Original Research Article

Study of carotid intima-media thickness and its association with coronary artery disease and other risk factors

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Abstract

Background: The investigation of the cardiovascular diseases requires invasive and non-invasive tools in establishing the diagnosis. This study was mainly undertaken to relate the CIMT with the risk factors of coronary artery diseases.

Material and methods: A case control study was undertaken in department of General Medicine in a tertiary care hospital in 30 cases and 60 controls. Intima-media thickness was measured by using B mode scanner as the distance between the leading edge of the first echogenic line of the far wall of the carotid artery (lumen-intima interface) and the leading edge of the second echogenic line (media-adventitia interface).

Results: The number of risk factors was higher in cases than controls. The cases demonstrated high CIMT than controls. The CIMT increased with increase in number of risk factors.

Conclusion: CIMT can be used as non-invasive tool in assessment of coronary artery diseases.

Key words

Carotid intima media thickness, B mode scanner, Risk factors, Case control study, Non-invasive tool.

Introduction

Rapid health transition across the world is favoring the increase in burden of cardiovascular diseases especially in developing countries. Increase in life expectancy, delayed industrialization and recent urbanization are other reasons for this increase in developing countries [1]. The literature available shows that the atherosclerosis is a multifactorial disease and characterized by the presence of fatty streaks along the vessel wall leading to development of

plaques on the walls of arteries reducing the calibre of vessels [2].

A number of risk factors are incriminated in the pathogenesis of the atherosclerosis and a number of diagnostic modalities have been proposed including the stress echocardiography, exercise electrocardiography, thallium scanning and coronary angiography. Carotid intima media thickness (IMT) emerged as promising technique in detection of atherosclerosis in pre occlusive phase since atherosclerosis is generalized process. Extra cranial carotid arteries provide excellent and reproducible sites for IMT assessment because of accessibility, adequate size, and limited movement [3]. IMT of carotid artery can be assessed by B- mode ultrasound in a relatively simple way and provides a safe, inexpensive, precise and reproducible measure [4]. The data available is scant regarding the IMT as non-invasive tool in detection of CAD in symptomatic and asymptomatic individuals especially in Indian population. Hence, the aim of study was to measure carotid intima media thickness and correlates it with coronary artery disease.

Materials and methods

This was a case control study in the Department of Medicine of a tertiary care hospital for a period of one and half year from June 2019 to November 2020. About 90 study subjects meeting the inclusion and exclusion criteria attending the outpatient department were constituted the study sample. An informed consent was obtained from each study subject and clearance from the institution ethics committee was obtained before the study was started. Inclusion criteria for the CAD cases group included ECG changes of CAD, 2 – D ECHO changes suggestive of CAD, TMT suggestive of CAD, angiography proven CAD patients and raised enzymes (CPK, CPKMB, Troponin T and I). Patients with Anti atherosclerotic regimen of more than 6 month, history of coronary artery bypass grafting,

history of angioplasty and patients with history of cerebrovascular disease were excluded.

About 30 study subjects had signs and symptoms suggestive of coronary artery disease and 60 members were healthy adults more than 30 years of age without present and past history of CAD, stroke and no risk factors for atherosclerotic disease like diabetes mellitus, hypertension, dyslipidemia, obesity.

All the cases thus selected were subjected for Carotid Artery Scanning with a high resolution Sonos 5500 with a duplex B-mode scanner and a linear phased array transducer of 7.5 MHz frequency. Intima-media thickness was measured as the distance between the leading edge of the first echogenic line of the far wall of the carotid artery (lumen-intima interface) and the leading edge of the second echogenic line (media-adventitia interface). The measurement of IMT was made at end-diastole (peak of the R wave) at 3 segments on each side: the distal 1 cm of common carotid artery just before the bifurcation, the carotid bifurcation, and the proximal 1 cm of internal carotid artery. The measurements were taken only on longitudinal scans and not on transverse scans. For each individual, the maximum and average of all measurements at the 6 predefined sites were considered for further analysis. The details collected were entered in pre designed proforma and analyzed accordingly.

Results

Majority of the cases in this study were aged more than 60 years. The sex was matched to compare the risk factors. About 53.3% of the cases and 35.0% of the controls were smokers. About 23.3% of the cases and 13.3% of the controls were alcoholics. Diabetes mellitus was present in 46.7% of the cases and 28.3% of the controls. About 33.3% of the cases and 41.7% had hypertension. Family history was present in 33.3% of the cases and 30.0% of the controls. More than quarter of the patients in both the groups had obesity (**Table – 1**).

Table – 1: Risk factors in the study group among the cases and controls.

Characteristics	Risk factors	CAD n (%)	Non CAD n (%)	χ^2 value, Sig
Age	41 – 50 years	1 (3.3)	4 (6.7)	0.736, NS
	51 – 60 years	9 (30.0)	20 (33.3)	
	More than 60 years	20 (66.7)	36 (60.0)	
Sex	Male	15 (50.0)	30 (50.0)	0.000, NS
	Female	15 (50.0)	30 (50.0)	
Smoking status	Smoker	16 (53.3)	21 (35.0)	2.977, NS
	Non smoker	14 (46.7)	39 (65.0)	
Alcohol	Alcoholic	7 (23.3)	8 (13.3)	1.44, NS
	Non alcoholic	23 (76.7)	52 (86.7)	
Diabetes mellitus	Diabetic	14 (46.7)	17 (28.3)	2.977, NS
	Non diabetic	16 (53.3)	43 (71.7)	
Hypertension	Yes	10 (33.3)	25 (41.7)	0.584, NS
	No	20 (66.7)	35 (58.3)	
Family history of CHD	Present	10 (33.3)	18 (30.0)	0.104, NS
	Absent	20 (66.7)	42 (70.0)	
Obesity	Present	8 (26.7)	19 (31.7)	0.238, NS
	Absent	22 (73.3)	41 (68.3)	

Table – 2: Lipid related risk factors in the cases and controls.

Risk factors	CAD Mean (± SD)	Non CAD Mean (± SD)	T value, Sig
Total cholesterol	193.43 (± 39.9)	171.62 (± 38.58)	2.5, Sig
Low density lipoprotein	117.25 (± 28.14)	102.62 (± 28.66)	2.297, Sig
High density lipoprotein	43.3 (± 9.54)	42.54 (± 4.42)	0.387, NS
Triglycerides	157.63 (± 60.46)	143.83 (± 68.6)	0.935, NS

Table – 3: CIMT thickness in the study group.

CIMT thickness	CAD Mean (± SD)	Non CAD Mean (± SD)	T value, Sig
CIMT/ R	0.98 (± 0.18)	0.78 (± 0.17)	5.112, Sig
CIMT/L	0.98 (± 0.19)	0.77 (± 0.19)	4.907, Sig
CIMT/ A	0.98 (± 0.17)	0.78 (± 0.16)	5.482, Sig
CIMT/ MX	1.1 (± 0.19)	0.83 (± 0.18)	6.514, Sig

Table – 4: Distribution of number of risk factors and CIMT.

No or risk factors	Frequency	Average IMT	Maximum IMT
0	13	0.8	0.87
1	23	0.83	0.89
2	24	0.86	0.95
3	21	0.83	0.92
4	7	0.91	1.0
5	1	0.90	1.0
6	1	0.95	1.0

There was a significant difference in total cholesterol and low density lipoprotein between the cases and controls. There was no statistically significant difference in high density lipoprotein and triglycerides between the cases and controls (**Table – 2**).

Mean CIMT of right carotid artery was 0.98 in cases and 0.78 in controls. The CIMT of left carotid artery was 0.98 in cases and 0.77 in controls. The average CIMT was 0.98 in cases and 0.78 in controls. The maximum CIMT was 1.1 in cases and 0.83 in controls. These differences were statistically significant between the cases and controls (**Table – 3**).

The average IMT for cases and controls without any risk factors was 0.8 and maximum CIMT was 0.87. Average IMT and maximum IMT had increased with increase in number of risk factors (**Table – 4**).

Discussion

This study was mainly undertaken to study the carotid intima media thickness in cases and controls. The risk factors were higher in the cases than controls in this study.

The mean CIMT was higher in cases than controls. In a study of relation between the hyperuricemia and Carotid IMT among patients of hypertension with hyperuricemia was 1.0 mm, hypertension without hyperuricemia patients was 0.92 mm, normotensives with hyperuricemia was 0.91 mm and controls had CIMT of 0.7 similar to this study [4]. In a similar study, the mean CIMT at common carotid IMT among no CAD patients was 0.53 mm, non-significant CAD was 0.74 mm and with significant CAD was 0.83 mm. Bifurcation IMT was 0.79 mm, 0.99 mm and 1.12 mm respectively among the population with no significant CAD, with non-significant CAD and significant CAD respectively [5]. The mean carotid artery intima media thickness among the individuals with moderate physical activity was 0.61 mm and those with low physical activity was 0.73 mm [6]. In a study by Grau, et al., the mean ACA IMT was 0.67 mm and 0.72 mm among females and males respectively. The maximal ACA IMT was 0.8 and 0.85 mm respectively, the mean CCA IMT was 0.79 and 0.83 mm respectively for females and males. The mean CB IMT was 0.74 mm and 0.8 mm, the maximal CB IMT was 0.9 and 0.96 mm, Mean ICA IMT was 0.58 and 0.62 mm respectively among males and females [7]. In a similar study by Coskon, et al., the CIMT was 0.78 mm in patients with no critical cardiac disease and 1.48 mm in patients with critical cardiac illness [8].

The average IMT for cases and controls without any risk factors was 0.8 and maximum CIMT was 0.87. Average IMT and maximum IMT had increased with increase in number of risk factors. The association between the CIMT average and maximum with risk factors was assessed in this study. There was significant difference between the CIMT average and maximum measurements and smoking status. There was no significant association between the CIMT values in relation to alcoholism, Diabetes, hypertension, family history of CAD, Obesity, gender and age in this study. In a study of association between the central fat distribution and CIMT, the univariate analysis had shown a significant association with age, sex, Systolic blood pressure, diastolic blood pressure, HbA_{1c} and BMI [9]. In another study by Hansa, et al., there was linear relationship with the risk factor number and CIMT which is close to results of this study [10].

Conclusion

This study had shown that the carotid intima media thickness increased with increase in the number of risk factors. CIMT can be used as non-invasive proxy in the investigation of coronary artery diseases.

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