

TRANSESOPHAGEAL ECHOCARDIOGRAPHY BE A ROUTINE WORK UP IN ALL YOUNG STROKES? A TERTIARY CARE CENTRE STUDY

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ABSTRACT

Introduction: Ischemic stroke is one of the major causes of morbidity and mortality in middle and late years of life. 85% CVA caused by ischemia, out of which 20% of is constituted by cardio embolic stroke. Cardio embolic stroke is defined as non-lacunar stroke with presence of potential cardiac source in the absence of cerebrovascular disease. The availability of new diagnostic techniques especially transoesophageal echocardiography (TEE) has allowed clinicians to identify cardiac source of embolism. This study was undertaken to compare the diagnostic yield of transoesophageal echocardiography with transthoracic echocardiography in the detection of a cardiac source of embolism in patient with cerebral ischemia. **Materials And Methods:** Stroke patients admitted in medical wards for period of one year were selected for this study. Patients with or without cardiac disease below the age 45 years and patient without any known risk factors for thrombotic stroke were included in the study. Age > 45 years, patient with known risk factors for Atherothrombotic stroke and CT suggestive of haemorrhage were excluded. Both transthoracic echocardiography & transoesophageal echocardiography were done for all patients **Results:** In 30 patients included in the study transthoracic echocardiography revealed a potential cardiac source of embolism in 25% (4 patients) all of whom had clinical evidence of heart diseases and 14% (2 patients) who had no clinical evidence of heart disease. In addition to the yield by transthoracic echocardiography, transoesophageal echocardiography revealed a potential source of embolism in 56% (9 cases). In patients with clinical evidence of heart disease, cardiac abnormalities additionally detected by transoesophageal echocardiography are 2 cases of LA appendage clot, 6 cases of left atrial spontaneous echo contrast and one case of prosthetic valve dysfunction (which is statistically significant). In patients with no clinical evidence of heart disease, transoesophageal echocardiography detected one case of patent foramen ovale with atrial septal aneurysm. Thus transoesophageal echocardiography is more sensitive than transthoracic echocardiography in detection of potential cardiac source of embolism. **Conclusion:** TEE is of great value in patients with clinical heart disease in comparison with TTE. In patients without clinical evidence heart disease utility value of TEE was less pronounced, still, TTE can be used as a effective screening tool. We suggest TEE may be advised routinely as stroke evaluation tool especially in the young patients.

KEYWORDS: Stroke, Echocardiography, Transoesophageal, Transthoracic.

INTRODUCTION

Ischemic stroke is one of the major causes of morbidity and mortality in middle and late years of life. The incidence of stroke increases with age, this disability affects many people in their golden years. Stroke is the 3rd leading cause of death preceded only by cardiac disease and malignancy. Cerebrovascular accident is an abrupt onset of non-convulsive and focal neurologic defect. 85% CVA caused by ischemia, out of which 20% of is constituted by cardio embolic stroke.^[1]

Cardio embolic stroke is defined as non-lacunar stroke with presence of potential cardiac source in the absence of cerebrovascular diseases. It has an unfavorable outcome since it produces larger and more disabling stroke than other subtypes. Cardio embolic stroke is largely preventable, rendering measures of primary prevention valuable. Once the stroke has occurred the likelihood of recurrence is high, thus secondary prevention is also equally important.^[2]

The availability of new diagnostic techniques especially transoesophageal echocardiography (TEE) has allowed clinicians to identify cardiac source of embolism. TEE is

a new application of echocardiography that allows high resolution imaging of atria, atrioventricular valves and aorta by inserting an ultrasonic transducer in the esophagus.^[3]

Recent studies suggest that transesophageal echocardiography may detect a potential source in upto 65%,^[1] of patients with cerebral ischemic events or systemic arterial embolism. This study was undertaken to compare the diagnostic yield of transesophageal echocardiography with transthoracic echocardiography in the detection of a cardiac source of embolism in patient with cerebral ischemic events under the age 45 yrs.

Based on this aim of our study is to compare the diagnostic yield of transesophageal echocardiography with transthoracic echocardiography in the detection of cardiac source of embolism in patients with cerebral ischemic events. And also to document intracardiac lesions which could have been the source of embolism for ischemic stroke in this study population.

MATERIALS AND METHODS

Stroke patients admitted in medical wards for a period of one year was selected for this study. Patients with or without cardiac disease below the age 45 yrs and Patient without any known risk factors for thrombotic stroke were include in this study. Whereas patients with age more than 45 years, patient with known risk factors for Atherothrombotic stroke like diabetes mellitus, systemic hypertension, smoking and CT suggestive of hemorrhage were excluded from this study.

Only inpatients were included in series to ensure that investigation, treatment and follow up of cases are done properly and efficiently. Detailed history was taken from patients who were conscious and not aphasic. Based on this a total of 30 cases was included in this study.

Both transthoracic echocardiography & transesophageal echocardiography were done for all patients, on the same day by cardiologist who has adequate training. Standard parasternal and apical views were obtained using Aloka ultrasonic 2000 interfaced with 5MHZ transducer. Intra venous saline contrast was not given during transthoracic echocardiography.

The following echocardiographic abnormalities were considered a possible cardiac source of embolism. Left atrial or left ventricular thrombi, left atrial spontaneous echocontrast, mitral stenosis, myxomatous degeneration of mitral valve with prolapse, severe mitral annular calcification, atrial septal defect, patent foramen ovale, atrial septal aneurysm, left ventricular aneurysm or apical hypokinesia, aortic or mitral vegetation, atrial myxoma, moderate and severe globular left ventricular hypokinesia and prosthetic heart valve. Statistical analysis was done using SPSS software. Qualitative data was analyzed (Sex, TTE, TEE) to compare the difference

between those with clinical evidence of heart disease and those with no clinical evidence of heart disease by Pearson Chi-square test and Yates corrected chi-square test.

RESULTS

In our study 35 patients with ischemic stroke below the age of 45 yrs were assessed clinically and biochemically. Three of these patients had diabetes, 2 could not swallow and were not included in the study. A total of 30 patients were included in the study. Among which 17(56%) patients were male and rest 44% were female. Mean age with maximum incidence is 31-40 (56%); minimum incidence was in the younger age group 12-20 (10%).

Based in side of involvement of stroke 15 patients had right side involvement and 15 had left side involvement, hemiplegia was seen in 17 patients, hemiparesis in 12 patients and posterior circulation stroke in one patient. Aphasia was found in 12 (40%) cases. All of them had right hemiplegia. These 30 patients were divided into two groups based on presence or absence of clinical evidence of heart disease. About 16 patients had previous evidence of heart disease (Group I). There is female predominance in Group I since rheumatic mitral stenosis is more common in females. Both the patients less than 20 yrs had prosthetic valves in mitral position. Among patients with no clinical evidence (Group II) of heart disease among 14 cases there is a slight male preponderance and the age group affected maximum is 31-40.

In both Group I and Group II mean age was similar, which is not statistically significant. When comparing Group, I & Group II there is obvious sex difference, which is also statistically significant, more males in Group I, more females in Group II.

Out of 30 patients, 16 had clinical evidence of heart disease.

Table 1: Cardiac abnormality.

Cardiac Abnormality	Number	Percentage
Rheumatic heart disease	11	69%
Coronary artery disease	2	12.5%
Prosthetic valve	3	18.5%

This table shows rheumatic heart disease accounts for 11 cases (69%) of patients with heart disease. Still rheumatic heart disease forms the major cause of cardioembolic stroke in developing countries. Three patients had prosthetic valve in mitral position. They were on oral anticoagulant therapy.

In all the 30 patients including both groups subjected to transthoracic echocardiography the findings were:

Table 2: TTE findings.

Rheumatic heart disease	11
Mitral valve prolapses	2
Coronary heart disease	3
RHD with Left atrial clot	1
RHD with Left atrial spontaneous echo contrast	2
Prosthetic valve	3

In the study isolated mitral stenosis constitutes the predominant lesion which accounts for 45% (5 cases); in association with aortic valve involvement forms another 45% (5 cases); associated with tricuspid valve involvement in 10% (1 case). Mitral stenosis is commonly associated with atrial fibrillation, which increases risk of stroke by 17-fold compared with

Table 3: Transesophageal echocardiography.

Cardiac abnormality	Detected by TEE
Left atrial spontaneous echo contrast	8
Left atrial appendage clot	3
Left ventricular clot	1
Myxomatous mitral valve with mitral regurgitation	2
Patent foramen ovale	1
Atrial septal aneurysm	1
Complex aortic atheroma	-
Prosthetic valve dysfunction	1

When comparing with transthoracic echocardiography transesophageal echocardiography additionally detected 6 cases of left atrial spontaneous echo contrast, 2 cases of left atrial appendage clot, one case of patent foramen ovale with atrial septal aneurysm, one case of prosthetic valve dysfunction.

The heart disease of patients in Group I was confirmed by transthoracic echocardiography. Transthoracic echocardiography also detected 1 left atrial clot in a patient with rheumatic mitral stenosis, left atrial auto contrast in 2 cases; left ventricular thrombus in 1 case. Totally it detected cardiac source of embolism in 4 cases (25%).

Transesophageal echocardiography revealed a potential cardiac source of embolism in 13 patients (81%) i.e. it confirmed transthoracic echocardiography findings in 4 cases. And TEE detected an additional of 9 cases (56%), with left atrial spontaneous echo contrast in 6 cases (37%), 2 more cases of rheumatic mitral stenosis showed left atrial thrombus, left atrial appendage being better visualized in transesophageal echocardiography. In one case of prosthetic valve, mild dysfunction was visualized in transesophageal echocardiography, out of 16 cases; 7 cases of RHD had atrial fibrillation and one patient with prosthetic valve had atrial fibrillation.

Group II cases, no clinical evidence of heart disease transthoracic echocardiography detected 2 cases (14%) of mitral valve prolapse which is also confirmed by

matched controls. Only one case of rheumatic mitral stenosis had left atrial clot. In the remaining it is likely that fresh clots could have been discharged to systemic circulation.

In 30 cases 2 (6%) cases were identified to have mitral valve prolapse by transthoracic echocardiography. Both the patients had no clinical evidence of heart disease i.e. they belonged to Group II.

Two male patients below 40 yrs had ECG showing old inferior wall myocardial infarction. In both cases Transthoracic echocardiography showed hypokinetic inferior and posterior segments. One had associated left ventricular aneurysm with an adherent thrombus.

transesophageal echocardiography and additionally detected 2 (14%) abnormalities; one had patent foramen ovale detected by right to left shunting diagnosed by contrast studies and color flow imaging. This case also had associated atrial septal aneurysm, which is a common accompaniment patent foramen ovale.

Detection rates of TTE statistically compared in those patients with clinical evidence of heart disease and in those with no clinical evidence of heart disease. It shows that difference is statistically not significant. However, in patients with clinical evidence of heart disease, it is able to detect one out of four cases; whereas in no clinical evidence of heart disease one out of six cases. Similarly, TEE shows that those with clinical evidence of heart disease TEE is able to detect 11 times more than those with no clinical evidence of heart disease.

Comparing TEE against TTE in patients with clinical evidence of heart disease, cardiac abnormalities detected by TEE was 81% (13/16) patients against TTE which detected 25% (4/16) patients. It is statistically significant. Comparing TEE against TTE in patients with no clinical evidence of heart disease, cardiac abnormalities detected by TEE was 25% (4/14) patients against TTE which detected 14% (2/14) patients. This is not statistically significant.

DISCUSSION

This study demonstrates the increased yield of transesophageal echocardiography in the detection of a

potential cardiac source of embolism in stroke patients compared with transthoracic echocardiography. In our study transthoracic echocardiography revealed a potential cardiac source of embolism in 25% (4 patients) all of whom had clinical evidence of heart diseases and 14% (2 patients) who had no clinical evidence of heart disease.

In addition to the yield by transthoracic echocardiography, transesophageal echocardiography revealed a potential source of embolism in 56% (9 cases). In patients with clinical evidence of heart disease, cardiac abnormalities additionally detected by transesophageal echocardiography are 2 cases of LA appendage clot, 6 cases of left atrial spontaneous echo contrast and one case of prosthetic valve dysfunction. In patients with no clinical evidence of heart disease, transesophageal echocardiography detected one case of patent foramen ovale with atrial septal aneurysm.

Pop et al.^[4] found 5 (9%) of 53 patients with recent TIA or stroke and without clinical cardiac abnormalities had abnormal TEE. Six (32%) of 19 patients with clinically suspected cardiac source of embolism had both a positive TEE and a positive TTE. The lower yield of TEE in that study may be due to lack of color flow imaging and contrast studies to detect intracardiac shunts. The proportion of patients with AF is not mentioned and was likely to be lower than in our study

Zenker et al.^[5] found that 9 (45%) of 20 patients with a cerebral ischemic event under the age of 45 yrs and a normal TTE, TEE showed pathological findings which consisted mainly mitral valve prolapse, atrial septal defect and atrial aneurysms.

In the European multicenter study reported by **Daniel et al.**^[6] 479 patients with unexplained arterial embolism were studied with TTE and TEE. The majority of these patients had a cerebral ischemic event. Potential source of arterial source of embolism were detected by TTE in 176 (37%) of 479 patients and by TEE in 310 (65%) of 479 patients. TEE identified mitral valve prolapse, patent foramen ovale, left atrial and atrial appendage thrombi, spontaneous echocontrast, atrial septal aneurysm and valvular vegetation significantly more frequently than transthoracic echocardiography. The yield of TEE was higher in that study because of the inclusion of patient with peripheral arterial embolism.

Black et al.^[7] 100 patients with cerebral ischemic event or peripheral arterial embolism (63), before percutaneous Balloon dilatation of mitral valve (23), or before electrical cardioversion (14) were studied with TTE and TEE. TEE showed potential embolic sources in 36/53 (68%) patients with AF compared with 9/47 (19%) with sinus rhythm. TEE identified left atrial spontaneous echocontrast, left ventricular spontaneous echocontrast, mitral valve prosthesis thrombus, mitral valve prolapses and pronounced aortic atheroma significantly and more

frequently than TTE, which helped in avoidance of Balloon dilatation of mitral valve in some patients.

Cujec et al.^[3] compared diagnostic yields of TEE and TTE in detection of cardiac source of embolism. 63 patients with TIA or stroke underwent both procedures, TTE revealed potential source of cardiac embolism in 14% (9) of the patients with clinical evidence of heart disease, TEE revealed a potential cardiac source of embolism in 41% (26) of the patients, 27% (7) of these patients has no clinical cardiovascular abnormalities. Abnormality detected only by TEE included atrial septal aneurysm, PFO, left atrial appendage thrombus and myxomatous mitral valve. Patient identified cardiac source of embolism more frequently in AF and had larger left atrium.

Our present study correlates well with Cujec et al. both for no clinical evidence of heart disease ($X^2=1.54$, $P=0.21$; Not significant) and clinical evidence of heart disease ($X^2=0.03$, $P=0.87$; Not significant); because there is no statistically significant difference.

In our study TTE revealed only mitral valve prolapse in patients without clinical evidence of cardiac disease. This is in keeping with previous reports. In 25% of the patients with clinical evidence of heart disease, a potential source of cardiac embolism was detected by TTE. The incidence of transthoracic echo cardiographic abnormalities in stroke patients varies from 4 to 47%,^[8] depending on the criteria used. A definitive source of embolism such as valvular vegetation or thrombus or myxoma are detected in very few patients.

Patient with clinical evidence of cardiac disease frequently have potential cardiac source of embolism detected by TEE. Although its diagnostic yield in patients without obvious heart disease is low, TEE may have therapeutic impact and should be performed in young patients or those with multiple stroke or systemic embolism.

TEE is superior to TTE for the detection of left atrial thrombus, patent foramen ovale, atrial septal aneurysm, left atrial spontaneous echo contrast and myxomatous degeneration of mitral valve, associated with mitral valve prolapse. All of these cardiac abnormalities may be a source of embolism.

Atrial fibrillation is a well-known contributor to stroke. In our study, out of 8 patients in seven with atrial fibrillation transesophageal echo cardiogram revealed cardiac source of embolism. **Belder et al.**^[9] found that patients in atrial fibrillation with left atrial spontaneous echo contrast are four times more likely to have suffered thromboembolic event than patients in AF without spontaneous echo contrast. Three of the patients with left atrial spontaneous echo contrast had left atrial appendage thrombus. In patients with AF underlying structural heart disease is ruled out by TEE, then it is more likely to be

"lone AF".

One of the major limitations of this study is the lack of age matched control group of volunteers without strokes. The cardiac abnormalities associated with systemic embolism can also be detected in persons who do not have strokes, although the prevalence of all these abnormalities is higher in patients with strokes. Only stroke cases were taken for the study. Patients with TIA & normal CT brain were excluded. Saline contrast studies were not performed during TTE. The patient with PFO was detected by color flow imaging and contrast study only by TEE. Transthoracic contrast echo is insensitive and non-specific for the detection of right to left shunting through patent foramen ovale.

CONCLUSION

Transesophageal echocardiography is of great value in patients with clinical evidence of heart disease. In patients with no clinical evidence of heart disease transesophageal echocardiography has proved to be useful to detect lesions in small percentage of patients without clinical evidence of heart disease which are not even detected by transthoracic echocardiography. Hence transesophageal echocardiography is superior to transthoracic echocardiography in the detection of cardiac source of embolism in patients with cerebral ischemic event.

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