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Radiodiagnosis

TO ASSESS MORPHOLOGY OF CAROTID ARTERY ULTRASONOGRAPHICALLY AND CORRELATE WITH THE RISK OF CORONARY HEART DISEASES

Dr. (Prof.) Saurabh Atram	Professor Department Of Radiodiagnosis, MGM Medical College & M.Y. Hospital, Indore,
Dr. Pankaj Marskole	Senior Resident Department Of Radiodiagnosis, MGM Medical College & M.Y. Hospital, Indore
Dr. Jaipal Singh	Third Year Resident Department Of Radiodiagnosis, MGM Medical College & M.Y. Hospital, Indore
Dr. Aafrin Khan	Second Year Resident Department Of Radiodiagnosis, MGM Medical College & M.Y. Hospital, Indore
Dr. Vivek Yonati*	Associate Professor, Department of Radiodiagnosis, MGM Medical college & M.Y. Hospital, Indore Postal address: 80 Babji nagar, behind Mahindra showroom near Shalimar township, Vijay nagar, Indore *Corresponding Author

ABSTRACT

BACKGROUND AND PURPOSE: CAD is a progressive disease of one or more coronary arteries that leads to restriction of blood flow to the heart. The most common cause of CAD is atherosclerosis. Atherosclerosis leads to increase in IMT and formation of plaques in arteries, involving tunica media and intima of arteries. Therefore, CIMT has been associated with CAD. The aim of our study was to assess the risk of CAD and a positive association between CIMT, carotid plaque and the risk factors of CAD.

RESULTS: A strong positive association was found between CAD and CIMT. Mean CIMT was significantly higher in patients with risk factors as compared to patients without risk factors also IMT was higher in ICA as compared to CCA and carotid bulb. Plaques and stenosis were more frequently seen in carotid bulb.

CONCLUSIONS: Carotid IMT measurement and evaluation of carotid plaques can assess the risk of CAD and positive association exist between carotid IMT, carotid plaques.

KEYWORDS : Cimt, Cad, Atherosclerosis

INTRODUCTION

CAD is a progressive disease of one or more coronary arteries that leads to restriction of blood flow to the heart. The most common cause of CAD is atherosclerosis. Atherosclerosis leads to increase in IMT and can lead to formation of plaques in coronary artery, carotid artery and extremity arteries[1]. It involves tunica media and intima of arteries therefore CIMT has been associated with incidence and prevalence of CAD[2]. Multiple factors are associated with atherosclerosis which increases the risk of CAD. These are commonly categorized as: Non-modifiable risk factors, e.g. age, gender and genetic disposition and modifiable risk factors, e.g. dyslipidaemia, hypertension, obesity, diabetes, smoking, nutrition and physical inactivity.[3]

The aim of our study was to assess the risk of CAD and a positive association between CIMT, carotid plaque and the risk factors of CAD. We also assess the RI value in patients with risk of CAD. This study was primarily focused at assessing whether increase in IMT has relation with the severity of CAD.

Atherosclerosis and its complications are major cause of morbidity and mortality in modern world. Although modern pharmacotherapy and revascularization have markedly enhanced the prognosis of patients with atherosclerotic vascular disease[3]. CAD remains the leading cause of mortality and morbidity therefore early diagnosis with screening of CIMT can significantly reduce the morbidity and mortality due to CAD.

MATERIAL AND METHODS:

This study was carried out in the Department of Radiodiagnosis, Mahatma Gandhi Memorial Medical College and Maharaja Yashwantrao Hospital, Madhya Pradesh. A total of 250 patients were included in our study who were referred to the Department of Radiodiagnosis with the clinical suspicion of coronary artery disease.

Carotid USG was done by using linear probe of 7.5 MHz of Siemens Acuson X300. Both left and right common carotid arteries are analyzed. The IMT values are calculated as an arithmetical mean from the bulb, internal carotid and common carotid segments of both sides.

Patients presenting with abnormal ECG, cardiac ECHO and elevated cardiac enzymes, with risk factors and previous history of myocardial infarction and patients having the clinical suspicion of CAD were included in our study.

Excluded: traumatic, infective or postsurgical origin of CAD, patients <20yrs.

Table 1 : criteria used for grading of stenosis[4]:

Degree of stenosis (%)	ICA PSV(cm/sec)	Degree of plaque (%)
Normal	<125	None
<50	<125	<50
50-69	125-230	≥50
≥70	>230	≥50
Near occlusion	Low, or undetectable	Visible
Total occlusion	Undetectable	Visible, no detectable lumen

RESULT

Majority of patients in our study group belonged to the age group 61-70 years (54%) with a mean age of 60.7 years of

which majority of patients were male (60%). The most common presenting complaint of patient in our study was chest pain (74%)[5].The most common risk factor in patients was dyslipidemia (76.1%), followed by smoking (35.9%) and hypertension (33.7%). The mean IMT in CCA, ICA and Carotid bulb was more in higher age group 61-70 years in our study which was more in male as compared to female[6].

Table 2: Percentage of patients according to CIMT

IMT(mm)	CCA	Carotid Bulb	ICA
<0.7	12%	11%	11%
0.7-1.0	40%	40%	41%
>1.0	48%	49%	48%

We have also seen that ICA-IMT (1.17mm) is more than CCA (1.11mm) and Carotid bulb-IMT (1.15mm).

Out of 184 patient of CAD, 38% (95) patients had carotid plaque, majority of plaques were hard plaques, about 44% were ulcerated plaques and about 93.6% were echogenic plaques (Type 2, 3 & 4)[7]. Majority of plaques were seen in Carotid bulb 54.7%, followed by ICA 29.5%[8]. We have also seen that out of 95 patients of carotid plaque, 94 were having CAD. It shows that plaque is very significant for assessing CAD (p-0.000).

We also found that stenosis was seen more frequently in carotid bulb (28.2%) than CCA (8%) and ICA (15.2%). Majority of patients had moderate stenosis followed by mild stenosis.

The mean RI value was more in higher age group and in ICA in each age group[10].

Patients with HTN, DM, dyslipidemia, smoking and obesity were having significantly higher CIMT than non-hypertensive patients (p <0.05).

DISCUSSION

In our study, out of 250 patients, 73.6% patients found to have traditional risk factors which were dyslipidemia, smoking, HTN, DM and obesity in 76.1%, 35.9%, 33.7%, 29.3% and 24.5% respectively. However, 26.4% patients had no risk factors. Similar findings were also seen in a study done by V Achari et al[11].

In our study we have observed that mean IMT in carotid artery in 40-50 years, 51-60 and 61-70 years are 0.94mm, 1.07mm and 1.20mm respectively. It implies that with advancing age there is increase in mean IMT in carotid artery. Similar observations were also seen in the study conducted by Joseph P. et al[6].

The mean CIMT was higher in male (1.21mm) than female (1.02mm). Similar results were also seen in a study conducted by Heiss G et al[12].

We noticed that the mean CCA-IMT, ICA-IMT and carotid bulb-IMT was 1.08mm, 1.30mm and 1.17mm respectively in patients with risk factors while it was 0.73mm, 0.87mm and 0.77mm respectively in patients with no risk factors (p < 0.05). This suggests that mean CIMT is significantly higher in patients with risk factors. Similar observations were seen in the study conducted by Yogesh Saxena et al[13].

We have shown that the mean IMT of CCA, ICA and carotid bulb was 0.99mm, 1.15mm and 1.06mm respectively. It showed that IMT was higher in ICA as compared to CCA and carotid bulb. Similar observation also seen in the study done by Joseph P. et al[6].

Out of 184 patient of CAD, 38% patients were found to have plaque in carotid artery, of these 38%, 6.4% were soft plaque, 93.6% were calcified (hard) plaque and 44% were ulcerated

plaques. Type 1, 2, 3 and 4 plaques were present in 6.4%, 42.1%. 43.1% and 8.4% patients respectively. Type 1 & 2 were echolucent plaques and type 3 & 4 were echogenic plaques. There is low prevalence of type 1 and type 4. Thus echogenic plaques were found in more number of patients. Similar results were also seen in a study conducted by Amit Singh et al[14].

The plaques in CCA, carotid bulb and ICA were seen in 15.8%, 54.7% and 29.5% patients respectively. Thus we found that plaques were more frequently seen in carotid bulb (54.7%). Similar result is also seen in a study done by Teak-Geun K. et al[8].

In our study we observed that the distribution of plaques on the bilateral side , left and right side of carotid arteries were 82%, 11.7% and 6.3% respectively. Similar observations were seen in the study done by Mariana Selwaness et al[15].

We have also seen that out of 95 patients of carotid plaque, 94 were having CAD. It shows that plaque is very significant for assessing CAD (p-0.000).

Total of 15 (8%) patients out of 184 patients had stenosis in CCA, which 9 (60%) patients had mild stenosis, 4 (26%) had moderate and 2 (13.4%) had severe stenosis. Similarly, total of 28 (15.2%) patients were having stenosis of ICA, out of which 9 (36.6%) had mild stenosis, 14 (50%) had moderate stenosis and 5 (13.4%) patients had severe stenosis. Whereas total of 52 (28.2%) patients were found to have stenosis in carotid bulbs, out of which 13 (25%) had mild stenosis, 31 (59.6%) had moderate stenosis and 8 (15.4%) patients had severe stenosis. So we found that stenosis was seen more frequently in carotid bulb (28.2%) than CCA (8%) and ICA (15.2%).

The mean RI value in CCA, carotid bulb and ICA was 0.66, 0.68 and 0.71 in age group 40-50 years, 0.70, 0.73 and 0.75 in age group 51-60 years and 0.76, 0.79 and 0.82 in age group 61-70 years respectively. Thus RI value was more in higher age group and also more in ICA in each age group. Sidharth Das et al[11] in his study found that patients of CAD with risk factors were having High RI value.

(Table 3): The statistical results of IMT for assessing CAD in carotid vessels were significant in our study.

Table 3: Accuracy of CIMT in predicting CAD

	CCA-IMT	Carotid bulb IMT	ICA-IMT
Sensitivity	81%	85.5%	82.6%
Specificity	97%	90.9%	95.5%
PPV	98.6%	96.34%	98.06%
NPV	64.64%	69.79%	66.32%

CONCLUSION

Carotid USG is safe, reproducible, sensitive and specific modality for assessing the vulnerability of plaques in determining the risk of CAD. Measuring the CIMT and evaluation of carotid plaques can assess the risk of CAD and positive association exist between CIMT, carotid plaques, its type and morphology as well as unstability of plaques with the risk of CAD. By assessing the IMT especially ICA-IMT, we can predict the risk of CAD. Therefore, we recommend that Carotid Ultrasonography should be done in every patient who is suspected clinically of CAD for evaluation of CIMT, plaques morphology and Doppler characteristics, thereby help in early diagnosis which can significantly reduce the morbidity and mortality due to CAD.

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