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RESEARCH ARTICLE

Correlation of Ischemic Stroke with Echocardiographic Findings in Young Patients

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ABSTRACT

Background: In the management of patients with ischemic stroke and transient ischemic attack, determining the source of the embolic event is critical. In 15–30 percent of all strokes, cardiogenic embolism is suspected to be the cause. In these patients, echocardiography is a frequently utilized and adaptable method that can provide full information on thromboembolic risk. The relevance of transthoracic-echocardiography(TTE) and transesophageal-cardiography(TEE) in clinical practice is discussed in this article, which analyses probable cardiac origins of stroke. Aim of this study is to determine the clinoradiological association between ischemic stroke in young and find out the relevance of Transthoracic and Transesophageal Echocardiography in evaluation of cardiac source in ischemic stroke.

Methods: This cross-sectional observational study was done between July 2020 and April 2022. A total of 31 patients of ischemic stroke were included. The mean Glasgow coma scale(GCS) and National Institutes of Health Stroke Scale(NIHSS) score of these patients They underwent transthoracic-echocardiography followed by transesophageal-cardiography, their clinical profile has been recorded and analyzed using Statistical Package for the Social Sciences (SPSS), V21 software.

Results: The mean age of the subjects was 34.74 ± 6.38 years, the group was consisting of 28 males and 3 females. The most common complaint was one sided weakness and speech difficulty. transesophageal-cardiography detected bicuspid aortic valve in one patient, right atrial thrombus in one patient and patent foramen ovale in one patient over and above transthoracic-echocardiography findings in this study.

Conclusion: This study reinforces the importance of transesophageal-cardiography in stroke in young patients. transesophageal-cardiography is not only an effective tool in picking up the clots inside the cardiac chambers but also it was found to be significantly effective in detecting valvular lesions and small septal defects like patent foramen ovale. It is recommended that all strokes in young patients need to undergo transthoracic-echocardiography as well as transesophageal-cardiography to find the source and etiology of cardio embolic stroke.

Keywords: Ischemic stroke, transthoracic-echocardiography(TTE) and transesophageal-cardiography(TEE), patent foramen ovale (PFO), RA thrombus.

Introduction

In the last decade the incidence of ischemia has been ascribed due to metabolic, environmental and behavioral changes. Strokes are a leading cause of death and disability worldwide, being the third most common cause of mortality in the United States.¹ A higher proportion of younger individuals suffer from stroke in developing countries as compared with developed countries.² More than 1.5 million people die of post-stroke cardiovascular complications worldwide annually, such as myocardial infarction, unstable angina, congestive heart failure, coronary artery diseases and recurrent strokes. Various cardiac disorders including atrial fibrillation, ventricular thrombus, valvular heart disease, cardiac tumors, and structural heart defects can cause cardioembolic stroke and recurrent strokes.³ It is also important to determine whether post stroke cardiac dysfunction is triggered by stroke, is an unrelated complication, or is the underlying cause of stroke. Thus, extensive evaluation is mandatory in post stroke patients.⁴ The use of echocardiography has largely replaced the ECG in measuring left ventricular morphology and provided additional insights into associated changes in ventricular function.⁵ The early focus of echocardiographic predictors of vascular outcome was on LV morphology.⁶ In a similar vein, LVM and other cardiovascular parameters have been shown to predict the risk of stroke.⁷ The common findings on echocardiography documented in literature mitral annular calcification height and enlargement of the left atrium (LA) and aortic root are further abnormalities linked to persistent hypertension i.e left ventricular hypertrophy, dilated cardiomyopathy further leads to stroke.^{8,9} Data from India on stroke among the young are mostly limited to ischemic stroke. As per studies, of all the stroke admissions in India 25% are below the age of 45 years.¹⁰ Stroke in young has a tremendous economic impact as the victims are disabled in their most productive age group.¹¹ The relevance echocardiography (both transthoracic and trans esophageal) to analyze possible causes of stroke was studied in this article.

Aim/Objectives

Aim of this study is to determine the clinico-radiological association between ischemic stroke in young and find out the relevance of Transthoracic and Transesophageal

Echocardiography in evaluation of cardiac source in ischemic stroke.

Study Design

This Cross sectional, observational study was conducted among young patients attending Government tertiary care hospital in North India, during the period from July 2020 to April 2022. A total of 31 patients were registered. Inclusion criteria used were subject age less than 45 years, all consecutive, confirmed & diagnosed cases of ischemic stroke and patients who are willing for treatment of ischemic stroke.

Considering the prevalence of acute ischemic stroke as 9.67% for every 100 populations. the sample size was calculated for the study using the formula, $N = 4pq/L^2$, P: Prevalence, Q: 1- prevalence, L: Allowable error, $p = 9.67\% = 0.0967$, $q = 0.9033$ (1-p), $L = 11\% = 0.11$, $N = 4 * 0.0967 * 0.9033 / 0.11 * 0.11$ and 28 obtained. The minimum sample size required for the study was 28 patients.

Study Methods

The institutional ethical committee (IEC) and SRC approval was taken vide Reg No-155/2020 dated 4th Dec 2020. A The subjects meeting study criteria explained the nature and purpose of this study and included them after obtaining the informed consent. A detailed history was taken and examination findings noted. The severity of stroke was measured by using the National Institute of Health Stroke Scale (NIHSS) and the Glasgow Coma Scale. All the routine investigation including the complete blood counts, biochemical metabolic parameters were done. The chest X-ray and ECG, 24 hours Holter monitoring, NCCT/MRI brain was done to confirm ischemic stroke followed by TTE and TEE have been done. TEE was done by using 5 MHz multiplane TEE transducer of Philips Epiq 7 system. The data collected was analyzed using a statistical package for social sciences (SPSS) version 21.

Results

In this study, the mean age was 34.74 ± 6.38 years and consisted of 28 males and 3 females. The chief complaints among the patients were in, 70.9% had one sided weakness followed by 58% had speech difficulty, 38.7% had facial weakness, 35.4% had headache, dizziness & vomiting, 9.6% each had loss of consciousness, difficulty in vision and altered sensorium/behavior and 6.4% had seizures (Table-1). The mean GCS score was 13.8 ± 2.1 and the mean NIHSS was 7.2 ± 6.1 (Table-2).

Table 1: Distribution subjects according to chief complaints

Chief complaints	Frequency	Percent
One sided weakness	22	70.9%
Speech difficulty	18	58%
Facial weakness	12	38.7%
Headache, dizziness & vomiting	11	35.4%
Loss of consciousness	3	9.6%
Difficulty in vision	3	9.6%
Altered sensorium/behavior	3	9.6%
Seizure's	2	6.4%

Table 2: GCS and NIHSS score

Score	Mean
GCS	13.8±2.1
NIHSS	7.2± 6.1

The ECG was normal in 87.1% patients and 2 had left ventricular hypertrophy, 1 had atrial fibrillation and 1 had ischemia. None of the patients had cardiomegaly on X-Ray chest PA View. One patient each had AF and 1 had VPC on 24-hour Holter-monitoring. Non-contrast computed tomography findings were 20 had infarct and 1 had infarct with midline shift. MRI brain findings were 18 had acute infarct, 4 had subacute infarct and 1 had chronic infarct.

On Transthoracic echocardiography, 19.4% of subjects had abnormal study, whereas on TEE, 28.8% of subjects had abnormal Study (Table-3).

The findings detected on TEE over and above TTE were PFO, RA thrombus and bicuspid aortic valve with nodule on non-coronary cusp.

The comparison between transthoracic echocardiography and transesophageal echocardiography (Table-4). A significant association was obtained between them meaning transesophageal echocardiography helped in finding cardiac changes than the transthoracic echocardiography. In this study, TEE have diagnostic sensitivity of 66.6%, specificity of 100%, positive predictive value of 100%, negative predictive value of 96.4%, and obtained accuracy of 94.6%.

Table 3: Echocardiography findings

ECHO findings	TTE	TEE
LVH	03	03
LV Clots, RWMA	02	02
Thrombus in RA	Not detected	01
Bicuspid Aortic valve, small nodule on non-coronary cusp	Not detected	01
EF<50%, RWMA and mitral regurgitation	01	01
Patent foramen ovale (PFO)	Not detected	01
Normal study	25	22

Table:4 Association between transthoracic echocardiography and transesophageal echocardiography

Transesophageal ECHO	Transthoracic ECHO	N	Mean	SD	95% CI		p-value
					Lower	Upper	
	Yes	9	2	0.50	0.75	0.63	<0.02*
No	22	1.59	0.00				

*Level of significance: 0.05

Table 5: Diagnostic test evaluation

Screening test results	Diagnosis		Total
	Detected	Not detected	
Positive	6 (a)	0 (c)	6 (a+c)
Negative	3 (b)	22 (d)	25(b+d)

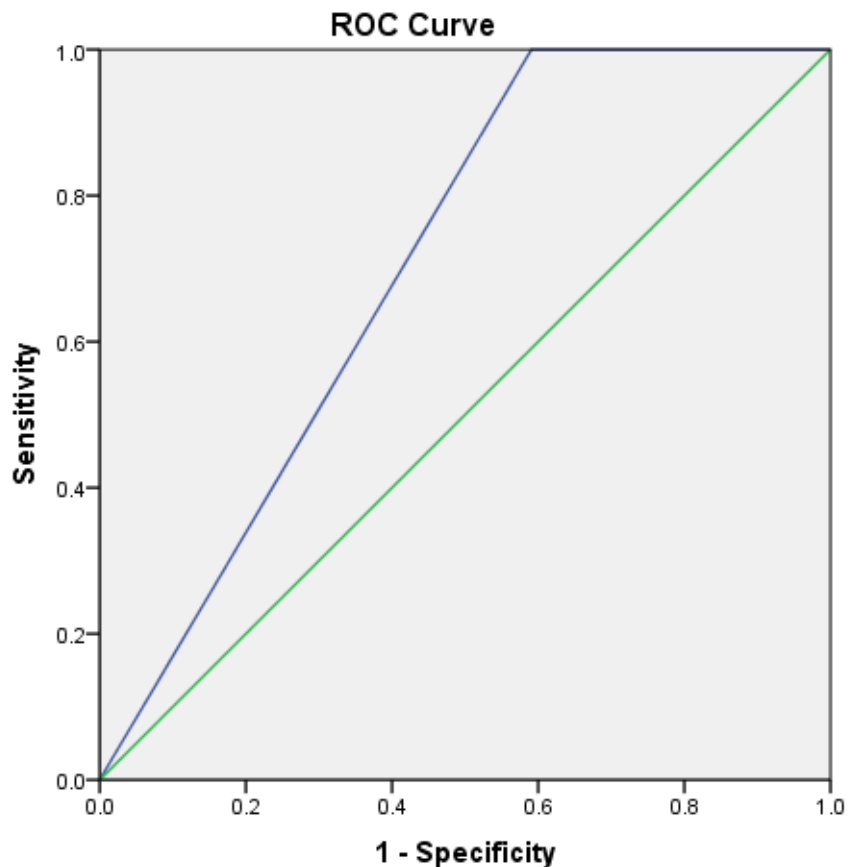
Total	9	22	31 (a+b+c+d)
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Table :6 Area under the curve

TTE/TEE	Validity	S.E	Area	95% CI		p-value
				Lower	Upper	
Positive	9	0.09	0.705	0.52	0.88	0.05*
Negative	22					

*Level of significance: p<0.05

Figure 1: ROC curve



Diagonal segments are produced by ties.

Discussion

Ischemic stroke in young is considered to be a catastrophic event and identifying the etiology remains a diagnostic challenge in a number of cases especially in the absence of valvular heart disease, prosthetic valve, and atrial fibrillation. Ischemic stroke in younger patients is increasing, and risk factors are changing over time. Although stroke in young comprises only 10- 15% of all strokes, it has a tremendous economic impact as the victims are disabled in their most productive age group.¹¹

In the present study the mean age was 34.74 ± 6.38 years and consisted of 90.3% males and 9.7% females. The youngest patient in this study was 28years. The study by Nayak et al. reported a mean age of 35.1 years and consisted of 76%

males and 24% females.¹⁰ Similar demographic findings were recorded in the study by Rohini B, Aristeidis H et al¹².

Ginens F et al. which reported 71.7% had headache, 58.3% had facial weakness and 15% had blurred vision.¹³ In the present study 74.2% had either side hemiparesis majorly. The study by Rohini B, Aristeidis H et al. also reported similar findings in 69.3% patients. ¹²

The mean GCS in this study was 13.8 ± 2.1 . 7/31 subjects were less than equal to 11. In a study by Ossama Y et al. which showed the mean GCS was 11.¹⁴ The mean NIHSS score in this study was 7.2 ± 6.1 , maximum NIHSS score was 21/42. In Rohini B, Aristeidis H et al. ¹² the mean being 5.5 and study

by Ossama Y et al. ¹⁴ reported a median NIHSS score of 20.

Abnormal Holter monitor findings were seen in 2/31 patients in which one had atrial fibrillation and one had ventricular premature complexes. A higher rate of atrial fibrillation was documented by Vivek A et al, i.e 14.8%. ¹⁵

In the present study TTE of 80.6% subjects was normal and the remaining 19.4% had LVH, clot, EF <50% and mitral valve lesion. The study by N. Uma et al. ¹⁶ and Caplan et al. ¹⁷ also had similar findings like LVH, mitral valve lesion and calcifications. LVH was the most common which was a similar finding in the study by Marco et al. ¹⁸

The TEE findings in the present study showed 28.8% were abnormal, 2/31 had clots, 1/31 had thrombus in the right atrium and 1/31 had bicuspid aortic valve over and above TTE findings. Whereas the study by Vivek A et al. TEE findings were seen in 33% patients. ¹⁵ The study by Jose Biller et al. ¹⁹ 60% had TEE abnormality, 34% in the study by J R Beattie et al.²⁰ and 30% in the study by T Retting et al.²¹

The present study showed significant association between TTE and TEE suggesting TEE was more superior than TTE. In a study conducted by De Abreu TT, Mateus S et al. to compare TEE with TTE in patients with ischemic stroke, it was seen that TEE had additional therapeutic implications in about 32% of patients who otherwise had a normal TTE.²²

Rus et al. it was noted that in young patients with cryptogenic stroke, TEE abnormality was found in 51% of the patients and led to change in therapeutic management in 47% of the patients. ²³

In another comparative study by Rettig T, Bouma B, van den Brink R, it was noted that TEE was superior to TTE in detecting potential cardiac source of embolism. ²¹

Conclusion

This study reinforces the importance of TEE in stroke in young patients. TEE is not only an effective tool in detecting the clots inside the cardiac chambers but also in detecting valvular lesions and small septal defects.

Recommendation of the study

It is recommended that all strokes in young patients need to undergo TTE as well as TEE to find the source and etiology of cardio embolic stroke.

Limitations:

This study faced difficulty in following up patients in COVID-19 Pandemic situation. Most of the TEEs have been done by wearing PPEs, due to which accessibility of TEEs may be compromised. Due to invasive procedure (TEE) some subjects were never followed up. Multiple coordination among departments was compromised during COVID pandemic situation.

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