Original article:

STUDY OF CORRELATION OF INTIMAL THICKNESS OF CAROTID ARTERY IN PATIENT WITH ISCHEMIC CV STROKE.

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ABSTRACT

BACKGROUND: Stroke, both ischemic and hemorrhagic is a common and devastating disorder.There has been 100% incease in incidence of stroke in low and middle income countries including India. The cumulative incidence of stroke ranged from 105 to152/lac persons per year in India.[4] Currently stroke is the leading cause of mortality and morbidity worldwide and more than 80% of deaths occurring in low and middle income countries. The incidence of stroke increases with increasing age and with elderly population worldwide.[1,2]

METHODOLOGY : This case control observational study was done on Indoor patients of Department of Medicine, L.G. Hospital, Ahmedabad which had a sample size of 50 cases and 50 controls .

RESULTS: According to our study, CIMT is higher in 5th decade of life, with male: female ratio of 4:1,in which Mean CIMT is higher in female cases as compared to male and control group. Mean CIMT is high in cases and controls with plaques when compared to without plaques. Cases with diabetes+hypertension and hypertension+smoker have higher CIMT compared to other risk factor. Even in the patient with hemiparesis / hemiplegia type of ischemic cerebrovascular stroke, it has high average CIMT compare to other neurological defecites.

CONCLUSION: People with risk factors like Diabetes mellitus, Hypertension and Dyslipidemia should undergo screening for CIMT measurement by Carotid Doppler which is non invasive and cost effective and if their CIMT is above 0.06 mm; it should be prevented with early medical intervention and lifestyle modifications, so these patients can be prevented from ischemic CVA in future.

Key words : INTIMAL THICKNESS .CAROTID ARTERY .ISCHEMIC CV STROKE

INTRODUCTION

Stroke is becoming an important cause of premature death and disability in low- income and middle- income countries like India, largely driven by demographic changes and enhanced by the increasing prevalence of the key modifiable risk factors. As a result developing countries are exposed to a double burden of both communicable and non-communicable diseases.

The incidence of stroke varies in various parts of the world but is highest in Japan and China.[2] The cumulative incidence of stroke ranged from 105 to152/lac persons per year in India.[3] The estimated adjusted prevalence rate of stroke 84-262/ lac in rural and 334-424/lac in urban area.[4] The risk factors for stroke are modifiable and non-modifiable.[5] The modifiable risk factors are mostly related to atherosclerotic burden and include diabetes, hypertension, smoking and hyperlipidemia[2].Several risk prediction scoring systems have been evolved to identify individuals with high risk. However, most of these scoring systems have some limitations.[3]The carotid intima media thickness has emerged as a reliable independent marker of atherosclerosis and cerebrovascular disease. However well-defined cut off value for CIMT is not there.[6,7]

So in this study we are evaluating the value of CIMT in the individual with risk factors ,who will be prone for stroke. Stroke can be prevented in high risk population by screening CIMT and intervened by lifestyle modification and prophylactic treatment with statins.

METHODS AND MATERIALS

Method of collection of data was done by evaluation of patients which include Detailed history, clinical examination and laboratory investigations through a proforma specially designed for this study.

CASES

INCLUSION CRITERIA

- Age 30-80 years
- Both the sexes
- Clinical symptoms/signs suggestive of ischemic stroke
- Infarct proven by CT/MRI of brain

EXCLUSION CRITERIA

- Patients with valvular heart diseases
- Pregnancy and postpartum stroke
- Patients with past history of connective tissue disorders/vasculitis
- Recurrent strokes

CONTROLS

50 controls from inpatient department of L.G. Hospital matched by age, gender and risk factors like diabetes, hypertension, smoking and dyslipidemia.

All patients were subjected to the following laboratory investigations:

- CBC
- Blood urea, Serum Creatinine
- RBS/FBS/PPBS
- Fasting Lipid Profile
- ECG
- 2DECHO

- CT or MRI BRAIN
- Carotid artery Doppler

RESULT AND OBSERVATION

This study is a Comparative study of 50 cases and 50 controls in which we have studied the CIMT values and its correlation to the risk factors of Cerebrovascular Accident.

TABLE 1: AGE WISE DISTRIBUTION OF PATIENTS

Age in **years**	**Cases**		**Controls**	
	No	**%**	**No**	**%**
30-40	3	6.0	1	2.0
41-50	7	14.0	12	24.0
51-60	14	28.0	15	30.0
61-70	24	48.0	17	34.0
>70	2	4.0	5	10.0
Total	**50**	**100.0**	**50**	**100.0**
Mean ± SD	**59.86±9.72**		**58.92±10.65**	
P value	**0.6599**			

In the present study, it was found that majority of our patients fall in 6th decade, (48%) in case and (34%) in control group, followed by 5th as (28%) in case and (30%) in control group.

TABLE 2: COMPARISON OF CIMT VALUE IN REFERENCE TO AGE

Age in years	**Cases (n=50)**	**Controls (n=50)**	**P value**
30-40	0.10±0.03	0.06	**-**
41-50	0.11±0.02	0.07±0.01	**<0.0001**
51-60	0.17±0.06	0.06±0.01	**<0.0001**
61-70	0.09±0.02	0.07±0.02	**<0.0001**
>70	0.11±0.02	0.06±0.01	**<0.0001**

In the present study, it was found that CIMT is higher in fifth decade with mean (0.17 mm) in case group as compare to control group (0.06 mm). Moreover, CIMT in all other age groups of patients was statistically significant between case and control groups ($p<0.0001$).

TABLE 3: GENDERWISE DISTRIBUTION OF PATIENTS

Gender	Cases		Controls	
	No	%	No	%
Male	40	80.0	41	82.0
Female	10	20.0	9	18.0
Total	**50**	**100.0**	**50**	**100.0**

It was found that Male were more in both the groups ,male: female ratio was found as 4:1.

TABLE 4: COMPARISON OF CIMT IN TWO GROUPS ACCORDING TO GENDER

Gender	Cases (n=50)	Controls (n=50)	P value
Male	0.097±0.04	0.07±0.02	**<0.001**
Female	0.19±0.03	0.07±0.024	**<0.001**

In the present study, it was found that in case group, female patients have significantly higher CIMT size with mean 0.19 mm compared to control group (0.07 mm) and male patients(0.097).

TABLE 6: COMPARISON OF CIMT IN TWO GROUPS ACCORDING TO PLAQUE

Plaque	Cases		Controls	
	No	**%**	**No**	**%**
Absent	38	76.0	43	86.0
Present	12	24.0	7	14.0
Total	**50**	**100.0**	**50**	**100.0**

P value	0.3079

In the present study, Plaque was present in only 24% in case group while 14% in control group, suggest that plaque was statistically not significant.

TABLE 7: COMPARISON OF CIMT IN TWO GROUPS STUDIED ACCORDING TO ABSENCE &PRESENCE OF PLAQUE

Plaque	Cases (n=50)	Controls (n=50)	P value
Absent	0.098±0.03	0.068±0.02	**<0.0001**
Present	0.19±0.031	0.08±0.02	**<0.0001**

According to study of plaque wise distribution of CIMT, it was found that patients with plaque have highest CIMT size (0.19 mm) compared to control group (0.08 mm) which is highly significant ($p<0.0001$).

TABLE 8: COMPARISON OF CIMT IN THE PATIENTS WITH SINGLE RISK FACTOR IN CASES AND CONTROLS

Risk factors	Cases		Controls		P value
	No of Cases	Mean ±SD	Number ofcontrols	Mean ± SD	
DM	1	0.095	2	0.07	**<0.0001**
HTN	4	0.09±0.01	1	0.06	**<0.0001**
Smokers	3	0.06±0.01	7	0.067±0.01	0.3401
Dyslipidemia	3	0.07±0.047	2	0.045±0.007	**0.0421**

In the present study, it was found that CIMT size with single risk factor was almost similar in both the groups.

TABLE 9: COMPARISON OF CIMT IN PATIENTS WITH 2 OR MORE RISK FACTORS IN CASES AND CONTROLS

Risk factors	Cases		Controls		P value
	No of cases	Mean	No.of control	Mean	
DM+HTN	1	0.14	9	0.06±0.01	-
HTN+ Smokers	4	0.13±0.06	5	0.055	-
DM+ Dyslipidemia	5	0.078±0.01	2	0.067	-
HTN + Dyslipidemia	5	0.11±0.02	4	0.10±0.03	0.5992
Smokers + Dyslipidemia	2	0.07±0.02	5	0.05	-
DM+ HTN+ Smokers	3	0.10±0.01	1	0.06	-
DM+ HTN+ Dyslipidemia	11	0.09±0.04	6	0.082±0.006	0.6382
HTN+ Dyslipidemia+ Smokers	4	0.11±0.03	3	0.095	-
DM+HTN+Dyslipidemia+Smok	4	0.12±0.03	2	0.08	-

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In the present study, it was found that patients with multiple risk factors have higher CIMT Size as compare to control groups.

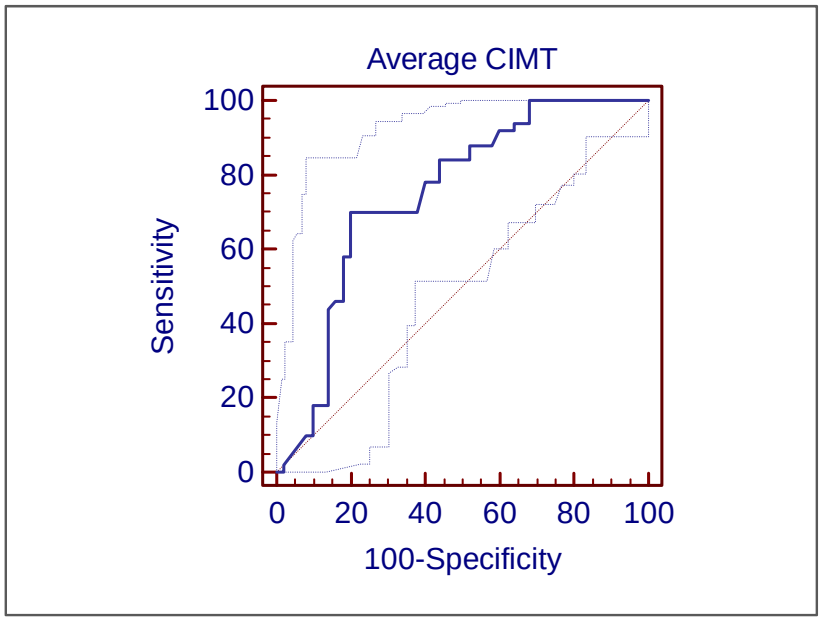
TABLE 10: CORRELATION OF CLINICAL NEUROLOGICAL DEFICIT AND AVERAGE CIMT

Neurological Defects	**No. of patients**	**Average CIMT**
Hemiparesis / hemiplegia	34	0.122
Right Hemiparesis / hemiplegia +aphasia	7	0.10
Aphasia	6	0.099
Monoparesis	3	0.097

In the present study,the patient with hemiparesis / hemiplegia type of ischemic cerebrovascular stroke have high average CIMT(0.122) compared to other neurological deficits, like hemiplegia with aphasia (0.10),isolated aphasia (0.099),and isolated monoparesis (0.097).

TABLE 11: ROC CURVE ANALYSIS FOR PREDICTING THE CIMT AS MARKER

CIMT	**Sensitivity**	**Specificity**	**LR+**	**LR-**	**AU ROC**
>0.07	74.00	80.00	3.50	0.37	0.747



In above graph if blue line is exactly meeting the dotted diagonal line then it indicates that the test cannot differentiate between two groups under study. Here the blue line is far away from dotted diagonal line which indicates that the used test will differentiate between two groups studied. The sensitivity and specificity of CIMT as marker in our study is 74% and 80%.

DISCUSSION

In our study, mean CIMT in case group is 0.117 mm (range 0.03 – 1.17 mm) and in control group, mean CIMT is 0.07 mm (range 0.04 – 0.15 mm), suggest that it is significantly higher in cases compared to controls. Similar study done by **SK Das et al**[8] found that in Case group CIMT is 0.84±0.19 mm and in control group CIMT is 0.6±0.09 mm which is statistically significant ($p<0.0001$).

In our study, Mean age is 58 years and majority of patients are in age group of 61-70 years [24 cases]. As the age increases, CIMT of cases increased drastically compared to controls that are Mean CIMT in cases in age group 30-40 is 0.10 mm, 41-50 is 0.11 mm, 51-60 is 0.17 mm and 61-70 years is 0.09 mm. In cases, mean CIMT is 0.117 mm (range 0.03 –

1.17 mm) and in controls its 0.07 mm (range 0.04 – 0.11 mm). In study done by **R Sahoo et al**[9], when the differences in mean CIMT were compared among different age groups in the cases, it was significant with P <0.05.

In our study there are 40 males and 10 females in both cases and control groups. In cases, Mean CIMT in males is 0.097±0.04 mm and 0.19±0.03 mm in females. In controls, Mean CIMT is 0.07±0.02 mm in both genders. Mean CIMT is more in female cases than males but female cases are less in number in our study. In Study done by **Rajeev H et al**[10], differences in mean CIMT between males and females in cases were not significant; however the difference was significant in both the genders when compared to controls with P < 0.001.

In our study, Carotid plaques are present in 12 cases and 7 controls. Mean CIMT is high in cases and controls with plaques when compared to cases and controls without plaques. In study done by **R Sahooet al**[9], Carotid plaques were present in 18 patients when compared to 7 in controls and CIMT was higher in patients with plaques (0.095 mm) when compared to patients without Plaques (0.07 mm).

In our study Mean CIMT in cases with risk factors such as Diabetes Mellitus, Hypertension, Dyslipidemia were significantly increased when compared to controls with risk factors (p<0.0001). Similar studied by **Rajeev H et al**[10]**, SK Das et al**[8]and**Y Saxena et al**[11]have found that cases compared to controls with risk factors were statistically significant (p<0.0001).

In our study, 46 out of 50 cases had CIMT between 0.06-0.19 mm [92%] and 45controls had CIMT between 0.06-0.15 mm[90%]. So we can hypothesize that people with risk factors having CIMT above 0.06 mm are more prone for ischemic cerebrovascular accidents. so early intervention with antiplatelete drug ,statins ,B.P control and diabetes control and lifestyle changes is essential in these people to avert future ischemic CVA.

In our study, the sensitivity of CIMT as marker in our study is 74% and specificity is 80%. In a study done by **R Sahooet al**[9], sensitivity was 48% and specificity was 96%.

SUMMARY

This is a case control observational study, done at L.G. hospital which had a sample size of 50 acute ischemic stroke cases and 50 controls .This study was done to measure carotid intima media thickness at which patients with risk factors are prone to develop acute ischemic stroke and to correlate carotid intima media thickness with risk factors of acute ischemic stroke.

1) Majority of our patients are in the 5^{th} & 6^{th} decade. CIMT increased with increasing age.
2) Male:female ratio is 4:1. Female patients have significantly higher CIMT size with mean 0.19 mm compared to control group (0.07 mm) and male patients (0.097).
3) Mean CIMT is high in cases(24%) and controls(14%) with plaques when compared to cases and controls without plaques. Patient with plaque have highest CIMT size (0.19 mm) compared to control group (0.08 mm) which is highly significant ($p<0.0001$).
4) CIMT size with single risk factor in case group were almost similar to control group.
5) CIMT is higher in patients with multiple risk factors compared to control group.
6) Patients with hemiparesis/hemiplegia type of neurological deficit have high average CIMT(0.122) compared to other neurological deficit.
7) ROC curve analysis of CIMT, suggest that sensitivity and specificity of CIMT is 74% and 80%.

Abbreviations

DM=Diabetes mellitus

HTN=Hypertension.

CIMT=

CONCLUSION

People with risk factors like age > 50 years, DM , HTN , Smoking and Dyslipidemia having CIMT above 0.06 mm are more prone for ischemic CVA, so people with risk factors

should undergo screening for CIMT measurement by Carotid Doppler which is non invasive and cost effective and if their CIMT is above 0.06 mm they should undergo early medical intervention to take care of risk factors and lifestyle modifications, so these patients can be prevented from ischemic CVA in future.

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