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A Study of Clinical Profile of Large Artery Disease in Ischemic Stroke Patients

Vinothkanna Selvaraj[1], Balaji Tamilselvan[2], Vasudevan Devanathan[3], Gowrishankar A[4], Rajendran Karuthudaiyal[5]

Author's Affiliation: [1]Associate Professor, [3]Professor and Head, Department of Neurology, [4,5]Professor, Department of General Medicine, Saveetha Medical College Hospital, Chennai, Tamil Nadu 602105, India. [2]Consultant Physician, Department of General Medicine, Vijaya Hospitals, Chennai, Tamil Nadu 600026, India.

Corresponding Author: Vinothkanna Selvaraj, Associate Professor, Department of Neurology, Saveetha Medical College Hospital, Chennai, Tamil Nadu 602105, India

E-mail: svkanna2006@yahoo.co.in

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Abstract

Developing country like India is facing a double burden of communicable and non-communicable diseases. Ischemic stroke is a heterogeneous disorder with multiple etiological mechanisms. Large artery atherosclerotic disease of both intracranial and extracranial arteries is one of the main cause of ischemic stroke disease. A Cross-sectional study was done in 90 patients in Saveetha Medical College Hospital analyzing the clinical features, risk factors and distribution of large artery disease in patients with ischemic stroke. Patient underwent clinical examination, information regarding demographic profile, risk factors of stroke were collected, blood investigations including complete blood count, blood glucose, renal and liver function, lipid profile and electrolytes were done. Each patient underwent magnetic resonance imaging (MRI) of brain with MRA. Out of 90 patients 73 had middle cerebral artery occlusion, 2 had anterior cerebral artery occlusion, and 15 had posterior cerebral artery occlusion. 71 patients (78.9%) had hemiplegia, 34 (37.77%) patients had speech involvement, 42 (46.66%) had giddiness, and 28 (31.1%) had altered sensorium. Headache was present in 25 (27.77%) patients, and 35 (38.88%) had visual disturbances. The site of extracranial occlusion was determined using Carotid Doppler. Among the 2 patients who had ACA occlusion, 1 had occlusion at the level of CCA and 1 at carotid bulb. Among the 15 patients who had PCA occlusion, 1 had CCA occlusion and 3 had occlusion at the level of carotid bulb. 73 patients who had MCA occlusion had 7 CCA occlusion, 16 ICA occlusion, 14 carotid bulb occlusion and 28 ICA and CCA combined occlusion. MCA occlusion is commonest among the intracranial artery occlusion and when MCA is involved majority of patients have extracranial involvement (CCA/ICA/ carotid bulb) pointing to the fact that extracranial occlusion is almost invariable present when the MCA infarct is present.

Keywords: Stroke; Large artery occlusion; Extracranial occlusion; Intracranial stenosis.

Introduction

Stroke is one of the major health care problem in the world. It is 3rd most common cause of mortality and morbidity in the western world.[1] The world health organization defines stroke as "rapidly developing clinical signs of focal disturbance of cerebral function with symptoms lasting ≥24 hours or leading to death, with no other apparent cause other than of vascular origin.[2] Studies have

shown a crude prevalence rate of stroke in range of 471 /1 lakh persons in india.[3] Patient with stroke has to depend for all his activities of daily living on a caregiver, hence it not only causes morbidity in the patients, but it also increases the caregiver burden.

Eetiology of ischemic stroke is mainly large artery atherosclerotic disease followed by small vessel disease and cardioembolism.[4]

The risk factors are classified into non-modifiable and modifiable risk factors. The non-modifiable risks are gender, age and family background. The modifiable risk factors are prior stroke, alcohol, smoking, obesity, hypertension, diabetes mellitus, oral contraceptives and dyslipidemia.[5] Identification of modifiable risk factors may prevent the first episode and recurrent episodes of cerebrovascular disease (CVA).[6]

Aims and Objectives

Aim

To study the clinical features, risk factors and distribution of large artery disease in patients with ischemic stroke.

Objectives

1. To identify the large artery disease in ischemic stroke patients.
2. To identify the risk factors causing large vessel disease leading to ischemic stroke.
3. To determine the distribution, pattern and severity of extracranial and intracranial arterial stenosis in patient with ischemic stroke.

Materials and Methods

A Cross-sectional study was done in 90 patients, the period of study was between February 2016 and January 2017 done in Saveetha medical college and hospital. Patients above the age of 40 diagnosed with ischemic stroke were included.

Young stroke age < 40 years, Patients with hemorrhagic stroke, Lacunar stroke, arterial dissection or fibromuscular dysplasia were excluded. Large artery disease is an important cause of stroke due to its high prevalence, frequent recurrence. Noninvasive studies, such as Carotid Doppler sonography (CDS), magnetic resonance angiography (MRA), and computerized tomography (CT), have been used to evaluate patients with ischemic strokes and this study aims at the effectiveness of non invasive investigation procedures.

Methodology

The study was initiated after obtaining clearance from both the Scientific Review Board and Institutional Ethics Committee of Saveetha Medical College and Hospital. Patient admitted with first occurrence of ischemic stroke were included in the study. All participants provided an informed consent for inclusion as study subjects. Patient underwent clinical examination at the time of admission. Information regarding demographic background and risk factors were collected. Initial investigations included complete blood count, blood glucose, renal and liver function tests, lipid profile and electrolytes. Each patient underwent magnetic resonance imaging (MRI) of brain in 1.5 Tesla Toshiba scanners with 8-Channel head coil. MRI protocol included T1, T2, T2-Flair and DWI sequences. At same time, Magnetic resonance angiogram (MRA) was obtained. The sites of stenosis in the intracerebral circulation were compared in subgroups based on age, risk factors and extent of carotid artery stenosis. Based on these investigations, patients with acute ischemic stroke are classified according to TOAST classification into five major categories: 1) Large artery atherosclerosis, 2) Embolism, 3) Small artery occlusion (lacunar), 4) Other Uncommon causes, and 5) Undetermined causes. The undetermined cause subtypes included (Va) patients with two or more "possible" or "evident" mechanisms for stroke and (Vb) patients for whom definite or possible causes of stoke could not be found with noninvasive tools.

Results

Our study included 90 patients with ischemic stroke who were above 40 years of age. There were 18 (20%) people between the age group of 44 and 50, 26 (28.88%) among 51 to 60 years of age and 30 (33.33%) in 61 to 70 years age group and 16 (17.77%) people were 70 and above age group. Out of 90 patients, 63 were males and 27 were females. The male to female ratio was 2:1.

In our study, risk factors like smoking, alcohol, hypertension, diabetes, dys lipidemia, Coronary Artery Disease (CAD) and atrial fibrillation was taken into account. 47 patients were smokers or had a past history of smoking. 32 were alcohol dependent. 62 patients had hypertension and 57 had diabetes mellitus, 33 had dyslipidemia.

Thirty-one patients had history of CAD and 9 had past history of atrial fibrillation.

Analyzing the involvement of large artery in ischemic stroke, Out of 90 patients 73 had middle cerebral artery occlusion, 2 had had anterior cerebral artery occlusion, and 15 had posterior cerebral artery occlusion (Table 1). Among the 2 patients who had anterior cerebral artery occlusion, 1 had right sided involvement and 1 had occlusion of the left anterior cerebral artery.

Out of 73 patients who had middle cerebral artery occlusion, 37 had right sided involvement and 36 had occlusion of the left middle cerebral artery. 15 patients had posterior cerebral artery occlusion, the right PCA occlusion was observed in 7 and left PCA occlusion in 8.

Out of the 90 patients who had ischemic stroke, 71 (78.9%) presented with hemiplegia, 34 (37.77%) patients had speech involvement, 42 (46.66%) had symptoms of giddiness, and 28 (31.1%) had altered sensorium. Headache was present in 25 (27.77%) patients, and 35 (38.88%) had visual disturbances.

The presence of clinical features in each type of arterial occlusion was identified and summarized.

In patients who had PCA occlusion, 14 (93.3%) had giddiness, 10 (66%) had altered sensorium, 8 (53.3%) had headache, 13 (86.66%) had visual disturbances and none of them had hemiplegia, speech involvement.

Among the 2 patients who had ACA occlusion, both the patients had hemiplegia, giddiness, headache. None of them had altered sensorium or visual disturbances. Out of the 73 patients with MCA occlusion, 69 (94.52%) had hemiplegia as presenting complaints, 34 (46.57%) had speech involvement, 26 (35.61%) had giddiness, 18 (24.65%) patients suffered from altered sensorium, 15 (20.54%) had headache, 22 (30.13%) had visual disturbances.

The site of extracranial occlusion was determined using Carotid Doppler. 9 patients had occlusion at the site of CCA, 16 had occlusion at ICA level, 28 patients had occlusion involving ICA and CCA. 18 patients had occlusion at the level of carotid bulb (Fig. 1).

The severity of extracranial occlusion was analysed. The Doppler study revealed, out of 9 patients who had occlusion at the level of CCA, 2 had 30 to 49% occlusion, 2 had 50 to 69% occlusion, 5 had 70 to 89% occlusion and none of them had complete occlusion. Sixteen patients who had occlusion at the level of ICA, 2 had 30 to 49% occlusion, 4 had 50 to 69% occlusion, 8 had 70 to 89% occlusion and 2 of them had complete occlusion. Twenty-eight patients who had occlusion at the level of both CCA and ICA, 4 had 30 to 49% occlusion, 6 had 50 to 69% occlusion, 16 had 70 to 89% occlusion and none of them had complete occlusion.

Eighteen patients who had occlusion at the level of both carotid bulb, 6 had 30 to 49% occlusion, 5 had 50 to 69% occlusion, 7 had 70 to 89% occlusion and none of them had complete occlusion. The comparison of intracranial and extracranial occlusion yielded the following result. Among 2 patients who had ACA occlusion, 1 had occlusion at the level of CCA and 1 at the level of carotid bulb. In our study 15 patients had PCA occlusion, out of them 1 had CCA occlusion also and 3 had occlusion at the level of carotid bulb. Seventy-three patients who had occlusion of MCA, 7 among them had occlusion of CCA, 16 of them had occlusion of ICA, 14 had occlusion of carotid bulb and 28 had both ICA and CCA occlusion (Table 2).

Table 1: Side of Intracranial Arterial Occlusion on Ischemic Stroke.

	No of cases (n = 90)	Percentage (%)
Right ACA	1	1.11
Left ACA	1	1.11
Right MCA	37	41.1
Left MCA	36	40
Right PCA	7	7.77
Left PCA	8	8.88

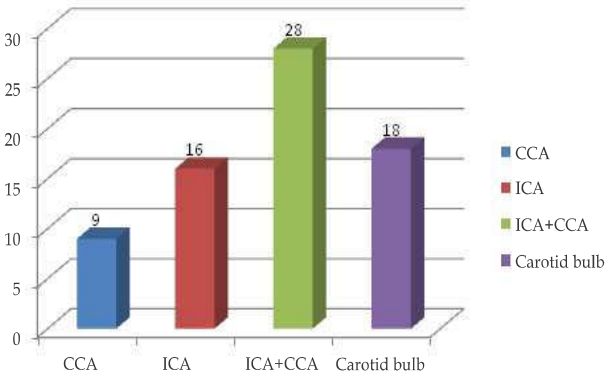

Fig. 1: Distribution of extra-cranial artery occlusion

Table 2: Correlation between intracranial and extracranial arterial occlusion

	CCA	ICA	Cartoid Bulb	ICA + CCA
ACA (n = 2)	1	0	1	0
MCA (n = 73)	7	16	14	28
PCA (n = 15)	1	0	3	0

Discussion

The present study identifies the basic socio-demographic profile of the people affected by ischemic stroke and also attempts to delineate individual symptomatology, risk factors, severity of occlusion and pattern of distribution of large artery involvement and an association between them is made.

Age and Gender Distribution

Stroke is one of the most important causes of mortality and long-term severe disability. In our study among 90 patients with ischemic stroke, age range was from 40 to 99 with mean age of 61. In this study the incidence of stroke is maximum in the age group of 61 to 70 which comprise of 33% total patients. The mean age observation of 61 years in our study which correlates with study done by Maskey et al.[7] (mean age 63) and Awad et al.[8] (mean age 63.66). This indicates that individuals above 60 years of age are more prone for the occurrence of ischemic stroke, though the risk factors also plays a role in this.

In our study group 63 patients were male and 27 were females. The male to female ratio was 2:1. which correlates with study of Ukoha et al.[9] (1.9:1). So it can be concluded that incidence of stroke is more common in male sex which correlates with study done by Aiyar[10], Pinhero et al.[11], Eapen et al.[12] Since the sample selection was done such that it did not have a selection bias, i.e., 90 continuous patients were chosen, hence this study obviously proves that the prevalence of stroke is two times more common in male than in female.

Clinical Presentation and Ischemic Stroke

The clinical features such as hemiplegia, giddiness, speech involvement, altered sensorium, visual disturbances, headache was evaluated and analyzed.

In our study most common clinical presentation was hemiplegia 78.9% which was followed by giddiness 46.66%, speech involvement 37.77%. This observation closely correlates with the study done by Chitrambalam et al.[13], in which most common was hemiplegia (in <45 years 93.3%, in >45 years 89.2%) followed by speech involvement (in <45 years 43.3%, in >45 years 30.8%).

Hemiplegia is the most common clinical symptom and this may be attributed to the fact that middle cerebral artery occlusion is more in our study. As studied by Wade smith et al.[14], the speech involvement that is aphasia found in these patients is associated with the occlusion of left middle cerebral artery.

Altered sensorium was present in 31.11%, headache in 27.77% and visual disturbances in 38.88%. This correlates with the results of a study done by Vaidya and Drusty.[15]

Risk Factors and Ischemic Stroke

Hypertension, diabetes, dyslipidemia, alcohol, smoking and cardiac disorders are major risk factors. In our study most common risk factor was hypertension and it is also the commonest risk factor which correlates with the study done by lipska et al.[16] (40%), Sallam et al.[17] (67%) followed by diabetes mellitus 63%, smoking 52.22%, alcohol 36%, and dyslipidemia 36%, CAD 34.4%. The prevalence of hypertension in our study among the 90 ischemic stroke patients were 69%.

A study conducted by Lindsberg and Roine observed that two-thirds of all ischemic stroke types on admission had diabetes mellitus thus corresponding to our study in which diabetes is the 2nd leading risk factor.[18]

Site of Occlusion

The burden of intracranial atherosclerosis has been reported in different populations worldwide. The incidence of intracranial atherosclerosis is very high in northern India and it is responsible for 30–50% of ischemic strokes in Asian population. Stenosis of the large branches of the circle of Willis can lead to stroke by hypoperfusion or by artery-to-artery embolism. Carotid artery stenosis contributes significantly to the total burden. Carotid artery stenosis can lead to stroke by multiple mechanisms— embolism, thrombotic occlusion, dissection or hypoperfusion. Our study shows that patients with extracranial stenosis almost always have associated intracranial stenosis but the reverse is not true in the majority. In our study the most common artery involved in occlusion is middle cerebral artery 81.11% out of which right MCA corresponds to 41.1% and left MCA occlusion was 40%, followed by posterior cerebral artery 16.66% and anterior cerebral artery 2% (Table 1).

Occlusion of Extracranial Arteries and its Severity

Color Doppler sonography of carotid arteries forms an important part of the evaluation of extracranial insufficiency. Accurate diagnosis of hemodynamically significant stenosis is critical to identify patients who

would benefit from surgical intervention. The value of a safe, noninvasive, and low-cost screening test is therefore of a great advantage.

The occlusion of ICA was found in 16 patients, and out of these 16, 12.5% had complete occlusion, 50% had 70 to 89% occlusion, 25% had 50 to 69% and 12.5% had 30 to 49% occlusion.

The CCA occlusion was found in 16 patients, and out of these 9, 55.5% had 70 to 89% occlusion, 22.2% had 50 to 69% occlusion and 22.2% had 30 to 49% occlusion.

The involvement of both ICA and CCA occlusion was found in 28 patients, and out of these 28, 57.1% had 70 to 89% occlusion, 21.4% had 50 to 69% and 14.2% had 30 to 49% occlusion.

Carotid bulb is also an important site of occlusion. In our study at the level of carotid bulb, occlusion was found in 18 patients, and out of these 18, 38.9% had 70 to 89% occlusion, 27.8% had 50 to 69% and 33.3% had 30 to 49% occlusion.

A study conducted by Fernandes et al. showed that carotid Doppler in 17% of patients who had TIA were found to have stenosis of 50% or greater and for the patient with persistent central neurological symptoms (stroke), stenosis was found in ≥50%.[19]

In a study by D'mello[20], out of 50 patients with ischemic stroke recruited for the study, 30% had occlusion at the level of ICA and CCA, and carotid bulb is the next common site of involvement which correlates with our study.

The correlation between extracranial and intracranial site of occlusion was made. The analysis revealed that when the site of occlusion is middle cerebral artery,the extracranial involvement is more at the site of both CCA and ICA followed by ICA and two patients who had complete occlusion were under this MCA occlusion category. Out of 73 patients with MCA infarct, 65 patients had an extracranial (CCA/ICA/ carotid bulb) occlusion, which suggests significant involvement of extracranial arteries when MCA is the site of occlusion.

Conclusion

Age group of 60 to 70 years are more prone for ischemic stroke, and this validates the point that atherosclerosis increases with the age.

1. Male preponderance is twice as common as female with ischemic stroke.
2. Modifiable risk factors such as smoking, alcohol, play a vital role in stroke along with nonmodifiable risk factors such as hypertension, diabetes and dyslipidemia, out of which the ratio is more towards hypertension, thus making it the commonest determining factor of stroke.
3. Hemiplegia is the commonest presentation because of the predominant involvement of middle cerebral artery occlusion and speech involvement is associated with the left MCA infarct.

MCA occlusion is the commonest among the intracranial artery and when MCA is involved majority of patients have extracranial involvement (CCA/ICA/ carotid bulb) pointing to the fact that extracranial occlusion is almost invariable present when the MCA infarct is present.

The severity of stenosis is more commonly about 70 to 89% i.e., 41% of the ischemic stroke patients when presented to the hospital had severe stenosis.

Strengths of the Study

There are only limited studies available which correlated the intracranial and extracranial site of occlusion and also which assessed the severity of stenosis. Our study aims at finding these correlations which would determine the future directions. In light of the above findings, the role of carotid Doppler in detecting the site and quantifying the degree of stenosis is very well justified. The extracranial occlusion findings done in our study are very important because of the fact that extracranial occlusion increases the possibility of recurrent stroke.

Limitations

1. Sample size is relatively small.
2. Cerebral Catheter Angiography (CTA) would have thrown a better light on the intracranial atherosclerosis which was not included in our study.

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