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Role of carotid intima-Medical thickness in predicting ischemic stroke

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Abstract

Background: Combined carotid intima-media thickness (CIMT) is a marker of atherosclerosis and is also a predictor for ischemic stroke.

Objective: To determine CIMT and serum lipid levels in patients of ischemic stroke.

Method: A total of 120 patients enrolled in this study 60 cases and 60 controls group. No history of ischemic stroke in control group. The age group was 40-50 years, 50-60 years and 60-70 years. A detailed history of cases and controls was taken, clinical examination and high-resolution Ultrasonography. They were subjected to routine investigations, blood sugars and lipid profile.

Result: A total of 20% ischemic stroke patients and 33.3% of control patients found within age group of 40 to 50 years. In age group of 50 to 60 years 35% ischemic stroke patients and 26.7% in control groups. The age group of 60 to 70 years included 45% ischemic stroke patients and in control group 40%. The ischemic stroke patients had experienced highly significant CIMT at right (0.723 ± 0.070 millimeter) common carotid artery as compared to controls (0.501 ± 0.061 millimeter) had no previous history of stroke.

Conclusion: There is increase in CIMT in patients of ischemic stroke. Elevated serum lipid concentration is related to the occurrence of ischemic stroke in the elderly cohort, an association that is largely dependent on atherosclerosis severity as measured by CIMT.

Keywords: Ischemic stroke, Carotid Intima-media thickness, Atherosclerosis, Dyslipidemia

Introduction

Stroke is second commonest cause of the death and is leading cause of permanent disability. World health organization (WHO) defines stroke as rapidly developing clinical signs of focal (or global) disturbance of cerebral function with symptoms lasting 24hrs or more and may be finally leading to death with no clear cause other than that of vascular origin^[1]. In most cases atherosclerosis of the large extra-cranial arteries is the underlining cause of focal cerebral ischemia^[2]. Atherosclerosis is the diseases of arterial wall that occur at susceptible sites in the major conduit arteries. Atherosclerotic lesion causes stenosis with potentially lethal distal ischemia or can trigger thrombotic occlusion of major arteries of heart, brain and legs etc. there are several well know risk factors which accelerate the process of atheromatous changes which are hypertension, smoking, diabetes and dyslipidemia. Carotid intima-media thickness (CIMT), determined noninvasively by high-resolution ultrasound imaging, has been widely used as an intermediate phenotype for atherosclerosis. As a reflector of systemic atherosclerosis, increased carotid artery IMT has been associated with a higher risk for stroke^[3]. CIMT is a measurement of the thickness of artery walls, by external ultrasound. Measuring CIMT is gaining acceptance as a non-invasive, inexpensive method to assess the extent of atherosclerosis^[4,5]. In this study we determined CIMT and serum lipid levels in patients of ischemic stroke.

Material and methods

A Case control study was carried out in the department of Radiodiagnosis at Sri Aurobindo Institute of Medical Sciences and PG Institute, Indore and approval from the ethical and research committee. The duration of this study was May 2018 to June 2020. A total of 120 patients enrolled in this study 60 cases and 60 controls group. No history of ischemic stroke in control group. The age group was 40-50 years, 50-60 years and 60-70 years. The patients included in the study were those referred with clinical and radiological diagnosis of ischemic stroke.

A detailed history of cases and controls was taken, clinical examination and high-resolution Ultrasonography. They were subjected to routine investigations, blood sugars and lipid profile.

Inclusion criteria

All the patients with diagnosis of ischemic stroke. Age group between 40-70 years.

Exclusion criteria

Hemorrhage stroke, Rheumatic valvular heart disease, transient ischemic attack.

Procedure

All carotid ultrasonography examinations performed with the Philips IU 22 & sonocitemicromax sonographic machines equipped with up to 11 MHz liner array transducer were used the examination was done sitting on the patients right side as in abdominal sonography. The patients were comfortably positioned with the head resting on the table surface to avoid neck muscle tension that would hamper penetration of the ultrasonic sound waves. The advantage of sitting at the patient's side is that it provides a spatial orientation identical to that in most other type of ultrasound examination. For the examination of specific vessels, the patients told to turn the head to the opposite side while keeping the neck relaxed. The patient is told not to speak, to breathe quietly and evenly and to swallow as little as possible to avoid motion artifacts. The transducer should press very lightly on the skin to respect the pressure sensitivity of the cervical soft tissue and laryngeal area. CIMT was measured by doing carotid doppler on both the carotid arteries. Imaging of both common carotid arteries up to their bifurcation was done.

Result

In case 60 patients with ischemic stroke and 60 normal individuals were participated in control group. A total of 20% ischemic stroke patients and 33.3% of control patients found within age group of 40-50 years. In age group of 50-60 years 35% ischemic stroke patients and 26.7% in control groups. The age group of 60-70 years included 45% ischemic stroke patients and in control group 40%. (Table 1) An ischemic stroke patient was found Male, Female 42 (70%) vs 18 (30%) cases and 38 (63.3%) in control group had no previous history of stroke found to be male. 22 (36.6%) normal individuals were female also included in this study as controls. In dyslipidemia there was significant difference in case vs control (83.3% vs.20%) group.

The ischemic stroke patients had experienced highly significant IMT at right (0.723 ± 0.070 millimeter) common carotid artery as compared to controls (0.501 ± 0.061 millimeter) had no previous history of stroke. The ischemic stroke patients had experienced highly significant IMT at left (0.694 ± 0.069 millimeter) common carotid artery as compared to controls (0.481 ± 0.063 millimeter) had no previous history of stroke. There was a statistically strongly significant difference reported in IMT at right and left common carotid arteries between cases of ischemic stroke and controls. (Table 1)

There was significant difference between cases group total cholesterol (170.78 ± 33.66) and low-density lipoprotein (113.75 ± 24.01), as compare to total cholesterol (136.02 ± 31.87) and low-density lipoprotein in control

group. High-density lipoprotein (36.93 ± 8.93) in cases group was increased as compare to high density lipoprotein (34.13 ± 11.35) in control group. In cases group triglyceride (125.49 ± 50.00) found to be decreased as compare to triglyceride (140.97 ± 82.73) in control group. (Table 2)

A maximum of 12 ischemic stroke patients found within the age group of 40-50 years, 10 (83.3%) of them had elevated serum lipid levels in case and control group had not elevated serum lipid levels. A total of 21 ischemic stroke patients of age group 50-60 years, 18 (85.7%) of them had elevated serum lipid levels in case and 5 (31.2%) in control group. 27 ischemic stroke patients belonged to age group 60-70 years and most of them, 22 (81.4%) had elevated serum lipid level in case and in control group 7 (29.1%).(Table 3)

IMT of common carotid artery found to be significantly raised in cases of ischemic stroke as compare to control group can be easily seen in figure 1.

Discussion

IMT is a measurement of the thickness of artery walls, usually by external ultrasound. 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^[6]. 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^[7]. In present study also no significant different but, CIMT has a positive association to male sex. IMT of common carotid artery found to be significantly raised in cases of ischemic stroke as compare to control group. An independent association of this dyslipidemia from CIMT in risk of stroke suggest additional pathophysiological role of dyslipidemia to atherosclerosis in relation to stroke. We confirm that IMT and dyslipidemia are closely associated and have a linear relationship that is greater the dyslipidemia the greater the atherosclerosis measured by CIMT supported by study^[8]. In this study there was strong bond seen between dyslipidemia and CIMT. Elevated serum lipid concentration may influence the composition of carotid atherosclerotic plaque, for example when there is increased serum lipid level, it makes plaque more active and unstable with greater probability of stroke the same were seen in study conducted by Burke AP *et al*.^[5] CIMT was significantly more in patients of ischemic stroke as compare to controls. The mean CIMT in this present study was similar to the values^[9]. We have demonstrated the positive association between ischemic stroke in carotid artery intima-media thickness. This study was similar as previous study^[3]. Raised CIMT is also related to several risk factors like old age, male sex, hyperlipidemia as demonstrated by study of Salonen R *et al*. There results were also like our study.

We endorsed the prior observation that high serum lipid level is associated with stroke. This observation was supported by O Leary DH *et al*.^[10] There was significant difference between cases group total cholesterol (170.78 ± 33.66) and low-density lipoprotein (113.75 ± 24.01), as compare to total cholesterol (136.02 ± 31.87) and low-density lipoprotein in control group.

Conclusion

The IMT of the common carotid artery is strongly associated with the risk of stroke in older adult. There was no significant difference in CIMT on left and right. There

was significant difference between cases group total cholesterol and low-density lipoprotein as compare to total cholesterol and low-density lipoprotein in control group. Elevated serum lipid concentration is related to the occurrence of ischemic stroke in the elderly cohort, an association that is largely dependent on atherosclerosis severity as measured by CIMT. The association of elevated serum lipid concentration with stroke was less apparent among those with less advanced compare with more advanced carotid atherosclerosis. Although elevated serum lipid concentration and CIMT are closely correlated, each factor may be an independent integral in the risk of ischemic stroke.

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