 68 years and 68.4 years in cases and controls respectively which is higher as compared to other studies.

In a study by Keser et al, total 114 patients were included, the male to female: ratio was 1.5:1[21]. In our study, the overall male to female ratio was high. Males were more than females.

Bots et al performed a case–control study in a subgroup of their population that showed an association between common-carotid-artery intima–media thickness and the risk of myocardial infarction and stroke associated with diabetes mellitus[22]. In a study by Holaj et al, carotid IMT was determined by ultrasonography. There was significant difference in intima media thickness in patients with diabetes mellitus as compared to control group (0.892±0.154 mm versus 0.812±0.124 mm; $p<0.01$)[23]. The results obtained in our study showed that diabetic patients had an average 0.35mm thick IMT than control subjects. According to present study, the intima media thickness of both right and left common carotid artery in diabetic patients was significantly high than the control group ($p<0.001$).

In one group of studies it was revealed that known diabetes implicates longer diabetes duration which seems to be a factor associated with an increased IMT[24]. Our analysis also supports such a concept because study including patients with known diabetes showed thick IMT compared with control subjects.

Salonen and Salonen, in a study of 1257 middle-aged Finnish men, observed an association between common-carotid-artery intima–media thickness and cardiac events. This observation was based on a one-year follow-up and a total of 24 events[25]. Because the definitions of high-risk categories in their study were different from those we used, direct comparison of our results with theirs is not possible.

The intima–media thickness of the carotid artery is strongly associated with the diabetes mellitus. In diabetic subjects the influence of blood sugar predominates, as documented by a comparison of the carotid IMT between diabetic and non diabetic subjects.

CONCLUSION

In diabetic subjects carotid intima media thickness is increased as compared to the non diabetic subjects.

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