

Cardioembolic Stroke in Young Patients – A Prospective Analysis

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ABSTRACT

Introduction: One in six ischemic strokes is caused by cardiogenic embolism. The current knowledge regarding the natural history, diagnosis, prevention, and treatment of cardioembolic stroke is reviewed in this study. Nonrheumatic atrial fibrillation is the most frequent substrate for brain embolism and patients with this dysrhythmia have a fivefold increase in the risk of stroke. Study aimed to evaluate the clinical assessment of the patients with ischemic stroke less than 45 years of age.

Material and Methods: 50 patients who were admitted in the medical and neurology wards of Govt. Stanley medical college, Chennai during the study period from December 2003 to May 2004 for ischaemic stroke were clinically examined. The inclusion and exclusion criteria were satisfied, results were clinically and statistically assessed and the relevance of transthoracic echocardiography was studied in them.

Results: Cardiogenic embolism mostly affects the male population more frequently and the most commonly affected age group is 30-45 years. The clinically identifiable cardiac lesion was present in 77% of the cases. The most common disease is rheumatic valvular disease as seen in about 5 cases followed by ischemic heart disease which was found in about 3 cases. Abnormal ECG findings were observed in 12% of cases in the form of atrial fibrillation. Left atrial enlargement, old infarct changes, conduction abnormality and recurrent stroke(12%) were the other findings. In these, 66% (4 cases) were due to the cardioembolic origin. The echocardiographic study increases the sensitivity of detecting cardiac lesion by 22%.

Conclusion: Cardiac lesion accounts for 36% of brain embolism. Hemiparesis is the most common presentation (88% of cases) followed by Hemiplegia. The middle cerebral artery is most commonly affected by embolism. Rheumatic heart disease (39%) and Ischemic heart disease are the important causes of brain embolism in this study.

Keywords: Embolism, Cardiogenic Embolism, Thrombus, Ischaemic Stroke, Rheumatic Heart Disease, Ischaemic Heart Disease.

INTRODUCTION

Cardiogenic brain embolism refers to an obstruction in the cerebral arteries by an embolus originating in the heart. Several clinical, epidemiologic and multicentric projects indicate that 15% to 20% of all ischemic strokes are cardioembolic in origin.^{1,2} In the 1950s, the only two cardiac disorders accepted as having an important risk of causing embolism were rheumatic mitral stenosis with atrial fibrillation and recent myocardial infarction.^{3,4} Many cardiac lesions and disorders carry a risk of cardiac thrombosis and embolism. More modern cardiac diagnosis testing has made

it possible to diagnose cardiac disorders more definitely and to attempt to quantify the risk of embolism.

Stroke is 90% ischemic in nature and is a leading cause of mortality and long-term disability globally. While most of the strokes originate from the cervicocranial vasculature, a 20% result from high-risk cardiac abnormalities and cryptogenic ischemic strokes have also known to have embolic features, suggesting a possible cardio-aortic origin.^{5,6}

The relative incidence of the types of stroke keeps changing as technology advances to allow more precise diagnosis of the cardiac lesion. These are transesophageal echocardiography (TOE), Transcranial Doppler ultrasonography, Ultrafast cardiac Computed tomography scan, Cardiac magnetic resonance imaging and Isotope - labeled platelet scintigraphy.^{7,8} Some cardiac conditions like patent foramen ovale, mitral valve prolapse are diagnosed mostly by the above investigations.

The primary sources of cardioembolic embolism include valvular diseases, left ventricular and atrial thrombi, cardiac tumors, and paradoxical emboli. The cardiac output evenly distributes the emboli from the heart throughout the body, but more than 80% of these emboli involve the brain. In the brain, approximately 80% involve the anterior circulation (ie, carotid artery territory), while 20% involve the vertebrobasilar distribution which is proportion to the distribution of cerebral blood flow.⁹

Once emboli reach the cerebral circulation, they obstruct brain-supplying arteries which cause ischemia to the neurons and the blood vessels supplying the brain. In contrast to thrombi, emboli are usually loosely attached to the vascular walls and tend to migrate distally. When this happens, reperfusion of the damaged capillaries and arterioles causes blood to leak into the surrounding infarcted tissue. This explains the more frequent association of hemorrhagic infarction with cardiogenic embolism than with other causes of ischemic stroke.¹⁰ In a nutshell, cardioembolic stroke is not one disease with a single natural history. A variety of

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cardiac disorders lead to cardioembolic stroke and each has unique clinical features, risks of initial and recurrent stroke, and optimal therapy.

Study aimed to evaluate the clinical assessment of the patients with ischemic stroke less than 45 years of age.

MATERIAL AND METHODS

This study was conducted at the Medical Wards / Neurology ward in Govt. Stanley Medical College, Chennai, among the patients admitted for the ischemic stroke of less than 45 years of age.

Inclusion Criteria: Age group between 15 - 45 years, transient ischemic attack, acute onset.

Exclusion Criteria: Age group <15 yrs and > 45 years, Haemorrhagic stroke, Diabetes mellitus, Hypertension, Hyperlipidemia, Smoking, Alcohol. In this study the total number of cases is 50, and the age group of above 45 years is excluded because atherosclerosis is common. Thus who were admitted as inpatients with thromboembolic stroke were subjected for investigations, treatment and follow up.

Site of lesions	Infarct	Normal Study	(%)
Rt. Side	11	-	22%
Lt. Side	27	-	54%
Multiple	1	-	2%
No lesion	-	11	22%

Table-1: CT scan reports

Categories	Male	Female	Total
Cardiac Origin	3	1	4
Non-Cardiac	2	0	2
Total Cases	5	1	6

Table-2: Recurrent stroke

The detailed clinical history, was taken from the patient or reliable informants.

Those who were admitted in the ward with an ischemic stroke under the age group of 45 years were subjected for CT scan. If the CT scan showed haemorrhage, the cases were excluded from this study. CT scan finding of infarct with symptoms of stroke was subjected to transthoracic and Doppler echocardiography. If it is normal and in whom a cardiac defect is suspected then the patients were subjected for transesophageal echocardiography.

RESULTS

In this study the total number of cases is 50. 84% of cases are male. 16% of the cases are female. Sex proportion in cardiogenic brain embolism, males account for 77% of cases and females account for 23% of cases. The most common age group affected is 30 - 45 years. In this age group the males constitute 74% and females 62%.

Hemiparesis was the most common presentation 88% and 12% had hemiplegia in cardiogenic brain embolism (Figure

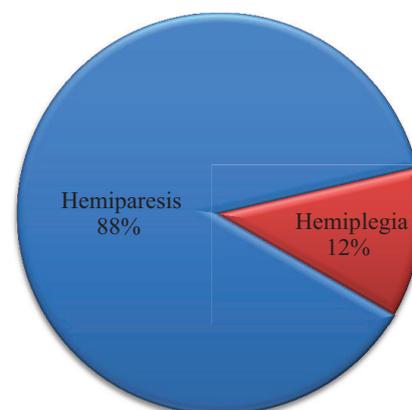


Figure-1: Neurological deficits in cardiogenic brain embolic stroke

SI. No.	Cardiac Lesions	Male	Female	Total	%
1.	Rheumatic Heart Disease				
	a) MS	3	2	5	10
	b) MS/MR	-	1	1	2
	c) MS/AS	1	-	1	2
2.	MVP	-	1	1	2
3.	Mechanical valve	3	-	3	6
4.	Ischemic heart diseases	3	-	3	6
5.	HOCM	-	-	-	-
6.	Clinically normal heart	32	4	36	72

Table-3: Clinically detected cardiac lesions

SI. No.	Cardiac Involvement	Male	Female	Total	%
1.	MS/PHT	3	2	5	10
2.	MS/MR	0	1	1	2
3.	MS/AS	1	-	1	2
4.	MVP	1	1	2	4
5.	Mechanical valve	3	-	3	6
6.	Ischemic heart disease	5	-	5	10
7.	HOCM	1	-	1	2
8.	Normal Study	28	4	32	64

Table-4: Echocardiographic findings

1). Aphasia in most commonly associated neurological deficit followed by sensory disturbance (Figure 2). 5% of patients had left sided infarct and 22% of patients had right sided infarct (Table 1). The commonest site involved was internal capsule, 38%. (Figure 3)

The clinically identified cardiac lesion is about 14 (77%) cases. The most common disease found in rheumatic valvular disease as seen in about 5 cases followed by ischemic heart disease which was found in 3 cases. Abnormal ECG findings were observed in 12% of cases in the form of atrial fibrillation. Other findings include Left atrial enlargement, old infarct changes and conduction abnormality. Recurrent stroke occurred in 12% (6 cases) of total cases, out of which 66% (4 cases) are due to the cardioembolic origin (Table 2). Rheumatic valvular disease was detected clinically in 14%

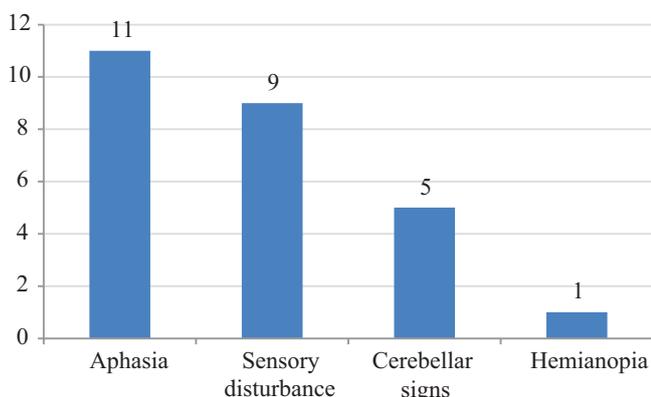


Figure-2: Associated neurological deficits

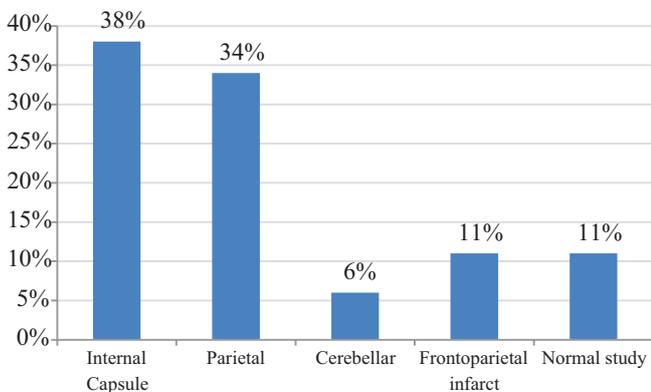


Figure-3: CT scan findings in cardiogenic brain embolic stroke

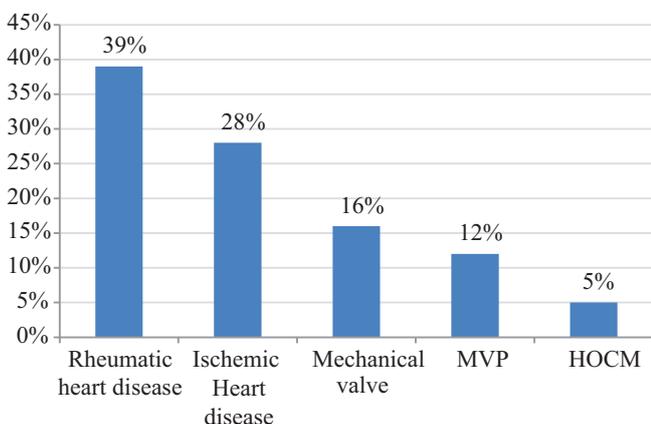


Figure-4: Cardiac Lesions

of case of these, mitral stenosis accounts for 10% (Table 3). 36% of patients with ischemic stroke have a cardiac origin (Table 4).

TIA occurred in about 6 cases, of these 4 cases had normal echocardiogram, 2 cases had cardiac lesion in the echocardiogram. One case of RHD/MS/PHT and one case of the mechanical mitral valve was noted. In all the above cases CT scan findings were normal (Figure 4).

Prosthetic mitral valve replacement accounts for 16% of thromboembolic stroke in the present study. Out of the 18 cases, cardiac lesions were detected by clinical examination alone in 14 cases (78%). By using echocardiography cardiac lesions were detected in all 18 cases. Thus, the echocardiographic study increases the sensitivity of detecting cardiac lesion by 22%.

DISCUSSION

Stroke and ischemic heart disease are among the leading causes of death and disability worldwide.^{11,12} Even more worrisome is that in the recent year's stroke rates are gradually increasing in certain developing nations. There is a suggested escalation in the prevalence and incidence of stroke in India over the last 3 decades. While the frequency of the specific causes of ischemic stroke may differ around the world,¹³ the purpose of this review is to explore the subtype of stroke known as the cardioembolic stroke. A cardioembolic stroke is when the heart pumps unwanted materials into the brain circulation that results in the occlusion of a brain blood vessel and subsequent damage to the brain tissue.¹⁴

Pasquale G et al. studied that the prevalence of cardioembolic stroke in patients younger than 45 years of age is much higher, ranging from 23% to 36%.¹⁵ In this study the prevalence is 36% which is comparable to other studies in the literature.

Mitral valve is involved in 39% of cases. Wells FC, Shapiro IN studied 150 cases of rheumatic heart disease wherein mitral valve was involved in 25% of cardioembolism.¹⁶ 62% of the rheumatic valvular disease, producing cardiac embolism is associated with atrial fibrillation in this study. Specific risk factors for left ventricular thrombus include the presence of hypokinetic or akinetic segments of the ventricular wall, injury to the endocardial surface or persistently abnormal left ventricular flow pattern. The complications are more common in transmural and in anterior wall infarct.¹⁷ 28% of the cardiac embolism is due to ischemic heart disease. Of these, the majority is due to hypokinesia of left ventricle.

HOCM carried a low-risk factor of embolism and contributed to 5% of the cardiac embolism in the present study. Thromboembolism remains a major cause of morbidity and mortality, complicating prosthetic valve replacement.¹⁸

By using echocardiography cardiac lesions were detected in all 18 cases. Thus, the echocardiographic study increases the sensitivity of detecting cardiac lesions by 22%. Thus the echocardiographic study is clearly superior to conventional clinical examination and remains as a gold standard for detecting cardiac lesions producing systemic embolization.

CONCLUSION

Cardiac lesions (18 cases) account for 36% of the brain embolism. Hemiparesis is the most common presentation (88% of cases) and Hemiplegia occurs in 12% of cases due to cardiogenic brain embolism. The middle cerebral artery is most commonly affected by embolism. Rheumatic heart disease is the leading cause of embolism in this study (39%). The incidence of embolism increases with atrial fibrillation. Ischemic heart disease is one of the important causes of brain embolism in this study. Stroke recurrence occurs in 8% of cases with previous cardiac problems. Echocardiography serves as a gold standard in the diagnosis of potential cardiogenic emboli.

REFERENCES

1. Bogousslavsky J, Cachin C, Regli F, et al., Cardiac sources of embolism and cerebral infarction. Clinical consequences and vascular concomitants: the Lausanne Stroke Registry, *Neurology*, 1991;41:855–9.
2. Cerebral Embolism Task Force, Cardiogenic brain embolism, *Arch Neurol*, 1989;46:727–43.
3. Albers G.W., Amarenco P., Easton J.D., Sacco R.L., Teal P. (2004) Antithrombotic and thrombolytic therapy for ischemic stroke. *Chest* 126:483S–512S.
4. Kistler J.P. Cerebral embolism. *Compr Ther* 1996; 22:515–530.
5. Sacco R.L., Adams R., Albers G., et al. Guidelines for prevention of stroke in patients with ischemic stroke or transient ischemic attack. *Stroke*, 2006;37:577–617.
6. Sacco R.L., Ellenberg J.H., Mohr J.P., et al. Infarcts of undetermined cause: the NINCDS Stroke Data Bank. *Ann Neurol* 1989; 25:382–390.
7. Kim E.Y., Lee S.K., Kim D.J., et al. Detection of thrombus in acute ischemic stroke: value of thin-section noncontrast-computed tomography. *Stroke* 2005; 36:2745–2747.
8. Demchuk A.M., Saqqur M., Alexandrov A.V. Transcranial Doppler in acute stroke. *Neuroimaging Clin N Am* 2005; 15:473–480, ix.
9. Hart RG, Albers G, Koudstaal P. Cardioembolic stroke. Ginsberg M, Bogousslavsky J, eds. *Cerebrovascular Disease: Pathophysiology, Diagnosis and Management*. Blackwell Science; 1998. 1392-429.
10. Gage BF, Waterman AD, Shannon W, Boechler M, Rich MW, Radford MJ. Validation of clinical classification schemes for predicting stroke: results from the National Registry of Atrial Fibrillation. *JAMA*. 2001; 285:2864-70.
11. Goyal A, Yusuf S. The burden of cardiovascular disease in the Indian subcontinent. *Indian J Med Res* 2006;124:235-44.
12. Lipska K, Sylaja PN, Sarma PS, Thankappan KR, Kutty VR, et al. Risk factors for acute ischaemic stroke in young adults in South India. *J Neurol Neurosurg Psychiatry* 2007;78:959-63.
13. Banerjee TK, Roy MK, Bhoi KK. Is stroke increasing in India-preventive measures that need to be implemented. *J Indian Med Assoc* 2005;103:162,164,166.
14. Ghandehari K, Izadi-Mood Z. Etiology of young adult onset brain infarction in Iran. *Arch Iran Med* 1006;9:240-3.
15. Pasquale G, Pinelli G. *Heart-Brain Interactions*. Berlin, Heidelberg: Springer Berlin Heidelberg; 1992.
16. Wells FC, Shapiro IN. *Mitral valve disease*. Oxford: Butterworth-Heinemann, 1996.
17. Keren A, Goldberg S, Gottlieb S, et al. Natural history of left ventricular thrombi: their appearance and resolution in the post-hospitalization period of acute myocardial infarction. *J Am Coll Cardiol* 1990;15:790–800.
18. Heras M, Chesebro J H, Fuster V. et al High risk of thromboemboli early after bioprosthetic cardiac valve replacement. *J Am Coll Cardiol* 1995;25:1111–1119.

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