Journal Of Medical Science And Clinical Research

IGM Publication   An Official Publication Of IGM Publication

Original Research Article

Relevance of Common Carotid Intima-Media Thickness and Carotid Plaque as Risk Factor for Ischemic and Haemorrhagic Stroke in Patients Attending Medical College and Hospital, Kolkata

Authors
Dr Chiradip Mallick[1*], Dr Nabanita Chakraborty[2], Dr Jayanti Roy[3]
[1]Senior Resident, [2]Professor, Department of General Medicine , Medical College & Hospital, Kolkata
[3]Associate Professor, Department of General Medicine, College of Medicine & Sagar Dutta Hospital, Kolkata
*Corresponding Author
Dr Chiradip Mallick
Senior Resident, Department of General Medicine, Medical College & Hospital, Kolkata

Abstract

Introduction: *A stroke or cerebrovascular accident is defined as an abrupt onset of a neurologic deficit that is attributable to a focal vascular cause due to cerebral ischemia or intracranial haemorrhage. Atherosclerosis and carotid artery stenosis are the major causes of stroke. Carotid Intimamedial thickness is a marker of subclinical atherosclerosis. So the measurement of CIMT is of major concern in high risk individuals.*

Aim: *To measure the carotid wall thickness (CIMT) using B-mode ultrasound of both right and left carotid artery and to establish association between CIMT and stroke.*

Methodology: *A Hospital based prospective, cross-sectional study concluded 100 diagnosed cases of stroke of which 50 ischemic stroke and 50 hemorrhagic stroke. All these patients underwent clinical evaluation CT Scan and MRI Scan of Brain, CIMT and blood investigation including complete hemogram, lipid profile , fasting blood glucose.*

Results: *Mean age for presentation of stroke was 68.68 with maximum number of patients belonging to 61-80 years of age group with lowest age taken was 39 and the highest was 92. 49 (98%) patients with hemorrhagic stroke and 30 (60%) patients with ischemic stroke had hypertension. The CIMT was measured using B-mode USG probe correlated with the type of Stroke. The minimum value of Right CIMT in Hemorrhagic Stroke was 0.6 with maximum value 1.1; the mean was 0.788 $\pm$ 0.1305 (mean $\pm$ SD). The minimum value of Right CIMT in Ischemic stroke was 0.6 with maximum value 1.2; the mean was 0.93 $\pm$ 0.1258 (mean $\pm$ SD). Independent T-Test was performed, and 95% confidence interval was between: 0.0931 to 0.1909 and p-value was <0.0001.*

Conclusion: *There was positive correlation between the CIMT and type of stroke. Between Right CIMT and type of stroke, the p-value was <0.0001 which is highly significant. Between Left CIMT and type of stroke, the p-value was also <0.0001 which is highly significant.*

Keyword: *CIMT, Hemorrhagic Stroke, Ischemic Stroke, B-mode Ultrasounds.*

Introduction

Stroke is the leading cause of death in India and worldwide. Stroke along with coronary artery disease, heart failure and other cardiovascular diseases constitute the major source of mortality[1]. A stroke or cerebrovascular accident is defined as an abrupt onset of a neurologic deficit that is attributable to a focal vascular cause. Cerebral ischemia is caused by a reduction in the blood flow to the brain parenchyma that last longer than several seconds. Neurological symptoms are manifested within seconds as neurons lack glycogen, so energy failure is rapid. If the cessation of flow last more than a few minutes, there is infarction or death of the brain tissue[2]. Intracranial haemorrhage is caused by bleeding directly into or around the brain; the neurological symptoms are produced by the mass effect on the neural structures, from the toxic effects of blood itself, or by increasing the intracranial pressure[2]. Atherosclerosis and carotid artery stenosis are the major causes of stroke. Atherosclerosis is a chronic complex disease characterized by subintimal collection of lipids, smooth muscle cells, fibroblasts and intracellular matrix[3]. Carotid Intimamedial thickness is a marker of subclinical atherosclerosis [Lorenz et al. 2007], is a strong predictor of future stroke and myocardial infarction, and it is associated more with large artery than small artery stroke. Intimamedial thickness is measured as the distance between lumen-intima and media-adventitia interfaces[4]. The carotid Intimamedial thickness is usually observed by a B-mode ultrasound and sensitive edge-detection software. CIMT is measured between the intimal luminal and the medial-adventitial interfaces of the carotid artery wall represented as a double-line density on an ultrasound image. Measurement of CIMT, the anatomic extent of atherosclerosis and its progression helps in identifying high risk subjects, who are candidates of primary prevention[5].

Methodology

This study is a prospective, hospital based cross-sectional study of conducted at Medical College and Hospital, Kolkata from December 2017-December 2018. A total 100 patients who were diagnosed to be suffering from cerebrovascular accidents by relevant clinical, radiological tests are selected from patients attending OPD and Acute and Chronic wards of Department of General Medicine and Neurology. All proven cases of cerebrovascular accidents are included in the study while patients with non vascular cerebral events like meningitis, traumatic CVA, drug induced CVA were excluded. After meeting the inclusion and exclusion criteria consent being taken from the patients and the following tests were done: CIMT, blood test like haemogram, lipid profile, blood sugar.

Results

Basic characteristics of the patients are given in table 1 & 2. In our study patient's age ranged from 39 to 92 years, which are divided into 3 groups. Most of our patients were in the age group 61-80, around 51% of the patients belonged to this age group followed by 25 patients (25%) in the age group 40-60 and 24 patients (24%) in the age group >80. Mean age being 68.68. We analyzed the gender distribution of our study group where we observed that majority of our patients were male (55%) and 45 patients (45%) were female.

Table 1 – Age distribution of the patients studied

Age group	Ischemic	Hemorrhagic	Total	Percentage
40-60	9	16	25	25
61-80	29	22	51	51
>80	12	12	24	24
Total	50	50	100	100

Table 2 – Demographic characteristics (Gender) of the patients

Gender	Frequency	Percentage
Female	45	45
Male	55	55
Total	100	100

In this case group 24 patients with hemorrhagic stroke have diabetes and 26 patients don't have diabetes. 21 patients with ischemic stroke have diabetes and 29 patients don't have diabetes. 49 patients (98%) with hemorrhagic stroke have hypertension while 30 patients (60%) with ischemic stroke has hypertension. 1 patient (2%) with hemorrhagic stroke and 20 patients (40%) with ischemic stroke don't have hypertension. Correlation between hypertension and type of stroke is statistically significant. It was seen that hemorrhagic stroke is more common in hypertensive patients however there was no statistical correlation between diabetes and type of stroke

Table 3 Presence of diabetes in the patients studied

Presence of Diabetes	Hemorrhagic CVA	Ischemic CVA	Total
Yes	24(48%)	21(42%)	45
No	26(52%)	29(58%)	55
Total	50	50	100

Table 4- Presence of hypertension in the patients studied

Hypertension	Hemorrhagic stroke	Ischemic stroke	Total
Yes	49 (98%)	30 (60%)	79
No	1 (2%)	20 (40%)	21
Total	50	50	100

Table 5 denotes the minimum, maximum values of Right CIMT along with its mean, median, standard deviation with type of CVA and table 6 denotes the minimum, maximum, values of Left CIMT along with its mean, median, standard deviation with type of CVA. In both the cases there was positive correlation between types of CVA and CIMT with P value being <0.0001

Table 5 - Minimum, maximum values of Right CIMT along with its Mean, Median, Standard deviation with type of CVA

Type of stroke	Minimum	Maximum	Mean	Median	Standard Deviation
Hemorrhagic CVA	0.6	1.1	0.788	0.8	0.1305
Ischemic CVA	0.6	1.2	0.93	0.9	0.1258

Table 6 - Minimum, maximum values of Left CIMT along with its Mean, Median, Standard deviation with type of CVA

Type of stroke	Minimum	Maximum	Mean	Median	Standard Deviation
Hemorrhagic CVA	0.6	1	0.798	0.8	0.119
Ischemic CVA	0.7	1.2	0.9	0.9	0.959

Discussion

In our study maximum patients (n=51) were in 61-80year age group (51%) followed by 40-60year age group (n=25) and >80year age group (n=24). The lowest age taken was 39 and the highest was 92. Among 100 patients 45 patients were female and 55patients were male of which 23 female patients were having hemorrhagic stroke and 22 patients were having ischemic stroke. In 55 male patients 27 patients were having hemorrhagic stroke and 28 patients were having ischemic stroke. The CIMT was measured using B-mode USG probe and correlated with the type of Stroke. The minimum value of Right CIMT in Hemorrhagic Stroke was 0.6 with maximum value 1.1; the mean was 0.788 + 0.1305 (mean + SD). The minimum value of Right CIMT in Ischemic stroke was 0.6 with maximum value 1.2; the mean was 0.93 + 0.1258 (mean + SD). Independent T-Test was performed, and 95% confidence interval was between: 0.0931 to 0.1909 and p-value was <0.0001. The study was found to be statistically significant. Next we measured Left CIMT in Hemorrhagic and Ischemic Stroke. The minimum value of Left CIMT in Hemorrhagic stroke was 0.6 with maximum value 1; the mean was 0.798 + 0.119 (mean + SD). The minimum value of Left CIMT in Ischemic Stroke was 0.7 with maximum value of 1.2; the mean was 0.9 + 0.959 (mean + SD). Independent T-Test and 95% confidence interval was between: -0.1449 to -0.0591, p-value was <0.0001. Correlation between Left CIMT and type of stroke was statistically significant. This is comparable to the study conducted by *El. Bots et al*[6] who found the risk of stroke increased gradually with increasing common carotid intima-media thickness. The odds ratio for stroke per SD increase (0.163 mm) was 1.41 (95% CI, 1.25 to 1.82). In men, the odds ratio per SD increase (0.172 mm) was 1.81 (95% CI, 1.30 to 2.51) and in women, an odds ratio of 1.33 (95% CI, 1.03 to 1.71) per 0.155-mm SD increase was observed. Among 100 patients 24 patients with Hemorrhagic CVA and 21 patients with ischemic CVA had Diabetes, while 26 patients with hemorrhagic CVA and 29 patients with ischemic CVA did not have Diabetes. The presence of Diabetes was compared to the type of Stroke and Chi-Square test was performed and the correlation was not found to be statistically significant. This is comparable with the study by *Jørgensen et al*[7] who found the diabetic stroke patient was 3.2 years younger than the nondiabetic stroke patient (P < .001) and had hypertension more frequently (48% versus 30%, P <.0001). Intracerebral haemorrhages were six times less frequent in diabetic patients (P = .002). Initial stroke severity, lesion size, and site were comparable between the two groups. However, mortality was higher in diabetic patients (24% versus 17%, P = .03), and diabetes independently increased the relative death risk by 1.8 (95% confidence interval [CI], 1.04 to 3.19). However in our study no correlation was found. 49 patients with hemorrhagic stroke and 30 patients with ischemic stroke had hypertension; while 1 patient with hemorrhagic stroke and 20 patients with ischemic stroke did not have hypertension. There positive correlation between hypertension and type of stroke. This is comparable with the study conducted by Michel Joffres et al[8] who found mean systolic blood pressure (SBP) was higher in England than in the USA and Canada in all age–gender groups. Mean diastolic blood pressure (DBP) was similar in the three countries before age 50 and then fell more rapidly in the USA, being the lowest in the USA. Only 34% had a BP under 140/90 mm Hg in England, compared with 50% in the USA and 66% in Canada. Prehypertension and stages 1 and 2 hypertension prevalence figures were the highest in England. Hypertension prevalence (≥140 mm Hg SBP and/or ≥90 mm Hg DBP) was lower in Canada (19·5%) than in the USA (29%) and England (30%). Hypertension awareness was higher in the USA (81%) and Canada (83%) than in England (65%). England also had lower levels of hypertension treatment (51%; USA 74%; Canada 80%) and control (<140/90 mm Hg; 27%; the USA 53%; Canada 66%). Canada had the lowest stroke and IHD mortality rates, England

the highest and the rates were inversely related to the mean SBP in each country and strongly related to the blood pressure indicators, the strongest relationship being between low hypertension awareness and stroke mortality.

Conclusion

In summary there was positive correlation between CIMT and stroke, that means higher the CIMT, higher the chance of stroke. There was also positive correlation between hypertension and stroke. In 98% of haemorrhagic CVA there was hypertension. So, early detection of hypertension and CIMT measurement can greatly avoid stroke and prevent morbidity and mortality in such cases.

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