Transthoracic Echocardiography in Thai Patients with Acute Ischemic Stroke

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Objective: *Transthoracic echocardiography (TTE) is routinely performed to look for the cardiac sources of emboli in many Western stroke centers. Due to a limitation of resources in Thailand, echocardiography is done in only some patients with acute ischemic stroke. The purpose of this study is to evaluate the need for cardiac investigations, especially TTE, in Thai patients with acute ischemic stroke.*

Material and Method*: Two-hundred and seven patients with acute ischemic stroke or transient ischemic attack (TIA), who had TTE results during August 2006 to November 2008, were studied. Patients were divided into 2 groups by the risk of cardioembolism: low- versus high-risk groups. All echocardiography results were reviewed and classified by the need for management change following the echocardiography.*

Results: *Abnormal TTE results indicating a need for change in management were found in 4% (4/102) and 18% (18/105) in low- and high- risk patients, respectively. The results of ECG alone led to change in management in 17% (36 patients). Atrial fibrillation was the most common cause of cardioembolism, which was found in 35 patients (17%).*

Conclusion: *Because of limited resources in Thailand, ECG should be routinely performed on all ischemic stroke patients and TTE in patients with high risk for cardioembolism. However, larger studies are still needed to clarify the benefits of echocardiography in low-risk patients.*

Keywords: *Echocardiography, Stroke, Thai, Asia*

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Stroke is one of the leading causes of death and morbidity. Cardioembolism accounts for 15-30% of ischemic stroke[1-4]. Cardiac investigations, electrocardiography (ECG), 24-hour ECG and transthoracic echocardiography (TTE), are routinely performed in many Western stroke centers to look for the cardiac sources of emboli. Echocardiography is superior to the ECG for evaluation of structural lesions of the heart, such as valvular heart diseases or infective endocarditis. Due to a limitation of resources in Thailand, echocardiography is performed on only some patients with acute ischemic stroke. The purpose of the present study is to evaluate the need for cardiac investigations, especially TTE, in Thai patients with acute ischemic stroke.

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Material and Method

Patients with acute ischemic stroke who had echocardiography during August 2006 to November 2008 at Thammasat University Hospital were included. Baseline characteristics of the patients and cardiac investigations-ECG and echocardiography-on each patient, were retrospectively reviewed. Acute ischemic stroke was defined by having ischemic stroke within 7 days of onset. Electrocardiography (ECG) was monitored continuously for the first 24-hour of admission in most patients, otherwise ECG was performed as a snapshot. Transthoracic echocardiography was performed by 2 cardiologists, mainly during the admission period. Patients were divided into 2 groups by the risks of cardioembolism. Patients with the presence of 1) atrial fibrillation, or sick-sinus syndrome, 2) recent myocardial infarction, 3) cardiac murmur or valvular heart diseases or prosthetic heart valve placement 4) stroke in the young (age $\leq$ 45 years old) or 5) abnormal computed tomography or magnetic resonance imaging of the brain, suggestive of

cardioembolism (having more than 1 lesions of new infarction in different vascular territories), were classified into a 'high-risk' group. Patients who had no known or obvious cardioembolic risks by history, physical examination, or ECG and for whom TTE was routinely ordered were classified into a 'low-risk' group. All echocardiographic results were reviewed and classified by the need for management change following the echocardiography, which was defined by the presence of thrombus, large myocardial infarction, cardiomyopathy, mitral stenosis, infective endocarditis, atrial myxoma or patent foramen ovale with atrial septal aneurysm. 'Need for management change' included any changes in management such as changing medications, further investigations or interventions. The data were presented as means for continuous variables and percentage (number) for dichotomous variables. The research protocol was approved by the human ethics committee of Thammasat University No.1 Faculty of Medicine.

Results

Two-hundred and seven patients had echocardiography during the study period. The mean age of the patients was 62 years. Baseline characteristics of the patients are presented in Table 1. TTE was performed on 203 patients. Both TTE and transesophageal echocardiography (TEE) were done in 4 patients. One-hundred and two (49%) and 105 patients (51%) were classified into 'low-risk' and 'high-risk' group, respectively. Results of TTE led to change in management in 4 (4%) and 18 patients (18%) in the low- and high- risk groups, respectively. The results of ECG alone led to change in management in 36 patients (17%) (Table 2). Abnormal echocardiographic findings that may affect long-term management or the need for anticoagulatant treatment were found in 52 patients (25%); left ventricular thrombus in 4 patients; hypokinetic segments, suggestive of myocardial infarction in 31 patients; valve replacement in 1 patient; cardiomyopathy in 6 patients; mitral stenosis in 8 patients; infective endocarditis in 1 patient and patent foramen ovale in 2 patients. Atrial fibrillation was the most common cause of cardioembolism, which was found in 35 patients (17%).

Discussion

Echocardiography in patients with stroke is used to detect a direct source of emboli (such as thrombus, myxoma, vegetation) or a condition with a known risk of stroke (such as mitral stenosis) and to

Table 1. Baseline characteristics of patients in the study

Baseline characteristics	(n = 207)
Age (mean ± SD)	62 ± 16
NIHSS* (mean ± SD)	10 ± 8
Female	81 (39%)
Transient ischemic attack (%)	20 (10%)
Stroke subtypes (%)	
Large-artery atherosclerosis	105 (50%)
Cardioembolism	49 (24%)
Small-artery occlusion	32 (16%)
Hypertension (%)	120 (58%)
Diabetes mellitus (%)	46 (22%)
Hyperlipidemia (%)	81 (39%)
Coronary artery disease (%)	25 (12%)
Old ischemic stroke (%)	25 (12%)
Old intracerebral hemorrhage (%)	3 (1%)
History of transient ischemic attack (%)	6 (3%)
Smoking (%)	59 (29%)
Symptomatic carotid stenosis[+] (%)	27 (13%)

*NIHSS: National Institute of Health Stroke Scale
[+]Symptomatic carotid stenosis was defined by having more than 50% stenosis at ipsilateral internal carotid arteries or common carotid arteries in patients with acute ischemic stroke

Table 2. Results of echocardiography classified by the changes in management

	Echocardiography in low-risk patients n = 102	Echocardiography in high-risk patients n = 105
No change in management	98 (96%)	60 (57%)
Change in management due to abnormal ECG*	-	27 (26%)
Change in management due to abnormal echocardiography	4 (4%)	9 (9%)
Change in management due to abnormal ECG and echocardiography	-	9 (9%)

*Abnormal ECG included atrial fibrillation, sick sinus syndrome and acute myocardial infarction

refine the risk in a condition known to be associated with emboli (such as atrial fibrillation)[5,6]. TTE is a noninvasive procedure. For the detection of left ventricular thrombi, TTE has a sensitivity of 86-95% and a specificity of 86-95%. TTE does not reliably visualize the left atrium or left atrial appendage and has sensitivity of only 39-93% for detection of left atrial thrombi and a sensitivity of less than 50% for the detection of patent foramen ovale[7]. For TEE, an ultrasound transducer is inserted into the esophagus which can cause discomfort. Cardiac, pulmonary and bleeding complications were found in 0.18% of the patients[8]. TEE has a sensitivity of 100% and a specificity 99% in diagnosis of left atrial thrombi. For the diagnosis of patent foramen ovale, in contrast TEE has a sensitivity of at least 89% and a specificity of 100%[7].

Routine echocardiography for the detection of a cardiac source of embolus in patients with stroke is still debated. Tribolet et al studied 435 patients with ischemic stroke whose ECG revealed sinus rhythm. TTE showed abnormal findings indicating a need for anticoagulation in 37.2% of the patients[9]. Douen et al studied 200 patients with ischemic stroke or transient ischemic attack. Pertinent TTE findings which brought about a shift in the treatment paradigm were found in 4% of the patients[10]. Echocardiography can detect intracardiac masses in about 4% (with TTE) to 11% (with TEE) of stroke patients. The yield is lower among patients without clinical evidence of cardiac disease by history, physical examination, ECG or chest radiography (less than 2%) than among patients with clinical evidence of cardiac disease (less than 19%)[7]. The Canadian Task Force on Preventive Health Care launched an update about echocardiography for the detection of a cardiac source of embolus in patients with stroke. They concluded that with fair evidence, echocardiography is recommended in patients with stroke and clinical evidence of cardiac disease. There is insufficient evidence to recommend for or against routine echocardiography in patients without clinical cardiac disease[7].

The present study revealed that abnormal findings from TTE that might affect the treatment plan were found in only 4% in low-risk patients but the yield increased to 18% in the group of high-risk patients. There are some limitations of the present study, however. First, this is a retrospective study. Some patients may have been misclassified because classification into low- versus high-risk groups was based on clinical data and ECG findings which were revealed from the medical records, and some of the reasons for ordering TTE might not have been completely recorded. Distribution of stroke subtypes was different from previous reports, because small-artery occlusion (SAO) is normally the most common stroke subtype, but in the present study large-artery atherosclerosis (LAA) was more common[3,4]. More severe stroke is usually found in LAA than in the SAO stroke subtype. This may be suggestive of some selection bias. This was retrospective study. Although echocardiography was performed by cardiologists, however there was no specific protocol in doing TTE/TEE. Additional large studies in Thai patients are still required to confirm the findings in the present study.

In conclusion, because of limited resources (either cardiologists or ultrasound machines) in Thailand, ECG should be performed in all ischemic stroke patients and TTE in patients with high-risk for cardioembolism. However, well-designed studies are needed to clarify the benefits of echocardiography, either TTE or TEE, in Thai patients with ischemic stroke and low risk for cardioembolism.

Potential conflicts of interest

None.

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การบันทึกภาพหัวใจด้วยคลื่นเสียงความถี่สูงในผู้ป่วยโรคหลอดเลือดสมองตีบและอุดตันระยะเฉียบพลันชาวไทย

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***ภูมิหลัง**: การบันทึกภาพหัวใจด้วยคลื่นเสียงความถี่สูงเป็นการตรวจเพื่อหาสาเหตุของโรคหลอดเลือดสมองตีบและอุดตันที่เกิดจากลิ่มเลือดจากหัวใจได้รับการตรวจในผู้ป่วยทุกรายที่หลายศูนย์รักษาผู้ป่วยโรคหลอดเลือดสมองในประเทศทางตะวันตกแต่ในประเทศไทยเนื่องจากมีข้อจำกัดในบุคลากรและทรัพยากร การตรวจด้วยการบันทึกภาพหัวใจด้วยคลื่นเสียงความถี่สูงจึงเลือกส่งตรวจในผู้ป่วยบางราย*

***วัตถุประสงค์**: ศึกษาความจำเป็นของการส่งตรวจหัวใจเพิ่มเติมโดยเฉพาะการตรวจการบันทึกภาพหัวใจด้วยคลื่นเสียงความถี่สูงในผู้ป่วยโรคหลอดเลือดสมองตีบและอุดตันระยะเฉียบพลันชาวไทย*

***วัสดุและวิธีการ**: ศึกษาในผู้ป่วยโรคหลอดเลือดสมองตีบและอุดตันระยะเฉียบพลันที่มีผลการตรวจการบันทึกภาพหัวใจด้วยคลื่นเสียงความถี่สูงในช่วงเดือนสิงหาคม พ.ศ. 2549 ถึง เดือนพฤศจิกายน พ.ศ. 2551 จำนวน 207 คน โดยจะแบ่งผู้ป่วยเป็น 2 กลุ่ม ตามความเสี่ยงในการเกิดหลอดเลือดอุดตันจากลิ่มเลือดหัวใจเป็นกลุ่มที่มีความเสี่ยงน้อย และกลุ่มที่มีความเสี่ยงมาก ผลของการบันทึกภาพหัวใจด้วยคลื่นเสียงความถี่สูงจะได้รับการทบทวนโดยแบ่งเป็นกลุ่มที่มีและไม่มีความผิดปกติที่จะนำไปสู่การเปลี่ยนแปลงการรักษา*

***ผลการศึกษา**: ผลการบันทึกภาพหัวใจด้วยคลื่นเสียงความถี่สูงที่ผิดปกติ และอาจนำไปสู่การเปลี่ยนแผนการรักษาพบในผู้ป่วยที่มีความเสี่ยงน้อยร้อยละ 4 (4 คน จาก 102 คน) และร้อยละ 18 (18 คน จาก 105 คน) ในผู้ป่วยที่มีความเสี่ยงสูง ผลการตรวจคลื่นหัวใจอย่างเดียวพบความผิดปกติที่จะนำไปสู่การเปลี่ยนแปลงการรักษาในผู้ป่วย 36 คน (ร้อยละ 17) หัวใจห้องบนเต้นแผ่วระรัวเป็นสาเหตุที่ทำให้เกิดลิ่มเลือดที่หัวใจที่พบบ่อยที่สุด (พบในผู้ป่วย 35 คน หรือคิดเป็นร้อยละ 17) ในผู้ป่วยโรคหลอดเลือดสมองชาวไทยจากการศึกษานี้*

***สรุป**: เนื่องจากข้อจำกัดในบุคลากรและทรัพยากรในประเทศไทยผู้ป่วยโรคหลอดเลือดสมองตีบและอุดตันควรได้รับการตรวจคลื่นหัวใจในผู้ป่วยทุกราย และตรวจการบันทึกภาพหัวใจด้วยคลื่นเสียงความถี่สูงในผู้ป่วยที่มีความเสี่ยงสูงในการเกิดหลอดเลือดอุดตันจากลิ่มเลือดหัวใจ อย่างไรก็ตามยังจำเป็นต้องมีการศึกษาแบบเก็บข้อมูลไปข้างหน้าที่มีขนาดผู้เข้าร่วมการศึกษามาก ในผู้ป่วยชาวไทยเพื่อศึกษาถึงประโยชน์ของการตรวจการบันทึกภาพหัวใจด้วยคลื่นเสียงความถี่สูงในผู้ป่วยที่มีความเสี่ยงน้อย*