DETERMINATION OF COMMON AND INTERNAL CAROTID ARTERY INTIMA- MEDIA THICKNESS BY B-MODE ULTRASOUND IN PATIENTS OF ACUTE CORONARY SYNDROME AND ITS CORRELATION WITH CONVENTIONAL CARDIOVASCULAR RISK FACTORS

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ABSTRACT

Background: *- High-resolution B-mode imaging of the carotid artery IMT has been shown to reflect verified atherosclerosis and is therefore widely used to detect and quantify noninvasive measurements of atherosclerosis [1]*

Aims: *To correlate the intima media thickness of common and internal carotid artery of patient suffering from acute coronary syndrome with conventional cardiovascular risk factors.*

Methods: *A cross sectional hospital based study was done in MBS Hospital Kota which included 100 patients of acute coronary syndrome. High-resolution B-mode ultrasonography has proved to be a valid and reliable method of detecting initial structural atherosclerotic changes of the arterial walls [2].*

Results: *100 patients of age group 35-70 years were involved in the study. There was significantly positive association in patients of acute coronary syndrome with traditional risk factors. Increased intima-media thickness is associated with increasing age, DM, HTN, BMI, WHR, LDL cholesterol, and smoking. Greater the number of risk factors, higher the thickness of intima-media noted.*

Conclusion: *The association of ACS, traditional risk factors and increased intima media thickness of carotid arteries suggest that intima media thickness is by itself as a powerful predictor of cardiovascular events.*

INTRODUCTION

Atherosclerosis is the underlying disease process leading to ischaemic heart disease (IHD), cerebrovascular accidents and peripheral vascular diseases [3]. It is the leading cause of

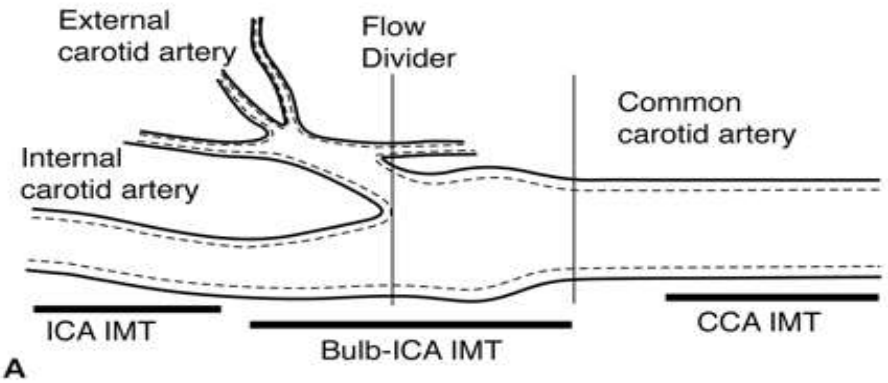
morbidity and mortality all over the world. It is a slowly progressive disease with multiple risk factors. Modifiable risk factors include diabetes mellitus (DM), fatty diet, hypercholesterolaemia, hypertension and smoking [4]. Non modifiable risk factors are male gender, race and family history. The carotid intima-media thickness (IMT) may be clinically useful as a marker of the development of atherosclerosis in the setting of various risk factors, as well as a marker of the response to therapy for atherosclerosis, a predictor of events, and a marker of advanced vascular disease in the peripheral, carotid, and coronary circulations [5]. Increase in common carotid intimal medial thickness (CCA-IMT) and carotid stenosis secondary to carotid plaque (CP) are markers of atherosclerosis. Its early detection helps to identify individuals at risk [6].Different groups have performed measurements as different sites of carotid artery and it has been shown that CCA-IMT is a good predictor of stroke incidence, where as internal carotid artery (ICA) IMT measurement has a greater power of prediction for myocardial infarction [7]. CCA-IMT has been shown to slow down or even regress with control of blood pressure, antihyperlipidaemic drugs and multifactorial interventions [8].

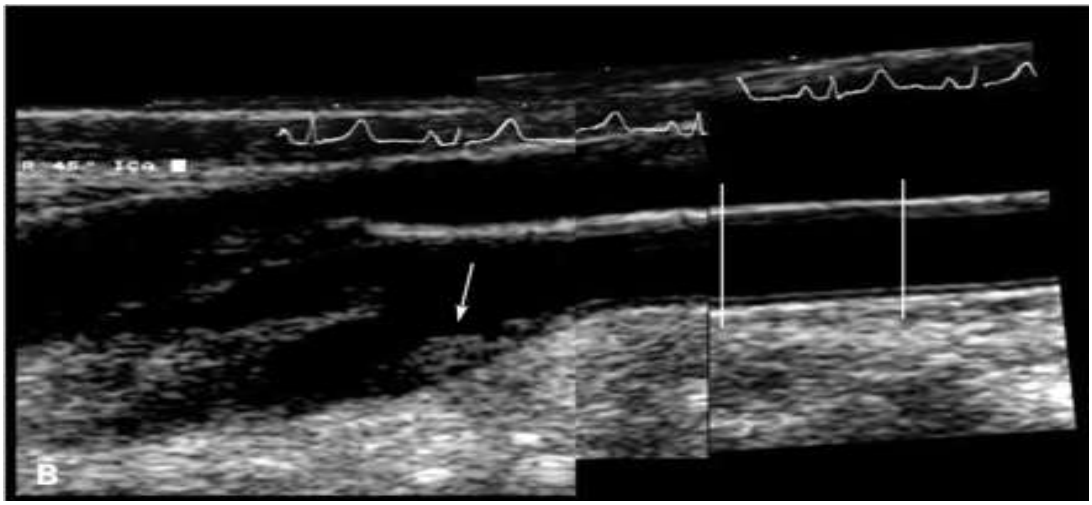
MATERIAL AND METHODS

A cross sectional study that was conducted in the department of Medicine, Govt. Medical college and attached M.B.S. Hospital, Kota from Dec. 2010 to Dec. 2011. Patients with Acute coronary syndrome, attending the out patients clinic, admitted in various wards who were symptomatic were enrolled in the study.

Trained radiologist measured common carotid artery intima-media thickness using B-Mode ultrasound. A Hewlett Packard 2000 high-resolution ultrasound unit with a 7.5 MHz transducer was used for imaging. It relies on acoustics characteristic of tissues to generate longitudinal and cross-sectional images of the near and far walls of the artery and of the lumen.

Pignoli et al defined the intima –media thickness as the distance from the leading edge of the first echogenic line to the leading edge of the second line on the near wall. At each longitudinal projection three determinations of intima media thickness were conducted at the site of the maximum thickness and at two points, 1 cm upstream and 1 cm downstream from the site of maximum thickness. The three values of both sides were average to get the mean intima media thickness measured in millimeters.





A. The CCA image is taken just before the carotid artery bulb (≈5 mm). The carotid artery bulb is measured at the level of the proximal ICA sinus, typically centered on the flow divider. The ICA measurement is made in the ICA where the walls are again parallel (ICA IMT). **B**. The CCA IMT is measured between 5 and 15 mm before the carotid bulb (lines), whereas the maximum IMT is measured at the site of the thickest wall in the carotid artery bulb or proximal ICA IMT (arrow).

Statistical methods used were unpaired student's t-test and determination of correlation coefficient (r value) and other variables by using Graph Pad InStat Version 3.10.

A value of $p>0.05$ is considered as not significant, $p<0.05$ as mildly significant, $p<0.01$ as significant, $p<0.001$ as highly significant, $p<0.0001$ as very significant that determine the significant independent risk factors of diastolic dysfunction.

Results

Table : mean values, standered deviation and standered error of mean of various parameter s of all the subjects of acute coronary syndrome and controls.

	ACUTE CORONARY SYNDROME (Total No.=100)			CONTROL (Total No.=70)		
VARIABLES	MEAN	S.E.	STD.DEV.	MEAN	S.E.	STD.DEV.
AGE(yrs)	54.83	1.075	10.75	55.67	1.61	9.57
Male(age-yrs)	54.0	1.2	10.8	57.20	1.7	8.5
Female(age-yrs)	57.47	2.1	10.07	51.80	3.5	11.2
BMI(kg/m2)	22.898	.454	4.54	21.88	.391	2.31
WHR	.896	.004	.036	.895	.005	.03

TC(mg/dl)	185.19	2.53	25.38	173.91	1.92	11.34
TG(mg/dl)	128.43	3.75	37.52	117.48	4.22	24.95
HDL(mg/dl)	42.48	.29	2.90	42.68	.20	1.2
LDL(mg/dl)	109.95	2.31	23.095	106.11	3.2	8.94
RT-CCA-IMT(mm)	.92	.03	.29	.76	.02	.12
LT-CCA-IMT(mm)	.96	.04	.38	.72	.01	.09
MEAN CCA-IMT(mm)	.94	.03	.30	.74	.02	.09
RT-ICA-IMT(mm)	.90	.03	.30	.71	.01	.09
LT-ICA-IMT(mm)	.88	.03	.34	.68	.01	.08
MEAN-ICA-IMT(mm)	.89	.02	.28	.70	.01	.07

The present study was under taken to determine the intima-media thickness of common and internal carotid artery (CCA-ICA-IMT) by high resolution B-mode ultrasonography to know relation between CCA-ICA-IMT of acute coronary syndrome (n=100) with those of control subjects (n=70). Also to study association of CCA-ICA-IMT with other risk factors like age, body mass index, waist hip ratio, hypertension, diabetes mellitus, smoking and serum lipids.

1. There was very statistically very significant ($p<0.0001$) increased CCA-ICA-IMT noticed in acute coronary syndrome patients when compared with the control subjects.
2. There was statistically significant increase in CCA-IMT noticed in acute myocardial infarction subjects when compared with the unstable angina subjects ($p<0.05$).
3. There was statistically very significant positive correlation between CCA-ICA-IMT and increasing age in both acute coronary syndrome ($p<0.0001$) and control ($p<0.0001$) groups with and without risk factor.
4. There was positive correlation between CCA-IMT and BMI in both control subjects and in acute coronary syndrome subjects. This correlation is not stastically significant ($p>.05$). BMI was statistically not significant ($p>0.05$) in acute coronary syndrome when compared with the control subjects
5. There was statistically significant positive correlation between CCA-IMT and WHR in both control ($p<0.01$) and acute coronary syndrome groups ($p<0.01$). The difference in WHR was statistically not significant ($p>0.05$) between two groups.

6. There was a statistically significant difference in CCA-ICA-IMT between hypertensives and normotensives in control group ($p<.01$) but not in acute coronary syndrome group ($p>0.05$). There was statistically highly significant difference ($p<0.001$) between two groups.
7. There was statistically significant difference in CCA-ICA-IMT between DM and non-DM in control group ($p<.01$) but not in acute coronary syndrome group ($p>0.05$). There was a statistically highly significant difference ($p<0.001$) between two groups.
8. There was statistically significant difference in CCA-ICA-IMT between smoker and non-smoker in control group ($p<.01$) but not in acute coronary syndrome group ($p>0.05$). There was statistically highly significant difference in CCA-ICA-IMT between smokers and non-smokers ($p<0.001$) in both groups with higher values in smokers.
9. There was a significant positive correlation ($p<0.01$) between CCA-ICA-IMT and LDL cholesterol in both groups but no correlation with total Cholesterol, HDL cholesterol and Triglycerides ($p>0.05$).
10. There was positive relation with the number of risk factors to increased thickness of intima-media, greater the number of risk factors higher the thickness of intima-media noticed.

DISCUSSION

Carotid atherosclerosis is important in view of its relationship to cerebrovascular ischemic disease and coronary atherosclerosis. Thus carotid intima-media thickness has been suggested as a surrogate marker for coronary atherosclerosis for use in clinical trials. Ultrasonographic assessment of common carotid artery intima-media thickness (CCA-IMT) provides a promising approach to study the natural history and determinants of the presence and progression of atherosclerosis in population based studies. The view that measurement of carotid IMT may be used as in indicator of atherosclerosis is supported by an association of IMT with cardiovascular risk factors and atherosclerosis in other arteries. There was statistically highly significant difference ($p<0.001$) in CCA-ICA-IMT between smoker of both groups. **Grethe ST et al**, in 1994 showed that with increase smoking, there was significantly greater ICA and CCA wall thickening. There was statistically highly significant difference ($p<0.001$) in CCA-ICA-IMT between hypertensives of both groups [9]. **Crouse JR et al,** 1987 showed positive correlation between hypertension and CCA-IMT [10]. There was statistically highly significant difference ($p<0.001$) in CCA-ICA-IMT between DM of both groups. **The Insulin Resistance Atherosclerosis Study (IRAS)**, **Lynne E at al i**n 1997 showed that the increased mean CCA IMT and ICA IMT ($P<.05$) were positively associated with the diabetes [11]. With increase in age, the values of mean CCA-IMT showed a statistically significant correlation in both group ($r= 0.434$, $P<0.001$ and $r= 0.457$, $P< 0.001$). . **Frost d et al** in 2000 showed positive correlation of increased CCA-IMT with age [12]. BMI was correlated with mean CCA-IMT in both control group ($r= 0.122$) and in acute coronary syndrome group ($r=0.119$).But stastically no significant difference in both group ($p>.05$). Similar results were obtained by **Nagai Y** et al, 1998 in their study [13]. In

Rotherdam study, Bots-ML 1997 significant positive association was noted with CCA-IMT for BMI [14]. The WHR was positively correlated with mean CCA-IMT in both groups (r=0.302, p<0.01 and r=0.318, p<0.01)**. The Kangwha Study, Lee YJ at al in 2008** showed that statistically significant positive association with C-IMT with the WHR (p<.05) [15] The mean CCA-IMT and ICA-IMT in acute coronary syndrome group, IWMI was 0.98 ± 0.31 mm and .92 ± 25 and in AWMI was 0.94 ± 0.31 and 0.90 ± 0.32. While in unstable angina subjects it was 0.84±0.21 mm and .81 ± .20. The difference in these values are significant (p < 0.05). In the Rotterdam study by **Bots ML et al**, (1997) a statistically significant increase in CCA-IMT was noted in myocardial infarction patients when compared with control group [14]

CONCLUSION

It is concluded from the present study that intima media thickness of common and internal carotid artery is increased in Acute Coronary Syndrome patients. Increased intima media thickness is associated with increased Age, Waist hip ratio, Hypertension, DM, LDL cholesterol and smoking.

The association of ACS, traditional risk factors and increased intima media thickness of carotid arteries suggest that intima media thickness is by itself as a powerful predictor of cardiovascular events.

B-Mode carotid ultrasonography can be utilized as a valuable screening tool due to its several advantages including ease of application, reproducibility, low cost and strong correlation with atherosclerosis. In conclusion, we demonstrated the usefulness of carotid intima-media thickness in predicting coronary artery disease but large-scale studies are required to define its role in clinical practice

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