

# TRANSESOPHAGEAL ECHOCARDIOGRAPHY IN PATIENTS WITH CEREBRAL ISCHEMIA

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## Abstract

**INTRODUCTION:** Transesophageal echocardiography (TEE) is superior to Transthoracic echocardiography (TTE) in detection of atrial septal defects and aneurysm, aortic atheroma, left atrial thrombus and mitral valve abnormalities. TEE is indicated in young adults with cryptogenic ischemic stroke who are suspected of having cardioembolic mechanism despite non-diagnostic TTE.

**METHODS:** A prospective clinical study was conducted in patients with ischemic stroke or TIA who had TTE done in Ghaem hospital, Mashhad during 2006-2007. Ischemic cerebrovascular events were detected by stroke neurologist. TEE was performed with VIPI3/GE device, USA and a 7 MHz transesophageal probe by an echocardiologist. Patients who did not have TTE before TEE were excluded. Comparison of TEE to TTE results was performed by the echocardiologist and stroke neurologist in each patient. Influence of TEE on therapeutic decisions in each patient was evaluated.

**RESULTS:** Forty-seven patients (20 females, 27 males) with a mean age of  $42.6 \pm 7.3$  years were studied. Cardiac and aortic abnormalities were detected in TEE of 35 cases (35/47; 74%) with ischemic cerebrovascular events. Cardiac abnormalities of 17 cases (36%) were only detectable by TEE. These seventeen cases included 7 patients with PFO, 1 case with ASD, 6 cases with aortic atheroma and 2 patients with clot in the left atrium. Comparing the preventive stroke strategies before and after TEE revealed that it was changed only in two cases (2/47; 4.3%) due to performing TEE. These included one patient with a small high-risk PFO and another case with dehiscence of mechanical mitral valve.

**CONCLUSION:** TEE revealed cardiac or aortic abnormalities in one-third of the patients with cerebral ischemia and has not been detected by TTE previously. The influence of TEE in therapeutic decisions of patients with ischemic cerebrovascular events is very low.

**Keywords:** Transesophageal echocardiography, Stroke, Transient Ischemic Attack.

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## Introduction

Echocardiography is commonly used in studies involving patients with stroke or transient ischemic attack (TIA). The purpose of echocardiography is to detect cardiac sources of cerebral emboli, thereby allowing the provision of appropriate therapy and preventing recurrent stroke. The value of echocardiography or other diagnostic tests may not elucidate the effect of test results on stroke patient management.<sup>1</sup> In this regard the task force should be commended for recognizing that the appropriate use of imaging requires an understanding of both the capacities of the

imaging technique and the value of therapy used to treat the identified condition. Identification of a condition that requires anticoagulation by echocardiography in a patient with another known condition requiring anticoagulation, i.e atrial fibrillation or mechanical heart valve, will not lead to a change in patient management.<sup>2,3</sup> A test useful to a clinician is one that provides important new information leading to a change in approach or important confirmation of a previously selected approach. A test useful to a patient is one that leads to a change in understanding and

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treatment associated with a better outcome. New information that does not improve outcome has no value.<sup>2,3</sup> Most echocardiographers view trans-thoracic echocardiography (TTE) and trans-esophageal echocardiography (TEE) as complementary and perform TTE initially in patients with ischemic cerebrovascular event. Then they proceed with a focused TEE study. If there is a reasonable likelihood that the results will influence therapy, it seems prudent to begin with a less invasive, although less sensitive TTE procedure. This approach will avoid the need for more resources and invasive TEE procedure.<sup>4</sup> The information provided by TEE may help to stratify subsequent stroke risk and possible aid in therapy.<sup>2</sup> We need a prospective study to see whether TEE can predict further ischemic cerebrovascular events, or a high-risk group that will benefit from Warfarin can be identified by TEE. This clinical study was designed to evaluate the influence of TEE in management of patients with ischemic cerebrovascular events compared to the TTE.

### Materials and Methods

An observational study was performed at the echocardiography center of Ghaem hospital, Mashhad during 2006-2007. Consecutive patients with ischemic stroke and TIA were enrolled in the study. Stroke was defined as an ischemic focal neurological deficit that persisted at least 24 hours.<sup>5</sup> TIA was determined by

taking past history from the patient or guardians. TIA was defined as an acute loss of ocular or focal cerebral deficit related to ischemia lasting less than 24 hours<sup>5</sup>. TTE was done with VIVI3/GE device, USA and 5 MHz probe. TEE was performed with VIPI3/GE device, USA and 7 MHz transesophageal probe. All of the TTE and TEE were done by an echocardiologist based on the standard protocol.<sup>6,7</sup> The patients were required to fast for at least 4 hours before TEE procedure and sedation was used in some patients. TEE was interrupted in patients who had intolerance to TEE probe. Patients who did not have TTE before TEE were excluded. Signed informed consent was obtained from the patient or his/her first-degree relatives. Patients who refused to give informed consent were excluded from this prospective study. The influence of performing TEE on therapeutic management and preventional strategies of the stroke patients was reviewed by an echocardiologist<sup>6,7</sup> and a stroke neurologist<sup>8,9</sup>.

### Results

TEE was done in 50 patients with stroke or TIA. Three cases did not have previous TTE and were excluded. 47 cases (27 males and 20 females) aged  $42.6 \pm 7.3$  years were investigated. 70% of patients to us for TEE were aged below 45 years. Ischemic stroke and TIA comprised 36 and 11 cases respectively. Table 1 demonstrates the frequency rate of the

**TABLE 1.** Cardiac and aortic abnormalities detected by TEE in 47 cases with ischemic stroke or TIA.

| Percentage | Number | Type of the abnormality                                                                        |
|------------|--------|------------------------------------------------------------------------------------------------|
| 17%        | 8      | Patent foramen ovale (PFO)                                                                     |
| 6.4%       | 3      | PFO with septal aneurysm                                                                       |
| 10.6%      | 5      | Mitral stenosis (2 cases had enlargement of left atrium and 2 others had left atrial thrombus) |
| 6.4%       | 3      | Atrial septal defect                                                                           |
| 2.1%       | 1      | Aortic valve replacement with normal function                                                  |
| 2.1%       | 1      | Mitral valve replacement with dehiscence                                                       |
| 12.8%      | 6      | Atheroma in the ascending Aorta or Aortic arch*                                                |
| 6.4%       | 3      | Mitral valve prolapse with mitral regurgitation                                                |
| 6.4%       | 3      | Fibroelastoma of mitral valve**                                                                |
| 64.3%      | 2      | Ventricular aneurysm                                                                           |
| 6.4%       | 3      | Decreased ejection fraction of left ventricle**                                                |
| 12.8%      | 6      | Mild mitral regurgitation**                                                                    |
| 4.3%       | 2      | Atrial smoke or echo contrast**                                                                |
| 6.4%       | 3      | Aortic valve insufficiency**                                                                   |

\* Five of these atheromas coexisted with cardiac abnormalities

\*\*All associated with other abnormalities in the TEE

abnormal findings in TEE of the patients. Cardiac and aortic abnormalities were detected in TEE of 35 cases (35/47; 74%) with ischemic cerebrovascular events. Overall, 49 abnormalities were detected in TEE of 35 cases. There was co-existence of multiple abnormalities in 29 cases (29/47; 61.7%). In this later group, cardiac and aortic abnormalities of 17 cases (17/35; 49%) were only detectable by TEE, while the abnormalities of the remaining cases could be detected by previous TTE. In other words TEE by itself could reveal a potential cause of stroke in 36% (17/47) of patients with stroke or TIA. These seventeen cases included 7 patients with PFO, 1 case with ASD, 6 cases with aortic atheroma and 2 patients with clot in the left atrium. Comparing the preventive stroke strategies before and after TEE revealed that it was changed only in two cases (2/47; 4.3%) due to performing TEE. These included one patient with a small high-risk PFO and recurrent TIAs and another case with dehiscence of mechanical mitral valve. Six stroke cases with aortic atheroma had been on aspirin and control of the atherosclerosis risk factors before TEE. Two stroke patients with clot in the left atrium had mitral stenosis and were on warfarin before TEE.

### Discussion

74% of patients with ischemic cerebrovascular events had abnormalities in TEE. Many studies overemphasise the role of TEE in stroke patients by reporting even mild degrees of valve thickening or mitral prolapse leading to a rate of abnormality as high as 83%.<sup>10</sup> Many of these patients have other causes of stroke such as atrial fibrillation or carotid atheroma, and a comprehensive assessment of the patient must be made rather than relying on the TEE alone.<sup>10</sup> Even then, about 30% of these patients will have a potentially important abnormality on TEE.<sup>10</sup> Within our study group, cardiac and aortic abnormalities of 17 cases (17/47; 36%) were only detectable by TEE, while 38% of the cases had abnormalities detected by previous TTE. This demonstrates the indication of TTE as a prelude to TEE in stroke patients aged <45 years. These seventeen cases included 7 patients with PFO, 1 case with ASD, 6 cases with aortic atheroma and 2 patients with clot in the left atrium. Reported studies demonstrate that TTE does not reliably visualize the left atrium or left atrial appendage and it has a sensitivity of only 39% to 63% for the detection of left atrial thrombi<sup>11,12</sup> and sensitivity of less than 50% for diagnosis of PFO.<sup>13,40</sup> TEE has a sensitivity of 100% and specificity of 99% for diagnosis of left atrial thrombi.<sup>12</sup> TEE with contrast saline demonstrated sensitivity of 89% and specificity of 100% for detec-

tion of PFO.<sup>12,14</sup> In stroke patients with clinical cardiac disease and no pre-existing indication for anticoagulation, screening yield of a cardiac abnormality is about 13% for TTE and 19% for TEE.<sup>15</sup> While in patients without clinical cardiac disease the screening yield of TTE is less than 2% in stroke patients aged 45 years or more.<sup>15</sup> In contrast to TTE, TEE frequently shows abnormalities even in the absence of clinical signs.<sup>10</sup> These include PFO, atrial septal aneurysm, left atrial spontaneous echo contrast, left atrial thrombus and aortic atheroma.<sup>10</sup> Other studies revealed that in patients with cryptogenic stroke, TTE allows detection of possible cardiac source of embolism in 24% to 79% of all cases, whereas TTE does so in 14 to 38%.<sup>1</sup> However, the importance of many of these findings is difficult to evaluate because of a lack of case-control comparison.<sup>1</sup> In patients with pre-existing indications for anticoagulation or in cases with contraindication to anticoagulation, these screenings rarely results in a change in management. PFO was the most frequent abnormality which was detectable only by TEE in our stroke patients. PFO may be detected by contrast TEE in up to 55% of young adult patients with cryptogenic stroke.<sup>16</sup> In the absence of a deep vein thrombosis and paradoxical embolism PFO is not assumed as a valid cause of stroke.<sup>8</sup> In our study group, TEE revealed 6 cases with aortic atheroma and 2 cases with thrombus in the left atrium which were not detectable by TTE. TEE may be preferred as initial procedure in detecting the above abnormalities. However, identification of patients susceptible to left atrial thrombus or aortic atheroma is difficult<sup>3,4</sup>. We believe in the value of TTE before TEE in cases in which identification of an intracardiac thrombus, PFO or septal aneurysm would provoke a change in the physician's management, i.e anticoagulation therapy or considering defect closure.<sup>3,4</sup> TEE could influence therapeutic and preventive strategies of 4.3% of our patients. In another study, TEE could change the management in 3% of the cases, since 75% of their candidates for anticoagulation based on TEE had been receiving warfarin due to atrial fibrillation.<sup>17</sup> Thus, most cases with thrombus in the left atrium have already been anticoagulated because of atrial fibrillation or mitral stenosis.<sup>17,18</sup> In contrast to these findings, detection of a previously undiagnosed left atrial thrombus or tumor, valvular vegetation and a high-risk PFO with simultaneous deep vein thrombus by TEE, will often lead to change in therapy.<sup>19</sup> TTE and TEE have greater utility in investigation of younger patients with ischemic stroke.<sup>20</sup> The American College of Cardiology and the American Heart Association recommend

echocardiography in patients with stroke or TIA who have clinical evidence of heart disease or who are less than 45 years of age without major risk factors.<sup>21</sup> TEE is not recommended in unselected patients<sup>21</sup> and should always be done after TTE.<sup>21</sup>

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