

# Early Echocardiography has a low yield in patients with transient ischemic attack

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*This article summarizes the results of a recently published study [1] whose primary objective was to describe the relative contribution of Trans Thoracic Echocardiography (TTE) in the cardiac evaluation of patients with Transient Ischemic Attack (TIA) in emergency department.*

Transient ischemic attack (TIA) is a transient episode of neurological dysfunction caused by focal brain, spinal cord, or retinal ischemia, without acute infarction; the short-term risk of stroke after TIA can exceed 10% after 90 days, and 25%-50% of 90-day strokes occur within 48 hours of initial TIA [2]. Patients are also at higher risk of other events, with 2.6% of patients with TIA or stroke hospitalized for major cardiovascular events within 90 days [3]. There are multiple causes of TIA and ischemic stroke, with cardioembolism accounting for 10%-30% of cases and atrial fibrillation accounting for 15% of all cardioembolic sources. Other contributors to cardioembolism include infective endocarditis, valvular heart diseases, mechanical valvular prostheses, paradoxical embolism through a patent foramen ovale (PFO), cardiac myxomas, and segmental wall motion abnormalities and dilated cardiomyopathies [2].

For these reasons, a cardiac evaluation is often performed on patients with TIA, including a 12-lead electrocardiogram (ECG) to assess for dysrhythmia, left ventricular hypertrophy, and active or recent myocardial ischemia (Class I, Level B) [2]. Additionally, the American Heart Association/American

Stroke Association guidelines suggest that transthoracic echocardiography (TTE) is “reasonable in the evaluation of patients with suspected TIAs, especially in patients in whom no cause has been identified by other elements of the workup” (Class IIa, Level B) and that “transesophageal echocardiography (TEE) is reasonable when identification of these conditions will alter management” (Class IIa, Level B) [2]. However, despite these concerns, there is limited literature that demonstrates the emergent need of echocardiography for cardiac evaluation of patients with TIA in an emergency department setting [4].

The management of TIA is increasingly being provided in outpatient settings such as emergency department observation units (EDOUs), present in 36% of U.S. EDs. Such EDOUs use accelerated diagnostic protocols (ADPs), which have been shown to decrease costs and lengths of stay, without compromising clinical outcomes or quality measures for patients with TIA [5-7].

The primary objective of the study [1] summarized in this article was to evaluate the contribution of TTE in the cardiac evaluation of patients with TIA in an EDOU and to determine if there were subgroups of patients with TIA in whom the yield of TTE may be very high or very low.

## STUDY DESIGN

In this study 236 consecutive patients presenting, from January 1, 2011 to July 31, 2013, with suspected TIA symptoms to the ED at Emory University Hospital, an urban university teaching hospital in the Southeastern United States, were evaluated in an EDOU using ADP criteria which have previously been reported [6]. Patients received a cardiac examination, ECG, cardiac monitoring, and transthoracic echocardiography in addition to brain imaging, carotid imaging and laboratory evaluation. TTE images were reviewed by a board-certified cardiologist.

An abnormal bedside cardiac exam was defined as presence of arrhythmia, abnormal heart sounds, murmurs, cardiac galloping or jugular venous distention. Subjects with an ECG demonstrating atrial fibrillation, atrial flutter, premature atrial contraction (PAC), premature ventricular contraction (PVC), pacing, second- and third-degree blocks, and left bundle branch

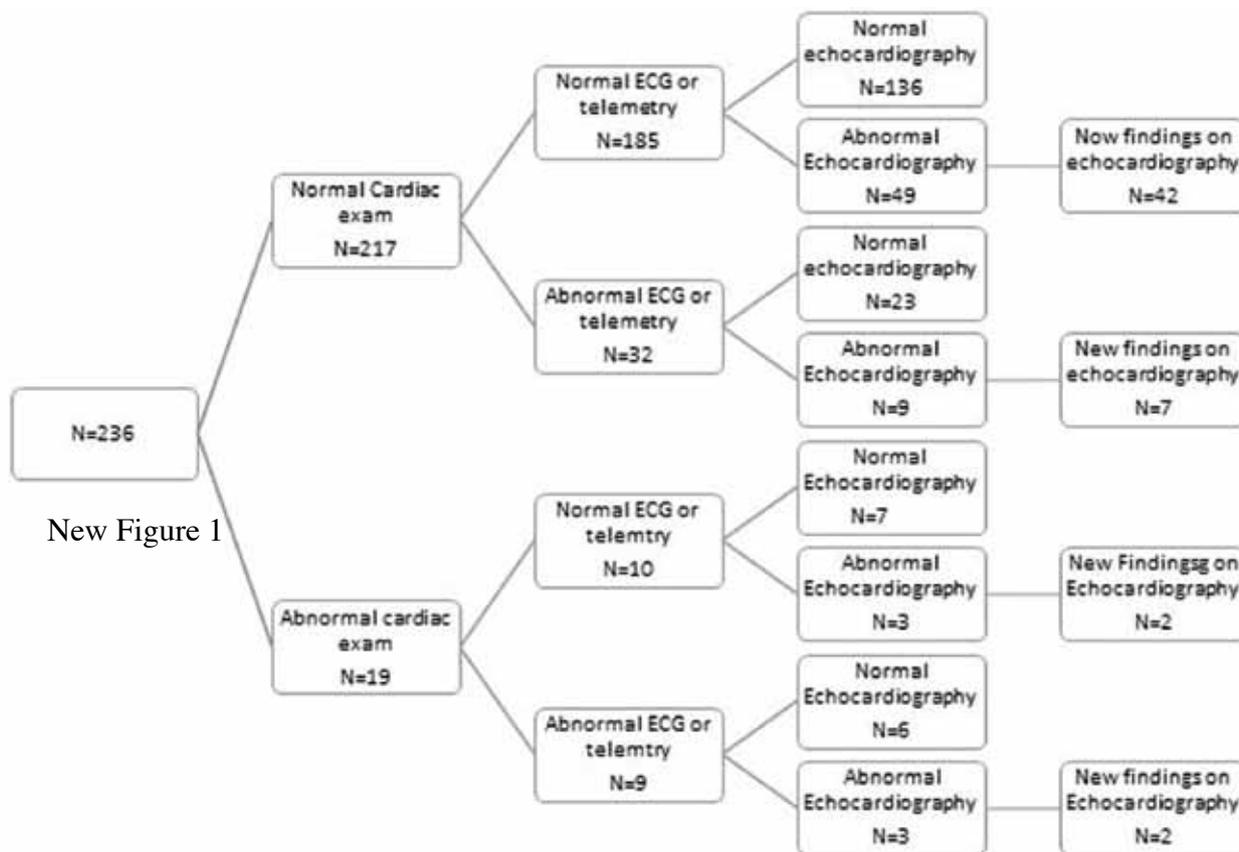
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**Figure 1.** Patient segregation work-up flowchart. Abbreviation: ECG, electrocardiogram. Image reproduced, courtesy of the National Stroke Association, from Ref 1. Harmouche *et al.* *J Stroke Cerebrovasc Dis.* 2017; 26 :1858

block were broadly defined as having an abnormal ECG.

An abnormal transthoracic echocardiogram was broadly defined as moderate or severe regional wall motion abnormality, valvular mass or lesion, the presence of intracardiac thrombus or positive bubble study. A positive bubble study was defined as presence of at least three agitated saline bubbles in the left atrium after 3-5 beats. Clinical outcomes included inpatient admission, return to the ED, stroke, or MI at 3 month follow up and were collected by reviewing hospital electronic records.

## RESULTS

Our cohort had a mean age of  $62.3 \pm 14.9$  years; 68% female, 57% African American, 38% white and 5.5% from other ethnicities. Mean length of stay in the EDOU was  $18.6 \pm 6.2$  hours. Overall, 92% had a normal cardiac

exam, 83% had normal ECG/telemetry, and 73% had normal echocardiographic findings.

Figure 1 shows the flowchart of procedures applied to our cohort and Table 1 provides the specific abnormalities found on cardiac examination and testing. A total of 136 (58%) patients had normal cardiac exam and normal ECG /telemetry and normal echocardiography, while 49 (21%) patients had abnormal echocardiographic findings with normal cardiac exam and normal ECG/telemetry findings. Within the latter subgroup, five subjects (2%) were diagnosed with moderate or severe diastolic dysfunction, one (0.4%) subject with regional wall motion dysfunction, 32 (14%) with indeterminate or positive bubble study, and one (0.4%) with valvular lesion found; no patient was found to have an intracardiac thrombus.

Of ten (4.2%) patients with abnormal

bedside cardiac examination and normal ECG/telemetry, three subjects (1.2%) had an abnormal echocardiography including severe diastolic dysfunction (n=1), severe wall abnormalities (n=1) and one had intracardiac thrombus (n=1).

A total of 23 subjects (9.7%) had normal cardiac exam and abnormal ECG or telemetry and normal echocardiography. Nine (3.8%) subjects had abnormal echocardiographic findings with normal cardiac exam and abnormal ECG or telemetry findings. Abnormal echocardiographic findings included moderate or severe diastolic dysfunction (n=1), regional wall motion dysfunction and positive bubble study (n=7). Of nine (3.8%) subjects with abnormal cardiac exam and ECG/telemetry, three had an abnormal echocardiogram, including severe diastolic dysfunction (n=1), severe wall motion abnormalities

Abnormal cardiac examination (n = 19, 8%; 95% CI 5% - 12%)	All findings	
Irregular rhythm	14 (5.9%)	
Lower extremity edema	4 (1.7%)	
Abnormal heart sounds	1 (.4%)	
Abnormal ECG/telemetry (n = 41, 17%; 95% CI 13% - 22%)	All findings New findings	
SVT/PAC/PVC	15 (6.4%)	13
Atrial fibrillation or flutter	12 (5.1%)	4
Bradycardia (P? < 50bpm)	3 (1.3%)	6
Left bundle branch block	3 (1.3%)	2
Pacing	2 (.8%)	2
Ventricular tachycardia	1 (.4%)	0
2nd/3rd degree AV block	0	0
Abnormal echocardiography (n = 64, 27%; 95% CI 21 - 33%)	All findings New findings	
Indeterminate or positive bubble study	41 (17.3%)	37
EF < 45%	18 (7.6%)	11
Diastolic dysfunction	9 (3.8%)	3
Regional wall abnormalities	6 (2.5%)	3
Clot	2 (.8%)	2
Valvular mass/lesion/endocarditis	1 (.4%)	1

**Table 1.** Abnormalities noted on ECG/telemetry and echocardiography, number of occurrence. Abbreviations: AV, atrioventricular; CI, confidence interval; ECG, electrocardiogram; EF, ejection fraction; PAC, premature atrial contraction; PVC, premature ventricular contraction; SVT, supraventricular tachycardia. \*Numbers may not add up as one subject may have more than one finding.

Table reproduced, courtesy of the National Stroke Association, from Ref. 1 Harmouche et al. *J Stroke Cerebrovasc Dis.* 2017; 26 :1858

(n=1), positive bubble study (n=1) and one patient with an intracardiac thrombus.

Of the 192 (81%) patients with a normal ECG, only one (0.4%) patient was found to have intracardiac thrombus; of the 44 (19%) patients with an abnormal ECG, only one (0.4%) patient was found to have intracardiac thrombus. Among the 125 (52.9%) patients with no past medical history of stroke or coronary artery disease, normal bedside cardiac exam, and normal ECG/telemetry, echocardiography identified no patients with intracardiac thrombus, and 29 (23%) patients with positive bubble study. A multivariate analysis did not show any significance between age, sex, comorbidities, presentation and presence of abnormalities on echocardiography.

Disposition included 19.5% who had subsequent inpatient admission for further workup and no subjects died during admission. At 3 months after TIA evaluation, four (1.7%) patients had a subsequent stroke, two (0.8%) had a non-ST elevation myocardial infarction and nine (3.6%) returned to the ED including two (0.8%) for recurrent TIA. No deaths occurred during the three month follow-up period. There was no significant difference in 90 day stroke or MI outcomes between patients with normal vs abnormal echocardiography.

### SIGNIFICANCE AND FUTURE DIRECTIONS

We found that although echocardiography was abnormal in 27%, intracardiac thrombus as a cause of symptoms was demonstrated in only two subjects (0.8%), a finding similar to those reported in other studies [8-10]. The most common finding in our series was an indeterminate

bubble study or PFO in 17% of patients, similar to the frequency of 20%-25% reported in the general population, with the effect on clinical management and need for closure remaining controversial [11-13].

The yield of echocardiography assessment during EDOU care in subjects with TIA and no history of stroke or CAD, normal bedside cardiac examination, and normal ECG/telemetry is low. In EDOUs where TTE is not available daily, outpatient TTE for this patient subgroup may be considered to limit prolonged lengths of stay. Multicenter studies are needed to validate our results and to determine the optimal window of time to perform echocardiography in this low risk subgroup of patients with TIA.

### CONCLUSIONS

Early TTE had a low diagnostic yield among TIA patients with no history of stroke or coronary artery disease, normal bedside cardiac exam, and normal ECG/telemetry in an EDOU setting.

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