Co-Relationof Carotid Artery Intima Media Thickness with Coronary Artery Disease

Joanne Elizabeth Mathew[1],Dr. S.R Tankiwale[2],Dr. Sourya Acharya[3]

[1,] *Student, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha, Maharastra*
[2,] *Professor, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha, Maharastra*
[3,] *Professor, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha, Maharastra*

Abstract:

Introduction :*Cardiovasculardiseasesgenerally go undiagnosedbefore the onset of symptoms and thereforethereis a need for modalitiesthat are reliable, cost-effective, easy to perform, with minimal limitations and thatcanact as earlyindicators of CoronaryArteryDisease. In recentyears, a multitude of studies have focused on CarotidArtery Intima Media Thickness (CAIMT) as an earlypredictor of CoronaryArteryDisease (CAD). This studyaims to find the co-relation between CAIMT and CAD.*

Materials and Methods : *This cross-sectional, retrospectivestudywasconducted on a sample size of 50 cases ofuncomplicated CAD. The patietntsweresubjected to CAIMT measurementusing B mode ultrasonography.*

Results *: 45 (90%) of the 50 cases that were diagnosed cases of CAD showed increased carotid artery intima media thickness with a mean of 1.17 ± 0.21. The findings were seen to be statistically significant (P=0.0001).*

Conclusion: *Increased carotid intima media thickness is a marker for coronary artery disease. It may have considerable importance as a screening tool for coronary artery disease and may improve risk stratification.*

Keywords: *Carotid Artery Intima Media Thickness, Coronary Angiogram, Coronary Artery Disease, Ultrasound*

I. Introduction

Cardiovascular disease is the number one cause of death globally. According to the World Health Organization, an estimated 17.5 million people died from cardiovascular diseases in 2012, of which 7.4 million were due to Coronary Artery Disease (CAD) alone [1]. With the steadily rising numbers and the high mortality rate associated with CAD, it is not surprising that countless hours and resources have been spent trying to tackle the problem.

Coronary Artery Disease can present with a myriad of symptoms such as angina which is seen in 50% of those diagnosed with obstructive CAD [2], amongst others such as fatigue with minimal exertion, palpitations, epigastric discomfort which are all labelled as 'anginal equivalents'. However, these symptoms are poorly linked to CAD as they are not only non-specific but might manifest only after significant narrowing of the vessels has occurred. A long asymptomatic latent period which is seen clinically for coronary artery disease emphasizes the need for an early diagnosis. If detected early, targeted preventive measures can be initiated in an attempt to retard the progression of the disease.

The gold standard to diagnose CAD remains Coronary Angiography[3]. However, in addition to the increased cost, Coronary Angiography is associated with complications such as infection, local vascular injury, myocardial infarction, stroke , complications related to the contrast material used or to the anesthesia and in some cases even death[4]. For these aforementioned reasons, in cases of suspected CAD that are stable and presenting with angina or other symptoms suggestive of ischemic heart disease and not experiencing any acute coronary events, are subjected to non-invasive modalities initially [5].

Non-invasive methods are used to improve risk stratification in patients with a clinical suspicion of CAD so as to guide physicians for further procedures and interventions and may enable assessment of presymptomatic lesions, eventually reducing the death and disability associated with coronary artery disease. Non-invasive procedures are broadly classified as either functional such as a stress electrocardiography or anatomic tests such as coronary CT angiography (CCTA), coronary magnetic resonance angiography (MRA), and coronary artery calcium scoring (CACS). However, these tests are not without limitations. In low-risk individuals, these limitations have led researchers to look for more cost-effective, reliable and non-invasive modalities in an attempt to detect CAD at its primordial stages.

Since its inception in the 1940's, medical ultrasonography has had a numerous applications. However, it wasn't until 1986, that Pignoli et al [6]reported using ultrasound to measure the Carotid Artery Intima Media Thickness. In 1991, Salonen et al[7] demonstrated the use of intima media thickness in the detection of atherosclerotic changes in the carotid arteries. CAIMT has since been the focal point in a multitude of studies as it is a relatively inexpensive, reliable and a non-invasive parameter that can be used in the detection of

atherosclerosis [8]. Increased media thickness has also been associated with myocardial infarction [9] and stroke[9].In low- and middle- income countries where over three quarters of the CAD global burden exists [1], the CAIMT measurement may prove to be an invaluable tool.

Keeping the above information in mind, this current study aims to determine the relation, if any, between Carotid Artery Intima Media Thickness and Coronary Artery Disease.

II. Objectives

The present study is designed to
1.1 Evaluate the CAIMT in cases of CAD
1.2 To correlate CAIMT with CAD

III. Materials And Methodology

This cross-sectional, retrospective study was conducted at AcharyaVinobaBhave Rural Hospital (AVBRH), Sawangi, Maharastra. The study included 50 cases of uncomplicated coronary artery disease admitted in AVBRH. The study did not include those who were non-ambulatory, those who had complications of coronary artery disease, patients with cardiogenic shock, or those who were not willing for inclusion in the study.

All cases included in the study were previously diagnosed cases of CAD using Coronary Angiography. The patients with ischemic heart disease involving any site were included. The patients were further evaluated by recording electrocardiographic changes, vital parameters, any signs of cardiac failure and peripheral pulsations including the carotid pulsations.

All the patients meeting the requirements were subjected to Carotid Doppler. The operator was blinded with respect to the findings of the coronary angiogram and the clinical evaluation. Both the external carotid arteries were evaluated for any plaque or calcification and the carotid intima media thickness was measured. The intima media thickness was evaluated using Phillips EnVisor Ultrasound Machine in the USG B mode. Using student's t-test, an attempt was made to correlate the Carotid Artery Intima Media Thickness and Coronary Artery Disease.

Strong confidentiality was maintained regarding the identity of patients as well as health care providers and informed consent was taken from all patients.

The proposed work was carried out according to the ethical guidelines prescribed by Central Ethics Committee on Human Research (C.E.C.H.R).
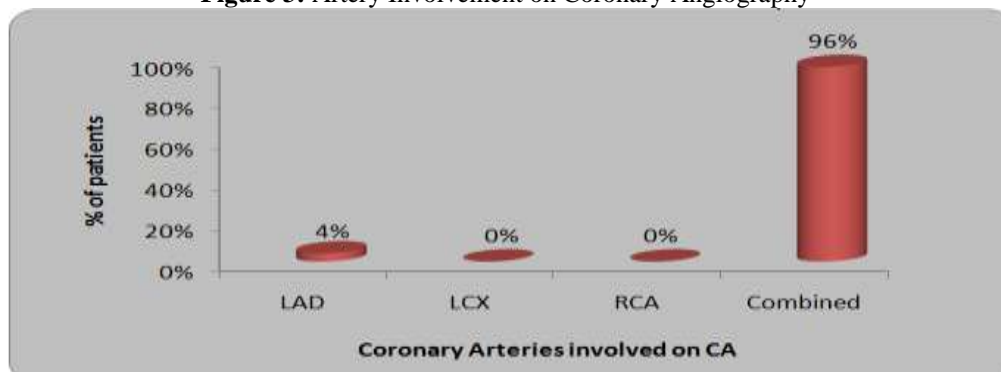
IV. Results

On Coronary Angiography, the Left Anterior Descending Artery was involved in 2 (4%) cases and there was multiple artery involvement in 48 (96%) of the cases.

Table 3: Artery Involvement on Coronary Angiography

	Number	%
LAD	2	4
LCX	0	0
RCA	0	0
Combined	48	96

**Figure 3:** Artery Involvement on Coronary Angiography

The data showed that 45 of the 50 patients had an increased carotid artery intima media thickness (>0.9mm) with a mean of 1.17 ± 0.21. The other 5 patients showed a normal intima media thickness (0.71-0.9mm) with a mean of 0.86 ± 0.21. The findings showed a statistically significance (P=0.0001).

Table 4: Co-relation of CAIMT with CAD

| CAIMT	N	Mean	Std. Deviation	Std. Error Mean	t-value
0.71 to 0.9 mm	5	0.86	0.05	0.01	4.61
>0.9 mm	45	1.17	0.21	0.02	P=0.0001,S

Figure 4: Co-relation of CAIMT with CAD
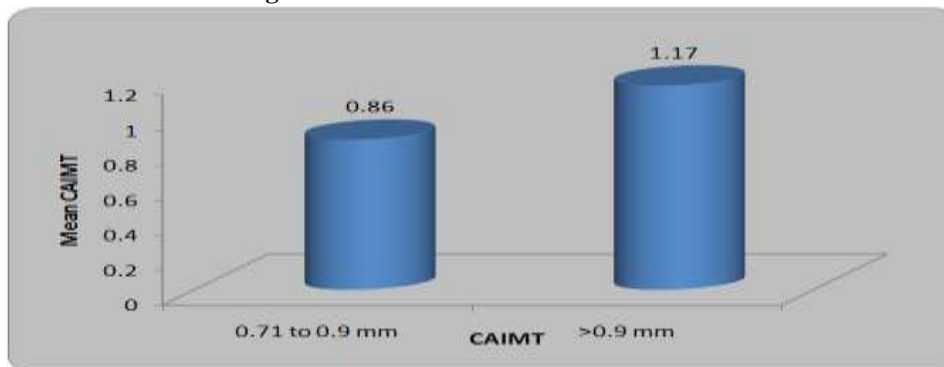
Of the 50 patients, 45 (90%) of the cases had increased Carotid Artery Intima Media Thickness (>0.9mm). The remaining 5 (10%) patients showed a normal intima media thickness (0.71-0.9mm).

Table 4: Percentage of patients with normal CAIMT and abnormal CAIMT

	Number	%
Normal	5	10
Abnormal	45	90
Total	50	100

Figure 4: Percentage of patients with normal CAIMT and abnormal CAIMT
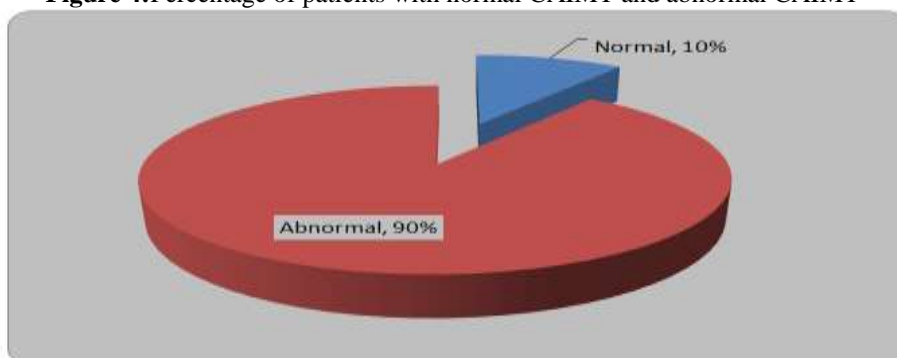
V. Discussion

The present study was conducted in the Department of Internal Medicine, AcharyaVinobaBhave Rural Hospital, Sawangi (Meghe), a tertiary level hospital.The study aimed to evaluate the Carotid Artery Intima Media Thickness (CAIMT) in cases of Coronary Artery Disease (CAD) and co-relate the findings of the same.The CAIMT was measured using B mode ultrasonography and it was read by an observer blinded to the results of the coronary angiogram. In healthy middle-aged adults, the normal carotid artery intima media thickness lies between 0.6 and 0.7 mm, while intima media thickness of 1 mm or more has been linked to a significant increased risk of developing Coronary Artery Disease[10]. Using these values as a reference, we used 0.9mm as the cut-off for normal thickness.

In this study, 45 (90%) of the 50 cases that were diagnosed cases of CAD showed increased carotid artery intima media thickness with a mean of 1.17 ± 0.21. The findings were seen to be statistically significant (P=0.0001). This was similar to a study done by UgurCoskun et al[11] which showed that the mean CAIMT in patients with CAD was 1.48 ± 0.28 (p=0.001) compared to the control group with a mean intima media thickness of 0.78±0.21. The findings were also similar to a study done by G. Geroulakos et al[12] which showed that CAIMT was significantly higher in patients of CAD with a mean intima media thickness of 0.9±0.17mm (P<005) in patients of single vessel disease, 0.96±0.17mm (P<0.01) in two vessel disease and 0.99± 0.21mm (P<0.01)in three-vessel disease.

The Carotid Artery Intima Media Thickness has been the focal point of numerous studies. The Atherosclerosis Risk in Communities (ARIC) Study [13] was conducted on 15,792 individuals. The carotid artery intima media thickness was measured at the beginning of the study and then repeated at intervals of 4-7 years using B mode ultrasonography. An increase in CAIMT was shown to be correlated with an increased risk for CAD. Another study showed that the Carotid Artery Intima Media Thickness actedas a surrogate marker of Atherosclerosis in Patient with Chronic Renal Failure on Hemodialysis [14]. Other studies showed that the CAIMT was useful in monitoring the usefulness of preventive strategies like lifestyle changes in the progression of atherosclerotic heart disease[15, 16, 18].

Currently, there is a growing consensus that the Carotid Artery Intima Media Thickness is useful in risk prediction in asymptomatic individuals or people who are at risk of developing coronary artery diseases. The American Heart Association at a conference in 2001 recommended the use of CAIMT for risk stratification in patients suspected of CAD[17]. In 2008, the American Society of Echocardiography issued a similar statement recommending the use of CAIMT in identifying subclinical cases of CAD and evaluating the risk of developing cardiovascular diseases in patients with an intermediate risk [18].

This study was not without limitations. The study had a small sample size of 50 patients. In addition, interobserver variation in the reading of the Carotid Artery Intima Media Thickness is possible in such studies.

VI. Conclusion

Since the gold standard for Coronary Artery Disease remains a Coronary Angiogram which is invasive and not without its own limitations, it cannot be used routinely and should be used only in cardiac emergencies or when there is a strong clinical suspicion in favor of CAD. In this study, it was found that increased carotid intima media thickness, which is measured non-invasively, is a marker for coronary artery disease. When used with other non-invasive modalities, CAIMT may prove useful in clinical practice as it may increase the level of clinical suspicion for CAD. It has proved to be reliable, cost-effective screening tool for Coronary Artery Disease.

References

[1]. Cardiovascular Diseases (CVD's)-WHO Factsheet
a. http://www.who.int/mediacentre/factsheets/fs317/en/ [last checked on 30.11.2016]
[2]. Lloyd-Jones D, Adams RJ, Brown TM, et al. Heart disease and stroke statistics—2010 update: a report from the American Heart Association. Circulation. 2010 Feb 23;121(7):e46-e215.
[3]. Kasliwal, Ravi R., et al. "Carotid intima–media thickness: Current evidence, practices, and Indian experience." Indian journal of endocrinology and metabolism 18.1 (2014): 13.
[4]. Tavakol M, Ashraf S, Brener SJ. Risks and complications of coronary angiography: a comprehensive review. Global Journal of Health Science. 2012 Jan;4(1):65-93.
[5]. Skelly AC, Hashimoto R, Buckley DI, et al. Noninvasive Testing for Coronary Artery Disease .Comparative Effectiveness Reviews, No. 171. Rockville (MD): Agency for Healthcare Research and Quality (US) 2016 Mar.
[6]. Pignoli P, Tremoli E, Poli A, Oreste P, Paoletti R. Intimal plus medial thickness of the arterial wall: A direct measurement with ultrasound imaging. Circulation.1986;74:1399–6.
[7]. Salonen, Jukka T., and RiittaSalonen. Ultrasonographically assessed carotid morphology and the risk of coronary heart disease. Arteriosclerosis, Thrombosis, and Vascular Biology 11.5 (1991): 1245-1249.
[8]. Van der Meer, Irene M., et al. Predictive Value of Noninvasive Measures of Atherosclerosis for Incident Myocardial Infarction The Rotterdam Study. Circulation 109.9 (2004): 1089-1094.
[9]. O'Leary, Daniel H., et al. "Carotid-artery intima and media thickness as a risk factor for myocardial infarction and stroke in older adults." New England Journal of Medicine 340.1 (1999): 14-22.
[10]. Jacoby, Douglas S., Emile R. Mohler III, and Daniel J. Rader. Noninvasive atherosclerosis imaging for predicting cardiovascular events and assessing therapeutic interventions. Current atherosclerosis reports 6.1 (2004): 20-26.
[11]. Coskun, Ugur, et al. Relationship between carotid intima-media thickness and coronary angiographic findings: a prospective study. Cardiovascular ultrasound 7.1 (2009): 1.
[12]. Geroulakos, Get al, et al. "The carotid intima-media thickness as a marker of the presence of severe symptomatic coronary artery disease." European Heart Journal 15.6 (1994): 781-785.
[13]. Chambless, Lloyd E., et al. "Association of coronary heart disease incidence with carotid arterial wall thickness and major risk factors: the Atherosclerosis Risk in Communities (ARIC) Study, 1987–1993." American journal of epidemiology 146.6 (1997): 483-494.
[14]. Paul, Jayanta, SomnathDasgupta, and MrinalKantiGhosh. "Carotid artery intima media thickness as a surrogate marker of atherosclerosis in patient with chronic renal failure on hemodialysis." North American journal of medical sciences 4.2 (2012): 77.
[15]. Kablak-Ziembicka A, Tracz W, Przewlocki T, Pieniazek P, Sokolowski A, Konieczynska M. Association of increased carotid intima-media thickness with the extent of coronary artery disease. Heart. 2004;90:1286–90.
[16]. Cobble, Michael, and Bradley Bale. Carotid intima-media thickness: knowledge and application to everyday practice.Postgraduate medicine 122.1 (2010): 10-18.
[17]. Smith SC, Jr, Amsterdam E, et al. Prevention Conference V: Beyond secondary prevention: Identifying the high-risk patient for primary prevention: Tests for silent and inducible ischemia: Writing Group II. Circulation. 2000;101:E12–6.
[18]. Stein, James H., et al. "Use of carotid ultrasound to identify subclinical vascular disease and evaluate cardiovascular disease risk: a consensus statement from the American Society of Echocardiography Carotid Intima-Media Thickness Task Force endorsed by the Society for Vascular Medicine." Journal of the American Society of Echocardiography 21.2 (2008): 93-111.