



## Cardiovascular

## CORRELATION OF INTIMA-MEDIA THICKNESS IN CAROTID & FEMORAL ARTERIAL BEDS ON DOPPLER ULTRASOUND WITH LIPID PROFILE AND FRAMINGHAM RISK SCORE IN ASYMPTOMATIC INDIAN POPULATION – A C.A.R.D.I.A.C STUDY

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**ABSTRACT**

**Background:** Cardiovascular diseases (CVD) and related deaths are on the rise. An efficient way to curb the mortalities by CVD is early detection of the atherosclerotic plaques for which carotid & femoral doppler bilateral B-mode ultrasound can be used to detect plaque in measure the IMT (intima-media thickness). In asymptomatic patients suspected to have subclinical atherosclerosis, scores like Framingham risk score (FRS) can be calculated in order to predict 10 years risk. **Objectives:** This study focuses on estimating the prevalence of plaque and future risk of atherosclerotic complications in asymptomatic population and measuring the intima-media thickness (IMT) of common carotid artery and common femoral artery with its age specific distribution as an index of subclinical atherosclerosis/CVD and correlate it with lipid profile. It also calculates 10-year risk via FRS and the predictive value of CCA-IMT, CFA-IMT and the Framingham risk score (FRS) for plaque formation in an Indian population of 200 subjects who underwent ultrasonography of both carotid and femoral arteries. **Study design:** Screening of extracranial carotid system and femoral arterial bed with B-mode ultrasound was performed in 200 asymptomatic patients as preventive cardiac check-up and those with relevant family history. Measurements of IMT were recorded over a 1 cm segment in the far wall of the arteries; the prevalence of plaque (focal IMT > 1.5 mm) was studied. Imaging results were correlated with lipid profile. FRS was calculated for each patient. **Results:** A total of 21 (10.5%) subjects had atherosclerotic plaques. Out of which 13 (6.5%) had right carotid plaques; 11 (5.5%) had left carotid plaques; 7 (3.5%) had right femoral plaques; 6 (3%) had left femoral plaques. The mean right CIMT was 0.686 +/- 0.1687 mm (0.4-1.4mm); the mean left CIMT was 0.684 +/- 0.1640 mm (0.4-1.2 mm); the mean right CFIMT was 0.598 +/- 0.1567 mm (0.4 to 1.6mm); the mean left CFIMT was 0.573 +/- 0.1343 mm (0.4 to 1.2mm). Significantly higher mean right CIMT was observed in high FRS as compared to intermediate and low FRS grade. **Conclusions:** Early screening for subclinical atherosclerosis is feasible with doppler ultrasound and correlates with lipid profile (LDL, triglycerides and cholesterol). Both CIMT, CFIMT independently predict incident plaque burden beyond traditional risk factors and correlate with FRS.

**KEYWORDS :** Carotid Doppler, Plaque, Intima-Media Thickness, Risk Score, Common Femoral Artery.

**INTRODUCTION:**

Atherosclerotic diseases are amongst the leading mortality causes in the world. Cardiovascular diseases, stroke, and myocardial infarction frequently occur without any prior symptoms. Hence, primary prevention of atherosclerotic events is crucial to identifying asymptomatic subjects at high risk of subclinical atherosclerosis. Doppler B-mode ultrasound is a non-invasive technique widely used to detect the early changes of atherosclerosis in arterial beds and detect plaques and thickened intima-media. CIMT, CFIMT and specific plaque characteristics such as the hypoechoogenicity, ulcerations and significant luminal stenosis are related to an increased risk of stroke in asymptomatic subjects. Moreover, an increased IMT is an independent factor for stenosis progression in patients with asymptomatic moderate (50–69%) stenoses [1]. Although the relationship between individual vascular risk factors and plaque formation and progression has already been studied, the cumulative effect of individual risk factors on plaque burden by calculating risk scores like FRS in Indian population has not yet been explored. To our knowledge, no data is currently available about a clinical predictive risk score like FRS on Indian population. We aimed to investigate if the IMT and the Framingham risk score, composed of the sum of single vascular risk factors (sex, age, hypertension, diabetes, dyslipidaemia, smoking), were predictive of plaque progression in Indian patients with or without detectable plaque at baseline. [2]

Calculating IMT and plaque detection on B-mode ultrasound is a screening imaging technique and also found to be a suitable non-invasive method to visualise the arterial wall and to monitor early stages of the atherosclerotic process. The clinical relevance of the ultrasonographic assessment of atherosclerosis is demonstrated by its strong prediction of future coronary and cerebrovascular events. Nine studies, with over 38,000 subjects combined, have demonstrated that carotid plaque detected by ultrasonography significantly predicts future CV events. [3]. Carotid sonography has largely replaced angiography for suspected extra cranial carotid atherosclerosis. The

biggest advantage of sonography is the ability to characterise plaques and identify those with higher risks of embolization besides estimating the degree of stenosis.

The National Cholesterol Education Program (NCEP) recommends calculating 10 years risk score of CVD by Framingham Risk Score (FRS). In general FRS is found to perform well in most Asian regions (with AUC 0.7-0.8) implying FRS is appropriate for Asian population as per a study conducted in March 2023 in Malaysia. [4] Framingham risk score is a sex-specific algorithm used to estimate the 10-year cardiovascular risk of an individual, i.e., chances of developing cardiovascular disease. The algorithm was first developed based on data obtained from the Framingham Heart Study, to estimate the 10-year risk of developing coronary heart disease. We, in this study, aim to see the correlation of CIMT, CFIMT with markers like lipid profile along with Framingham risk score to satisfactorily determine the 10 years CV risk in asymptomatic patients of Indian origin with relevant family history.

**MATERIALS AND METHODS:**

Study was done on 200 patients who presented for preventive cardiac check-up and those who had relevant family history of CAD. Blood samples were collected and lipid profile was done. B-mode ultrasound was performed on Panasonic Cardio Health Station with a 9 MHz linear transducer to detect any plaque in extra cranial carotid system, femoral arterial beds and to measure IMT in a 1 cm segment of far wall of the arteries, 1 cm proximal to the flow divider. Plaque was defined as any focal thickening >1.5mm protruding into lumen of the scanned vessel which was first determined by acquiring images in the short axis (transversal view) and then reconfirmed on longitudinal axis view. Within 1 cm region of interest, the system tracks 24 spatial measurements at 200 frames/sec for a total of 4,800 measurements every second. Thus, the reported IMT values were an average of 24 spatial measurements over a 1 cm region at end diastole. Further, relevant history was taken to calculate FRS.

Imaging results were correlated with:

- Lipid profile (Total cholesterol, High density lipoproteins (HDL) Low density lipoproteins, Triglycerides)
- Framingham Risk Score.



Image 1: Panasonic cardio health station

**Statistical Analysis:**

The collected data was entered in Microsoft Excel. Data were analysed and statistically evaluated using SPSS-PC-25 version.

**RESULTS:**

**Table no.1: Distribution of the cases according to plaque in different arteries**

N= 200	No.	%
Right common carotid	13	6.5
Left common carotid	11	5.5
Right common femoral	7	3.5
Left common femoral	6	3
Overall	21	10.5



Image 2: Right CCA plaque

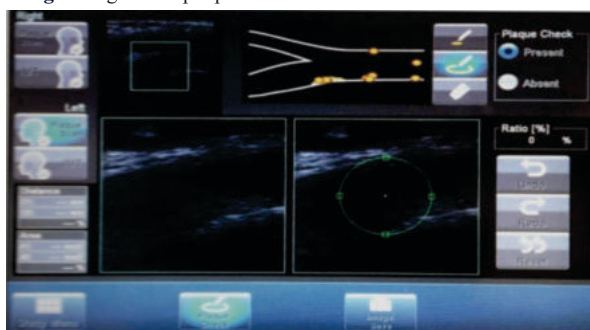


Image 3: Left CCA Plaque

**Table no. 2: IMT of different arteries**

	N	Minimum	Maximum	Mean	Standard deviation
Rt. CIMT	200	0.4	1.4	0.686	0.1687
Lt. CIMT	200	0.4	1.2	0.684	0.1640
Rt. CFIMT	200	0.4	1.6	0.598	0.1567
Lt. CFIMT	200	0.4	1.2	0.573	0.1343

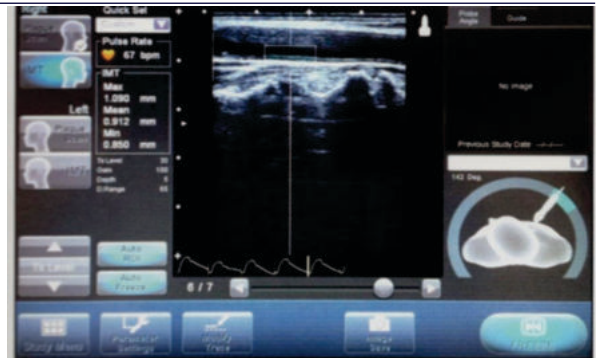


Image 4: Thickened carotid Intima-medial thickness of right carotid artery (1.090mm)

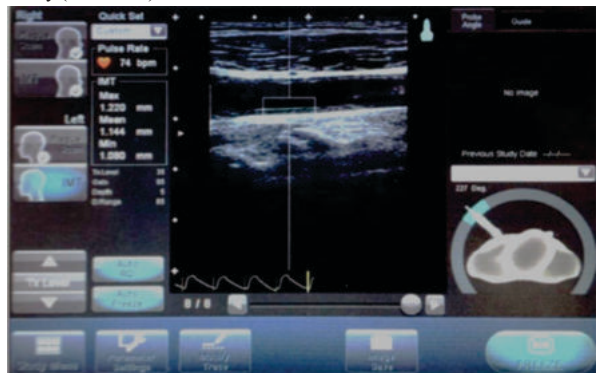
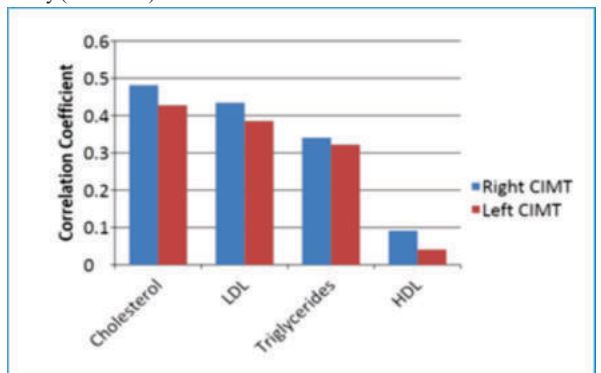


Image 5: Thickened carotid Intima-medial thickness of left carotid artery (1.144mm)



Bar Chart showing correlation of lipid profile with right and left CIMT

**Table no.3: Association of FRS with IMT at different arteries**

FRS		Rt. CIMT	Lt. CIMT	Rt. CFIMT	Lt. CFIMT
High (N=6) (>21)	Mean	0.958	0.918	0.683	0.75
	SD	0.206	0.1755	0.17	0.2336
Intermediate (N=58)(11-20)	Mean	0.754	0.737	0.632	0.596
	SD	0.1945	0.1932	0.2167	0.1695
Low (N=136) (1-10)	Mean	0.645	0.651	0.579	0.556
	SD	0.132	0.1342	0.1187	0.1026
P value LS		<0.001 S	<0.001 S	0.036 S	0.001 S

**DISCUSSION :**

- In our study, proportion of the cases with high and intermediate FRS were significantly more in the presence of plaque (23.81% vs 0.56%) and (57.14% vs 25.70%) respectively. Our study correlates with other studies which have shown that in the presence of plaque FRS was significantly higher than in its absence.
- Proportion of the cases were significantly more in males as compared to females in intermediate FRS grade (38.73% vs. 5.17%) while in low FRS grade, cases were more in females as compared to males (94.83% vs. 53.04%) (p<0.001 S).
- A significant positive fair correlation existed between the right CIMT and cholesterol (r= 0.481, p< 0.001s) with LDL (r= 0.434, p< 0.001s) and triglycerides (r= 0.341, p< 0.001s) but no

- significant, poor correlation was observed between right CIMT with HDL ( $r=0.091$ ).
- A significant, positive fair correlation existed between the left CIMT and cholesterol ( $r=0.427$ ,  $p<0.001s$ ) with LDL ( $r=0.385$ ,  $p<0.001s$ ) and triglycerides ( $r=0.322$ ,  $p<0.001s$ ) but no significant, poor correlation was observed between left CIMT with HDL ( $r=0.041$ ,  $p=0.56$  NS).
  - A significant, positive fair correlation existed between the right CFIMT and cholesterol ( $r=0.329$ ,  $p<0.001s$ ) with LDL ( $r=0.343$ ,  $p<0.001s$ ) and triglycerides ( $r=0.262$ ,  $p<0.001s$ ) but no significant, poor correlation was observed between right CFIMT with HDL ( $r=-0.035$ ,  $p=0.618$  NS).
  - A significant, positive fair correlation existed between the left CFIMT and cholesterol ( $r=0.256$ ,  $p<0.001s$ ) with LDL ( $r=0.209$ ,  $p<0.001s$ ) and triglycerides ( $r=0.230$ ,  $p<0.001s$ ) but no significant, poor correlation was observed between left CIMT with HDL ( $r=-0.020$ ,  $p=0.78$  NS).
  - A significant, positive fair correlation existed between the bilateral CIMT, CFIMT and total cholesterol with LDL and triglyceride but no significant, poor, correlation was observed between bilateral CIMT, CFIMT with HDL.
  - Framingham risk score classified the risk groups into three categories: Low risk (0-10), Intermediate risk (11-20) and high risk ( $>21$ )
  - Significantly higher mean right CIMT was observed in high FRS as compared to intermediate and low FRS grade.
  - FRS and IMT correlate well in positive prediction of 10 years CV risk in Indian population.

**Conflicts of Interest:** Nothing to Disclose.

**Data Availability Statement :** No new data were generated or analysed in support of this research

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