

Original Research Article

A study of carotid intima media thickness (CIMT) in cases of ischemic stroke

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ABSTRACT

Background: Measurement of Carotid Intima Media Thickness (CIMT) by carotid doppler is a non-invasive, safe and inexpensive investigation. CIMT may predict ischaemic stroke. However, the data about the usefulness of CIMT as a predictor in Indian scenario is relatively less. The primary objective of the present study was to determine utility of CIMT as a predictor of ischemic stroke.

Methods: This study was a case control study carried out at a tertiary care institute. The study included fifty cases of ischaemic stroke. Fifty age and sex matched controls were selected who were not relatives of cases.

Results: A detailed history of cases and controls was taken. They were subjected to routine investigations; blood sugars and lipid profile were sent. CIMT was measured by doing carotid doppler study on both sided carotid arteries. The results were analysed.

Conclusions: From this study, we concluded that there is increase in CIMT in patients of ischemic stroke. Age, gender and side of the vessel had no significant effect on CIMT. It was concluded that CIMT value has a direct correlation with ischemic stroke. Thus, Carotid intima media thickness can be used as a non-invasive predictor of future ischemic stroke incidence.

Keywords: Carotid Doppler, CIMT, Ischaemic stroke

INTRODUCTION

Cerebrovascular diseases rank foremost among all the disorders of the CNS.¹ It is the second leading cause of death worldwide.²

The current World Health Organization definition of stroke (introduced in 1970 and still used) is “rapidly developing clinical signs of focal (or global) disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin”.³ In most cases atherosclerosis of the large extra-cranial arteries is the underlining cause of focal cerebral ischemia.⁴ Atherosclerosis in the proximal

ICA is most severe in the first 2 cm and two mechanisms explain cerebral ischemia in this setting: local cerebral embolization from thrombus and reduced cerebral perfusion secondary to stenosis.⁵ Intima-media thickness (IMT), is a measurement of the thickness of artery walls, by external ultrasound. Measuring carotid IMT is gaining acceptance as a non-invasive, inexpensive method to assess the extent of atherosclerosis.^{6,7}

Key advantages are:

- Lower cost compared with most other methods
- Relative comfort and convenience for the patient being examined

- Lack of need for any invasive methods
- Lack of any radiation
- If no atherosclerosis in extracranial carotids patient spared of end arterectomy.

Ultrasound can be used repeatedly, over years, without compromising the patient's short or long-term health status. If possible CIMT can be used as an independent risk factor for stroke so that timely intervention can be done in patients to prevent stroke.⁸

Changes in carotid artery intima media thickness have also been adopted as a surrogate end point for determining the success of interventions that lower the levels of low-density lipoprotein cholesterol.⁹⁻¹¹

There are only a few studies showing an association between increased carotid intima media thickness and stroke.¹² The aim of the study was to evaluate role of CIMT in patients with ischemic stroke.

METHODS

This study was a case control study carried out at a tertiary care institute. The study included fifty cases of age more than 40 years with ischemic stroke confirmed by a CT Brain. Patients having haemorrhagic stroke, evidence of obvious source of cardiac emboli and patients having chronic kidney disease were excluded from the study.

Fifty, age and sex matched controls were selected who were not relatives of cases, had no past history of heart disease or stroke, no history of hypertension, diabetes, tobacco consumption, smoking, alcohol. Written consent from all patients was taken before participating in this study and prior approval was obtained from the hospital ethical committee.

A detailed history of cases and controls was taken. They were subjected to routine investigations, blood sugars and lipid profile. Cases with cardiac symptoms, ECG changes or past history of ischemic heart disease or valvular heart disease were subjected to echocardiogram to rule out cardiac emboli. CIMT was measured by doing carotid doppler on both the carotid arteries. Imaging of both common carotid arteries up to their bifurcation was done. Intimal plaques were searched. Sites with intimal plaques were avoided during measurement of CIMT. Mean values of CIMT of two sites of a particular side were taken for calculation of CIMT of that side. The results were analysed using Pearson Chi-Square, Fisher's exact test, unpaired t test, oneway ANOVA test.

RESULTS

In this study fifty cases of ischemic stroke and fifty age and sex matched controls were taken. Out of the 50 in each group there were 30 males and 20 females. Mean age of cases was 59.52 year and that of controls was

56.86 year. The difference in age distribution of cases and controls was not significant (Table 1).

Table 1: Age distribution among study groups.

Age		Study group		Total
		Cases	Control	
40 to 45	Count	1	3	4
	Percent	2.0%	6.0%	4.0%
46 to 50	Count	7	8	15
	Percent	14.0%	16.0%	15.0%
51 to 55	Count	7	15	22
	Percent	14.0%	30.0%	22.0%
56 to 60	Count	13	6	19
	Percent	26.0%	12.0%	19.0%
61 to 65	Count	11	11	22
	Percent	22.0%	22.0%	22.0%
66 to 70	Count	6	4	10
	Percent	12.0%	8.0%	10.0%
71 to 75	Count	5	3	8
	Percent	10.0%	6.0%	8.0%
Total	Count	50	50	100
	Percent	100.0%	100.0%	100.0%
Chi-square tests				
Pearson chi-squar	Value	Df	P value	Association
	7.455	6	0.281	non-significant

There was no difference in sex distribution of the two groups (Table 2).

Table 2: Sex distribution among study group.

Study group		Sex		Total
		Male	Female	
Cases	Count	30	20	50
	Percent	60.0%	40.0%	100.0%
Control	Count	30	20	50
	Percent	60.0%	40.0%	100.0%
Total	Count	60	40	100
	Percent	60.0%	40.0%	100.0%
Chi-Square tests				
Pearson Chi-Square	Value	df	P value	Association
	0.000	1	1.000	non-significant
Fisher's Exact Test			1.000	non-significant

Table 3a: Comparison of CIMT (right) among cases and controls.

	N	CIMT mean	SD	Unpaired T test	P value
Cases	50	1.052	0.2053	14.821	<0.01
Control	50	0.580	0.0926	Difference is significant	

There is a significant difference between CIMT of cases and controls (Table 3a and 3b).

Table 3b: Comparison of CIMT (left) among cases and controls.

	N	CIMT mean	SD	Unpaired T test	P value
Cases	50	1.083	0.1828	16.972	<0.01
Control	50	0.596	0.0880	Difference is significant	

Table 4a: Correlation between age and CIMT (right) in study group.

Age (years)	N	CIMT mean	SD	One-way ANOVA test	
				F value	P value
40 to 45	4	0.675	0.2872	0.608	0.723
46 to 50	15	0.833	0.2743	Not significant	
51 to 55	22	0.736	0.2920		
56 to 60	19	0.863	0.2793		
61 to 65	22	0.855	0.2874		
66 to 70	10	0.830	0.3268		
71 to 75	8	0.838	0.2825		

Thus, patients with ischemic stroke had a higher CIMT as compared to age and sex matched controls in both the carotids. There is no correlation between age and CIMT as per the results of the study (Table 4a and 4b). There is no correlation between sex and CIMT (Table 5a and 5b).

There is no significant difference in CIMT in right and left (Table 6). This shows that CIMT is a marker for the

disease process namely atherosclerosis affecting the entire circulation.

Table 4b: Correlation between age and CIMT (left) in study group.

Age	N	CIMT mean	SD	One-way ANOVA test	
				F value	P value
40 to 45	4	0.675	0.2872	0.726	0.630
46 to 50	15	0.800	0.2803	Not significant	
51 to 55	22	0.777	0.2975		
56 to 60	19	0.897	0.2486		
61 to 65	22	0.873	0.2881		
66 to 70	10	0.910	0.3035		
71 to 75	8	0.850	0.3162		

Table 5a: Correlation between sex and CIMT (right) in all subjects.

Sex	N	CIMT mean	SD	Unpaired t test	P value
Male	60	0.820	0.2904	0.171	0.865
Female	40	0.810	0.2808	Difference is not significant	

Table 5a: Correlation between sex and CIMT (left) in all subjects.

Sex	N	CIMT mean	SD	Unpaired t test	P value
Male	60	0.846	0.3052	0.273	0.786
Female	40	0.830	0.2503	Difference is not significant	

Table 6: Difference in CIMT on left and right in all subjects.

Side	N	CIMT mean	SD	Median	IQR	Unpaired t test	P value
Right	100	0.82	0.29	0.8	0.5	0.585	0.56
Left	100	0.84	0.28	0.8	0.5	Not significant	

DISCUSSION

A cerebrovascular disease is the second leading cause of death worldwide.² Intima-media thickness (IMT) is a measurement of the thickness of artery walls, usually by external ultrasound.

In this study, we evaluated Carotid Intima Media Thickness (CIMT) in patients with ischemic stroke. There was a positive correlation between CIMT and cases having ischemic stroke as per the study done by Lorenz M et al, which was similar to results obtained in this study.⁸ The said study was a prospective study in which a large sample of 5056 subjects was followed up and end points were myocardial infarction, ischemic stroke and death. It was found that CIMT independently predicts future vascular events.

According to Homma S et al, there is a positive correlation of CIMT with age but it was not statistically significant as per results obtained in this study. As per the study by Homma S et al, mean CIMT increased in a linear manner with age.¹³ It included healthy subjects with no co morbidities with age ranging from 21 to 105. However, in the present study, the results didn't correlate with the aforementioned study. This may be due to a smaller range of age distribution in the study groups. As per study done by Juonala M et al, CIMT has a positive association to male sex but there was no significant difference in CIMT in males and females in this study.¹⁴ However, in the said study the subjects selected were between the age of 24 and 39 years. Also, CIMT difference between the sexes became insignificant after correction for risk factors and carotid diameter.

As per Hernández SAR et al, CIMT on left side is more than right but that difference was not significant in this study.¹⁵ In this study, subjects having either hypertension or ischemic stroke were used. This aspect requires further evaluation with a larger sample size and without any known atherosclerotic risk factors.⁷

CONCLUSION

From this study, we concluded that:

- There was increase in CIMT in patients of ischemic stroke
- There was no significant effect of age on CIMT
- There was no significant effect of sex on CIMT
- There was no significant difference in CIMT on left and right

From above conclusions, it was noted that CIMT value has a direct correlation with ischemic stroke.

Carotid intima media thickness can be used as a non-invasive predictor of future ischemic stroke incidence.

Common carotid artery intima media thickness can also be used in early identification of asymptomatic individuals at risk of developing complications of atherosclerosis but it requires further validation.

Increased intima media thickness may represent a way to detect and target immediate risk populations in which prevention could be more efficient.

As the burden of complications of atherosclerosis is ever increasing, especially in India, CIMT, as a non-invasive and bedside test can be really helpful in categorizing atherosclerotic disease. Carotid intima media thickness can be considered as an independent risk factor in identifying people at increased risk of vascular events arising as a consequence of atherosclerosis.

The application of CIMT can be expanded to other vascular complications of atherosclerosis like ischemic heart disease and peripheral vascular disease.

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Ethical approval: The study was approved by the institutional ethics committee

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