

# Prevalence of transthoracic echocardiographic abnormalities in patients with ischemic stroke, intracerebral hemorrhage, and subarachnoid hemorrhage

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## Abstract

**Introduction:** This study investigated the prevalence of transthoracic echocardiographic abnormalities in patients with ischemic stroke (IS), subarachnoid hemorrhage (SAH), and intracerebral hemorrhage (ICH) in sinus rhythm.

**Material and methods:** The patients included 120 with IS, 30 with SAH, and 41 with ICH. All diagnoses were confirmed by magnetic resonance imaging or brain computed tomography. Two-dimensional echocardiograms were taken at the time stroke was diagnosed. All echocardiograms were interpreted by an experienced echocardiographer.

**Results:** Of 120 IS patients, 1 (1%) had a left ventricular (LV) thrombus, 1 (1%) had mitral valve vegetations, 30 (25%) had LV hypertrophy, 26 (22%) had abnormal LV ejection fraction, 4 (3%) had mitral valve prolapse, 33 (28%) had mitral annular calcium (MAC), 40 (33%) had aortic valve calcium (AVC), 3 (3%) had a bioprosthetic aortic valve, 10 (8%) had aortic stenosis (AS), 6 (5%) had atrial septal aneurysm, 2 (2%) had patent foramen ovale, and 40 (33%) had no abnormalities. Of 30 SAH patients, 5 (17%) had LV hypertrophy, 1 (3%) had abnormal LV ejection fraction, 1 (3%) had AS, 4 (13%) had MAC, 5 (17%) had AVC, and 20 (67%) had no abnormalities. Of 41 ICH patients, 9 (22%) had LVH, 1 (2%) had abnormal LV ejection fraction, 1 (3%) had AS, 6 (15%) had MAC, 8 (20%) had AVC, and 22 (54%) had no abnormalities.

**Conclusions:** Transthoracic echocardiographic abnormalities are more prevalent in patients with IS than in patients with SAH or ICH.

**Key words:** echocardiography, ischemic stroke, subarachnoid hemorrhage, intracerebral hemorrhage.

## Introduction

Transthoracic 2-dimensional echocardiography (TTE) has been used in the diagnosis and management of ischemic stroke (IS) with conflicting data as whether it should be considered an essential test in all IS patients in sinus rhythm [1-5]. Few data are published on TTE in patients with subarachnoid hemorrhage (SAH) [6].

We reported the prevalence of electrocardio-graphic abnormalities in patients with IS, SAH, and intracerebral hemorrhage (ICH) [7]. Of these patients, 120 with IS, 30 with SAH, and 41 with ICH who were in sinus rhythm had Doppler echocardiograms and 2-dimensional echocardiograms

performed trans-thoracically at the time stroke was diagnosed. The present article reports the prevalence of TTE abnormalities diagnosed at the time IS, SAH, and ICH were diagnosed.

### Material and methods

The patients included 120 (64 men and 56 women), mean age 67 ±11 years, with IS, 30 (14 men and 16 women), mean age 51 ±10 years, with SAH, and 41 (23 men and 18 women), mean age 61 ±10 years, with ICH hospitalized at Westchester Medical Center/New York Medical College. This was the first episode of IS, SAH, or ICH for each of the patients. All diagnoses were made by a board certified neurologist and confirmed by magnetic resonance imaging or brain computed tomography. Patients with chest pain or a diagnosis of acute myocardial infarction were excluded from the study. All patients were in sinus rhythm at the time of stroke.

Doppler echocardiograms and 2-dimensional echocardiograms were performed transthoracically at the time stroke was diagnosed. All echocardiograms were interpreted by a cardiologist experienced in interpreting echocardiograms.

The left ventricular (LV) ejection fraction was diagnosed as abnormal if it was less than 50% [8]. LV hypertrophy was diagnosed if the LV mass index exceeded 134 g/m<sup>2</sup> in men and 110 g/m<sup>2</sup> in women [9].

Student's *t* tests were used to diagnose continuous variables. Chi-square tests were used to analyze dichotomous variables.

### Results

The patients with IS were significantly older than the patients with SAH ( $p < 0.001$ ) and ICH ( $p < 0.002$ ). The patients with ICH were significantly older than the patients with SAH ( $p < 0.001$ ).

Table I shows the prevalence of echocardiographic abnormalities in the patients with IS, SAH, and ICH. Echocardiographic abnormalities were present in 67% of patients with IS, in 46% of patients with ICH, and in 33% of patients with SAH ( $p < 0.001$  comparing IS with SAH and  $p < 0.025$  comparing IS with ICH). An abnormal LV ejection fraction was present in 22% of patients with IS, in 3% of patients with SAH, and in 2% of patients with ICH ( $p < 0.01$  comparing IS with ICH and  $p < 0.02$  comparing IS with SAH).

Of 120 patients with IS, 14 (12%) had in-hospital mortality and 106 (88%) had nonfatal IS. Of 30 patients with SAH, 5 (17%) had in-hospital mortality, and 25 (83%) had nonfatal SAH. Of 41 patients with ICH, 11 (27%) had in-hospital mortality and 30 (73%) had nonfatal ICH.

### Discussion

Beattie *et al.* [1] reported that the mean prevalence of echocardiographic abnormalities in the medical literature for patients older than 45 years presenting with IS or transient ischemic attack was 0.1% for myxoma, 1.0% for vegetations, 2.0% for mitral stenosis, 0.3% for left atrial thrombi,

**Table I.** Prevalence of echocardiographic abnormalities in patients with ischemic stroke, subarachnoid hemorrhage, and intracerebral hemorrhage in sinus rhythm

Variable	Ischemic stroke (n = 120)	Subarachnoid hemorrhage (n = 30)	Intracerebral hemorrhage (n = 41)
Abnormal LV ejection fraction	26 (22%)	1 (3%)	1 (2%)
LV hypertrophy	30 (25%)	5 (17%)	9 (22%)
LV thrombus	1 (1%)	0 (0%)	0 (0%)
Mitral valve vegetations	1 (1%)	0 (0%)	0 (0%)
Mitral valve prolapse	4 (3%)	0 (0%)	0 (0%)
Mitral annular calcium	33 (28%)	4 (13%)	6 (15%)
Bioprosthetic aortic valve	3 (3%)	0 (0%)	0 (0%)
Aortic stenosis	10 (8%)	1 (3%)	1 (2%)
Aortic valve calcium	40 (33%)	5 (17%)	8 (20%)
Atrial septal aneurysm	6 (5%)	0 (0%)	0 (0%)
Patent foramen ovale	2 (2%)	0 (0%)	0 (0%)
LV enlargement	12 (10%)	1 (3%)	1 (2%)
Left atrial enlargement	26 (22%)	4 (13%)	6 (15%)
Mitral regurgitation	35 (29%)	4 (13%)	6 (15%)
Aortic regurgitation	26 (22%)	4 (13%)	6 (15%)
Normal echocardiogram	40 (33%)	20 (67%)	22 (54%)

LV – left ventricular

10.0% for cardiomyopathy, 9.0% for LV thrombi/patent foramen ovale/atrial septal defect, and 3.0% for atrial septal aneurysm. An abnormal LV ejection fraction was present in 5 of 47 patients (11%) with SAH [6].

In the present study, an abnormal LV ejection fraction was present in 22% of patients with IS, in 3% of patients with SAH, and in 2% of patients with ICH ( $p < 0.01$  comparing IS with ICH and  $p < 0.02$  comparing IS with SAH). LV thrombus was present in 1% of patients with IS. Mitral valve vegetations were present in 1% of patients with ischemic stroke. Atrial septal aneurysm was present in 5% of patients with IS. A patent foramen ovale was present in 2% of patients with IS.

Mitral valve prolapse was present in 2% of patients with IS [2, 3] and in 3% of IS patients in the present study. A bioprosthetic valve was present in 2% of 95 patients with IS [2] and in 3% of patients with IS in the present study. Aortic stenosis was present in 3% of patients with IS [3] and in 8% of patients with IS, 3% of patients with ICH, and in 2% of patients with SAH in the present study. Aortic valve thickening was present in 35% of 95 patients with IS [2]. Aortic valve calcium was present in 33% of patients with IS, in 17% of patients with ICH, and in 20% of patients with SAH in the present study.

LV hypertrophy is a major risk factor for IS [9-11] and was present in 25% of patients with IS, 17% of patients with SAH, and 22% of patients with ICH in the present study. Mitral annular calcium is also a risk factor for stroke [12-14] and was present in 14% of 95 patients with IS [2]. In the present study, mitral annular calcium was present in 28% of patients with IS, 13% of patients with ICH, and in 15% of patients with SAH.

Data on the prevalence of an enlarged left atrium, an enlarged left ventricle, mitral regurgitation, and aortic regurgitation in patients with IS, ICH, and SAH are not published but are presented in the present study in Table I.

Although there are conflicting data about the usefulness of TTE in the diagnosis and therapy of IS in patients with sinus rhythm [1-5], data from the present study support its use in patients in whom the etiology of stroke is unclear. In the present study, echocardiographic abnormalities were diagnosed in 67% of patients with IS, 33% of patients with SAH, and in 46% of patients with ICH. To the best of our knowledge, this study is the only series of patients showing the prevalence of all echocardiographic abnormalities in patients with IS, SAH, and ICH.

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