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Evaluation of transesophageal echocardiography in detecting cardiac sources of emboli in ischemic stroke patients

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Abstract

Background: Embolus is one of the causes of ischemic stroke that can be due to cardiac sources such as valvular heart diseases and atrial fibrillation and atheroma of the aorta. Transesophageal echocardiography (TEE) is superior in identifying potential cardiac sources of emboli. Due to insufficient data on TEE findings in ischemic stroke in Iran, the present study was done to evaluate TEE in detecting cardiac sources of emboli. The main aim of this study was to describe the cardiogenic sources of emboli using TEE in the ischemic stroke patients.

Methods: This is a cross-sectional study conducted during a 13-month period from January 2012 to February 2013 in Shiraz Nemazee teaching hospital. Patients admitted with stroke diagnosis were included; but hemorrhagic stroke cases were excluded. 229 patients with ischemic stroke diagnosis were included and underwent TEE.

Results: Causes of cardiac emboli were detected in 65 cases (40.7%) and categorized to high-risk (29.7%) and potential risk (11%). High risk cardiac sources included atrial fibrillation (8.7%), mitral valve disease (MS or MI) 11 cases (4.75%), aortic valve disease (AS or AI) 8 (3.5%), prosthetic valve 3 (1.35%), dilated cardiomyopathy 45 (19.65%) and congestive heart failure with ejection fraction < 30% in 8 cases (3.5%). Potential cardiac sources of emboli comprised 7 cases (3.05%) of septal aneurysm, 4 (1.75%) left ventricular hypokinesia, 13 (5.7%) mitral annular calcification and 9 cases (3.95%) complex atheroma in the ascending aorta or proximal arch.

Conclusion: Our study showed that high risk cardiac sources of emboli can be detected using TEE in a considerable percentage of ischemic stroke patients. The most common high risk cardiac etiologies were dilated cardiomyopathy and valvular heart diseases.

Keywords: Transesophageal, Echocardiography, Stroke, Embolic.

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Introduction

Cerebrovascular accident or stroke is among the most common causes of mortality and morbidity in developed and developing countries. The incidence of stroke has been reported to be increasing in developing countries located in Middle East (1-4). The age adjusted incidence rates of ischemic stroke in Iranian population was 616 per 100,000 residents (4). Currently stroke is the third cause of mortality worldwide associated with high economical and social burden (1,3).

Stroke is generally classed into ischemic and hemorrhagic categories. The ischemic type is divided into thrombotic and embolic varieties. This type of classification is based upon detecting thrombosis in carotid

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and vertebrobasilar arteries by Duplex ultrasonography, or finding embolic evidence when examining the heart through electrocardiogram and echocardiogram (1,4).

Usually, echocardiography is needed to find the source of emboli, because treatment of embolic and thrombotic stroke is quite different. Anti-coagulating agents like warfarin are used in the embolic type; however, we used anti-platelet in thrombotic type (5). There are two types of echocardiography: transthoracic echocardiography (TTE) and transesophageal echocardiography (TEE). TTE remains the cornerstone of noninvasive cardiac imaging, but TEE is superior for identifying the potential cardiac sources of emboli, including left atrial thrombi, valvular vegetations, thoracic aortic plaque, patent foramen ovale, and spontaneous left atrial echocardiographic contrast (6).

In some studies, cardiac causes of stroke were found in approximately 20% of cases (7). Some cardiac causes are patent foramen ovale with right to left shunt, atrial fibrillation, aortic artery atherosclerosis, severe left ventricular dysfunction, recent myocardial infarction, and valvular heart diseases (8-11).

Few studies have been done on stroke etiologies in Iran; they show several risk factors with different risks (12-13). According to these studies TTE was not able to detect several cardiac lesions specifically in the atrium and aortic arch.

The aim of this study was to evaluate the frequency of cardiac sources of emboli detected by TEE in the ischemic stroke patients in namazee Hospital of Shiraz University of medical sciences, the largest academic hospital in south of Iran.

Methods

This is a hospital-based cross-sectional study conducted during a 13-month period from January 2012 to February 2013in Shiraz Nemazee teaching hospital. All the patients admitted in emergency room and neurology ward with the diagnosis of ischemic stroke on the basis of their medical reports, clinical examination and CT scans were included and underwent TEE by an expert cardiologist. Patients with hemorrhagic stroke, those with watershed infarction and also those for whom TEE could not be done due to patients' clinical condition and had no permission to do TEE were excluded from the study; but patients with lacunars infarction were not excluded. The study protocol was approved by the institutional review board (IRB) of Shiraz University of Medical Sciences and the approval of the Ethics Committee was achieved before beginning of the study. All the participants gave their informed consent.

Totally, 229 patients full filed the criteria. TEE findings including valvular diseases, aortic arch atheroma, PFO, atrial septal defect, ventricular septal motion disorders, and other disorders were collected.

We completed the data gathering sheet by reviewing the patient's documents. The collected demographic data included age, gender, and risk factors such as hypertension, diabetes mellitus, hyperlipidemia, smoking, and any records of coronary artery diseases. The acquired data were assessed and analyzed in SPSS statistical software (version16), using descriptive statistics including frequency, percentage, mean and standard deviation and Chi-square test. The level of significance was set at $p<0.05$.

Results

In this study, 101 patients (44%) were male and 128 (56%) were female. Mean ±SD ages of male and female patients were 66±6.5 and 67±7.5, respectively. The youngest patient was 28 years old and the oldest was 97 years old. Sixteen patients (7%) were within the range of15 to 45 years old (young adult stroke) including 9 females and 7 males. 213 patients (93%) were older than 46 years, including 120 females (56%) and 93 males (44%).

High risk and potential cardiac sources of emboli (14) are shown in Table 1. Totally, 20 patients (8.7%) including 15 females (6.52%) and 5 males (2.18%) had atrial fi-

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Table 1. Prevalence of cardiac sources of emboli detected by TEE in ischemic stroke patients in both genders

High risk cardiac sources	Frequency N (%)		Total
	Female	Male	
Mitral valve disease (MS,MI)	7 (3)	4 (1.75)	11 (4.75)
Aortic valve disease (AS or AI)	5 (2.2)	3 (1.3)	8 (3.5)
Prosthetic Valve	2 (0.9)	1 (0.45)	2 (1.35)
Dilated cardiomyopathy	26 (11.35)	19 (8.3)	45 (19.65)
Congestive heart failure with ejection fraction < 30%	3 (1.3)	5 (2.2)	8 (3.5)
Potential cardiac sources			
Septal Aneurysm	4 (1.75)	3 (1.3)	7 (3.05)
LV Hypokinesia	3 (1.3)	1 (0.45)	4 (1.75)
Mitral Annular Calcification	8 (3.5)	5 (2.2)	13 (5.7)
Complex atheroma in the ascending aorta or proximal arch	5 (2.2)	4 (1.75)	9 (3.95)

MS: mitral stenosis, MR: mitral regurgitation, AS: aortic stenosis, AR: aortic regurgitation, LV: left ventricular

Table 2. Prevalence of aortic arch atheroma in ischemic stroke patients

Sex	Grade I & II	Grade III	Grade IV	Grade V	Total
Male	4 (1.7%)	9 (3.9%)	5 (2.5%)	4 (1.75%)	22 (9.6%)
Female	13 (5.7%)	12 (5.2%)	4 (1.75%)	5 (2.2%)	34 (14.8%)
Total	17 (7.4%)	21 (9.2%)	9 (3.9%)	9 (3.9%)	56 (24.5%)
Mean age (total)	65.7±10.4	70.04±8.3	73.5±7.8	75.1±10.1	72.2±8.6
Age <45 years	0	0	0	0	0
Age 45-60years	3 (1.2%)	3 (1.2%)	1 (0.4%)	1 (0.4%)	8 (3.2%)
Age >60 years	14 (6.2%)	18 (8.1%)	8 (3.5%)	8 (3.5%)	48 (21.3%)

brillation (AF).

Aortic arch atheroma was detected in 56 patients (24.5%) including 22 males (9.6%) and 34 females (14.9%) and all of the patients were older than 46 years. Also prevalence of aortic athroma was calculated within 3 age groups (age <45 years, age 45-60 years and age >60 years); it is presented in Table 2. Due to lack of variance similarity between ages in each grade groups of atheroma, Kruskal-Wallis Test was done; p value was not significant (p= 0.06).

Mean age of the patients with aortic atheroma was 72.2±8.60 years old that was more than patients without it (66.4±7.30 years old). Ejection fraction was lower than 30% in 8 patients (3.5%) and it was 30 – 50 % in 22 patients (9.6%), all of whom were older than 46 years old.

Discussion

In this study, stroke was more common in males than females (56% vs. 44%). As a whole, stroke has been reported to be slightly more common in females (range from 51 - 53%) (15-17).

In our study, cardiac source of emboli (CSE) was found in 40.7% (high risk cardiac source of emboli in 30.7% and potential cause in 11%) of patients and rheumatic valvular diseases in 16.7 % of CSE. According to a study on young adults suffering from ischemic stroke in Eastern Iran, CSE was present in 19.8% of the patients and rheumatic valvular disease comprised 46.6% of the CSE (15). In other studies, cardio embolism has been detected in 15.8–20 % of patients (18-20). Lower CSE findings in the above mentioned studies, at least partly is due to usage of transthoracic echocardiography for evaluation of cardiac source of emboli.

Prevalence of AF is less than 1% in the general population; it comprises approximately 2-10% of stroke patients over the age of 60 years, and increases up to 9% at the age of 80 to 89 years (18,19). AF Prevalence was 8.75% in our study. High prevalence of AF in present study may be because of its higher prevalence in old patients.

In present study, prevalence of septal aneurysm was 3.05% (7 patients) that is similar to the Zibaeenezhad et al. study in Iran

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(21). In a study by Nighoghossian et al. on 79 patients with unexplained stroke, atrial septal aneurysm found in 34.5% (22) although some studies demonstrated a lower range between 10.1 and 27.7% (23-25). Many reasons explain this difference including different diagnostic criteria, methodology, and age of patients.

Mitral annular calcification (MAC) may predispose patients to infective endocarditis and embolization of vegetative material. MAC has also been reported to be a risk factor for AF (27). We have detected MAC in 5.7% of patients that is lower than that of other studies on patients free of prevalent cardiovascular disease (26,27).

Another important finding in the current study was high frequency of aortic atheroma (24.5%, 56 cases) including 34 female (14.9%) and 22 males (9.6%). Mean age of the patients with aortic atheroma was higher than those without it (72.2 vs. 66.4 years); it was not statistically significant (p.v= 0.06).

In other studies, aortic atheroma prevalence was approximately 6.7 - 65.3% (28-30). Similar to the Framingham heart study (30), our results showed that aortic artery atherosclerosis was more frequent in females. This is consistent with an autopsy data showing that women have more fatty streaks in their abdominal aorta comparing to men at all ages (31).

Conclusion

Our study showed that in a considerable percentage of ischemic stroke patients a high risk cardiac source of emboli can be detected by TEE. Therefore, it is recommended that ischemic stroke patients be evaluated using TEE.

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Conflict of Interest

There are no conflicts of interest declared.

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