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Original Article

Diagnostic yield of transthoracic echocardiography for Stroke patients in a developing country

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Abstract

Objective: To assess the utility and cost effectiveness of transthoracic echocardiography (TTE) as part of stroke workup in a developing country.

Methods: All patients over the age of 14 years with acute stroke were prospectively enrolled in Aga Khan University stroke databank from August 1999 to May 2001 (22 month period). All patients were evaluated by a consultant neurologist and underwent standard stroke work up such as neuroimaging, TTE, carotid doppler sonography and blood tests e.g. serum glucose, lipid profile, blood urea nitrogen and serum creatinine. For the purpose of this study, patients with ischemic stroke were identified and their echocardiographic data was retrieved and analyzed. TOAST criteria was used to identify findings indicating cardioembolic stroke.

Results: Ischaemic stroke was identified in 393 (76%) patients. Of these 278 (71%) patients underwent transthoracic echocardiography as part of stroke workup. Although 199 (73%) patients had abnormal echocardiogram; only 43 (15.5%) had findings suggestive of possible cardioembolism as defined by the TOAST criteria.

Conclusion: Tranthoracic echocardiography is a valid diagnostic modality for stroke workup. However there is a need to further investigate the specific indications which can be used to prioritize patients for undergoing echocardiography to minimize cost (JPMA 58:375;2008).

Introduction

Stroke is the second leading cause of death world wide[1] and the third leading cause of death in the developed world. Stroke causes over 5.5 million deaths globally every year[2], two thirds of which occur in the developing world.[3] Moreover, stroke leads to higher disability adjusted life years (DALY) impact in developing countries compared to developed countries, making it a major public health issue.[4] Cardioembolic etiology has been reported to comprise 15% to 30% of ischaemic strokes[5,6] in developed countries. Atrial fibrillation accounts for more than 50% of cardioembolic strokes.[7] Other cardiac structural and functional abnormalities that have been associated with cardioembolic stroke are left atrial dilatation, poor left ventricularsystolic function, valvular heart diseases, cardiac tumours, patent foramen ovale and atrial septal defect.[8-10]

Echocardiography is performed to identify the cardiogenic source of embolus and has been recommended as a routine test in stroke workup.[10] However the cost effectiveness of echocardiography in secondary prevention of stroke has generated controversy. Some investigators have recommended echocardiographic evaluation of all stroke patients.[11] Others are suggesting echocardiography based on specific indications.[12] The purpose of our study was to assess the utility of transthoracic echocardiography as part of stroke workup. In the developing world cost of evaluation of stroke patients is a major issue and access to diagnostic modalities is limited requiring prioritization.

Methods

Aga Khan University Hospital is a JCIA (Joint Commission International Accredition) accredited tertiary care hospital in Karachi, Pakistan. Stroke care is delivered through a 24-hour on-call neurology team with a 5 bed stroke unit and full range of ancillary services. Aga Khan University (AKU) Stroke Data Bank enrolled all the patients admitted with a diagnosis of stroke from August 1999 to May 2001 (22 month period). All patients over the age of 14 years with acute stroke were prospectively enrolled in AKU stroke databank. All patients were evaluated by a consultant neurologist and underwent standard stroke work up such as neuroimaging, transthoracic echocardiography (TTE), carotid doppler sonography and blood tests e.g. serum glucose, lipid profile, blood urea nitrogen and serum creatinine. For the purpose of this study, patients with ischaemic stroke were identified and their echocardiographic data was retrieved and analyzed. TOAST (Trial of Org 10172 for acute stroke treatment) criteria was used to identify findings indicating cardioembolic stroke; prosthetic valve, left atrial dilatation with mitral stenosis, left atrial thrombus, left ventricular thrombus, dilated cardiomyopathy, akinetic left ventricle segment, atrial myxoma.[13]

Results

A total of 596 patients were enrolled in the study with diagnosis of stroke. Ischaemic stroke was the identified type in 393 (76%) patients. Mean age was 60.4 ± 12.5 years and 174 (63.6%) of the patients with ischaemic stroke were men. Of these 278 (71%) patients underwent transthoracic echocardiography as part of stroke workup. Although 199 (73%) patients had abnormal echocardiogram (Table 1); only 43 (15.5%) had findings suggestive of possible cardioembolism as defined by the TOAST criteria[13] (Table 2).

Table 1. Echocardiographic Findings (n = 199)*.

Findings	No (%)
Left ventricular segmental wall motion abnormalities with MI	1 (7.6)
Mild left ventricular systolic dysfunction	22 (7.6)
Moderate ventricular systolic dysfunction	17 (6.1)
Severe LV dysfunction	15 (5.4)
Left ventricle thrombus	4 (1.5)
Left ventricular dilatation	5 (1.8)
Right ventricular dilatation	1 (0.36)
Biventricular dilatation	1 (0.36)
Right atrial enlargement	2 (0.72)
Left atrial enlargement	15 (5.4)
Mitral stenosis	8 (2.9)
Left atrial enlargement with Mitral Stenosis	5 (1.8)
Left ventricular Hypertrophy with diastolic dysfunction	159 (57.1)
Valve prosthesis	3 (1.0)

*Since some patients had more than one significant finding so the cumulative percentage of abnormal findings is greater than the number of patients who had significant findings on echocardiogram.

Table 2. Echocardiography Findings consistent with TOAST criteria for possible cardioembolism (n = 43)*.

Findings	No (%)
Left ventricular segmental wall motion abnormalities with MI	
Severe Left Ventricle Systolic Dysfunction	
Left Ventricle Thrombus	
Left Ventricle Dilatation	
Left Atrial Dilatation with Mitral stenosis	
Valve Prosthesis	

*Since some patients had more than one significant finding so the cumulative percentage of abnormal findings is greater than the number of patients who had significant findings on echocardiogram.

Discussion

Transthoracic echocardiography is part of the routine workup of cardiac source of embolus in stroke patients in many centers across the world.[14,15] It is a non-invasive procedure with a sensitivity of 86% to 95% and a specificity of 86% to 95% for detecting left ventricular thrombi.[16-18] However, there is an ongoing debate regarding the cost effectiveness of this diagnostic tool. A recent hospital-based study from Canada reports that transthoracic echocardiography has a low yield, diagnosing only 4% of ischaemic stroke patients with abnormalilties suggesting cardioembolic etiology.[19] In contrast, another single centre study from Portugal revealed 37.2% of ischaemic stroke patients with Transthoracic echocardiography abnormalities suggestive cardioembolic etiology and the authors recommended the use of echocardiography as a routine procedure in all stroke patients.[11] Our study found 16% patients with TTE abnormalities consistent with cardioembolic origin suggesting a difference between our study population and those mentioned earlier.

In order to make any recommendations regarding the routine use of echocardiography for stroke patients we should keep in view the prevalent ischaemic stroke subtype, cost involved, average income and the accessibility of patients to these diagnostic modalities in a developing country.

Earlier study published by our centre showed lacunar stroke (42.7%) as the most common subtype of ischaemic stroke while large artery atherosclerosis accounted for 26.9% of ischaemic strokes.[20] In contrast to cardioembolic stroke incidence of 15% to 30% in developed countries[5,6], our study population had a lower number of patients with cardioembolic stroke (6.1%).[20] This high frequency of lacunar infarcts is due to high prevalence of hypertension (66.2%) and diabetes (41.5%) in our study population which are the strongest risk factors for lacunar infarction.[21] Our high prevalence of hypertension is comparable to other south-east Asian countries.[22] Other studies have also demonstrated a higher frequency of lacunar infarctions in South East Asian populations as compared to Caucasian populations[23] indicating a difference in stroke etiologies in different populations.

A recent analysis done at our centre showed average cost of stroke management to be 70,714 rupees (1179 U dollars)[22] with transthoracic echocardiography accounting to about 10% of this cost. This is expensive in a country where the gross national income (GNI) per capita of $ 690.[23]

Tertiary health care facilities are limited in our country. It is important to prioritize patients according to their need for diagnostic workup so that cost of stroke management can be decreased without compromising the quality of care. Recently Douen et al[19] showed that detection of echocardiographic abnormalities did not change therapy in these patients. However, the mortality and morbidity associated with stroke as described earlier, demands for secondary prevention treatment guided by

diagnostic modalities. TTE yield of 16% for secondary prevention treatment will have a major impact in secondary prevention of stroke. Therefore, keeping in view the yield of echocardiographic abnormalities suggestive of cardioembolic stroke according to TOAST criteria, low prevalence of cardioembolic stroke in our population, high costs involved with stroke management and echocardiography with a low average income in our country we recommend that transthoracic echocardiography is a valid diagnostic modality for stroke workup. However there is a need to further investigate the specific indications which can be used to prioritize patients for undergoing echocardiography to minimize cost and also to determine whether detection of TTE abnormalities leads to any change in treatment of these patients. This will provide us with the actual impact of TTE in terms of cerebrovascular accidents prevented and will decide on the inclusion of this modality as a routine procedure for every stroke patients.

Conclusion

Transthoracic Echocariography is a useful modality to identify the etiology of stroke in a low income setting. However, further research is required to prioritize patients leading to a higher yield of this effective modality. This information will enable health policy managers to decide about making TTE a mandatory diagnostic test in stroke treatment protocols.

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