Background and Purpose—Stroke is the third leading cause of death in most Western countries.1 Stroke can be ischemic (85%) or hemorrhagic (10% to 15%).2,3 and ischemic stroke can be classified, according to etiology,4 as: (1) large vessel atherosclerosis, (2) cardioembolic, (3) small vessel atherosclerosis (lacunes), (4) other determined etiology, or (5) undetermined etiology.

Embolic accounts for 15% to 20% of all strokes.5 Several heart diseases are potentially embolic,6–7 and some indicate anticoagulation as beneficial8–11 and should therefore be identified.

Although atrial fibrillation, responsible for 50% of cardioembolic strokes,11 can be diagnosed by an ECG, echocardiography is an important test in the diagnosis of the remaining embolic heart diseases. Nevertheless, the role of echocardiography in the management of patients with acute stroke is not clear; recent recommendations on the management of acute stroke12,13 fail to consider echocardiography as an essential test in all patients.

The goal of the current study was to determine the prevalence of heart disease that would have therapy implications (anticoagulation) in acute ischemic stroke patients without atrial fibrillation.

Results—Of the 853 patients admitted with ischemic stroke, transthoracic echocardiography was performed on 846 (99.2%). Of the 435 patients with ischemic stroke, in sinus rhythm, 37.2% had findings indicating anticoagulation as beneficial: dilated cardiopathy (19.1%), previous anterior wall myocardial infarction (6.2%), left ventricular systolic dysfunction with an ejection fraction <35% (3.7%), mitral valve stenosis with enlarged left atria (1.6%), intracardiac masses (0.5%), valvular prosthesis (0.2%), and >1 abnormality (5.5%).

Conclusions—In our study, transthoracic echocardiography had therapy implications in 37.2% of ischemic stroke patients in sinus rhythm. Transthoracic echocardiography should be considered an essential test in all ischemic stroke patients in sinus rhythm. (Stroke. 2005;36:000-000.)

Key Words: echocardiography ■ stroke, ischemic ■ anticoagulants

Materials and Methods
We conducted a prospective observational study from January 7, 2002, to October 16, 2003. The study was approved by our hospital ethics committee. Informed consent was obtained from all patients.

Patients
All patients sent to our unit for transthoracic echocardiography with an acute ischemic stroke in sinus rhythm were included in the study. Acute ischemic stroke was defined as an acute neurological deficit persisting for >24 hours, with primary cerebral hemorrhage or nonvascular causes excluded by computed tomographic brain scan within 24 hours of presentation.14 Sinus rhythm was defined at the time of the performance of the echocardiogram (as evaluated by the cardiac monitoring of the patient) or previously (as evaluated by previously performed electrocardiograms).

Heart diseases that indicate anticoagulation as beneficial8–11 were defined as: mitral valve stenosis with an enlarged (>55 mm) left atria, valve prosthesis, left ventricular systolic dysfunction (with an estimated ejection fraction <35%), dilated cardiopathy, previous myocardial infarction (with left ventricular wall dyskinesia), left atria, or left ventricle masses.

Echocardiography
The authors performed all echocardiograms using a 2.5-MHz transducer for M-mode, 2D, and Doppler transthoracic echocardiography. All exams were performed and interpreted by the recommendations of the American Echocardiography Society.15

Stroke is available at http://www.strokeaha.org DOI: 10.1161/01.STR.0000170636.08554.49
Results
During the study, 846 patients with acute ischemic stroke were sent to our unit for transthoracic echocardiography. A total of 435 of those patients were in sinus rhythm.

The demographic characteristics of the study patients are depicted in Table 1. All patients were white.

The echocardiography findings suggested a heart disease indicating a benefit of anticoagulation in 162 (37.2%) patients. The echocardiography findings are summarized in Table 2.

Discussion
In our study population, 37.2% of patients with acute ischemic stroke, in sinus rhythm, had findings on transthoracic echocardiography that had a therapy implication: a benefit of anticoagulation.

During the study period, 853 patients were admitted to our hospital with acute ischemic stroke, of whom 846 patients (99.2%) were sent to our unit for transthoracic echocardiography. These facts reduce the possibility of bias of the study population.

Some of the echocardiography findings indicating anticoagulation as beneficial might have been diagnosed without echocardiography: valve prosthesis and previous anterior wall myocardial infarction. Although this is true for valve prosthesis, we believe that the inclusion of the only patient with this condition does not significantly change the results of our study. The history and the ECG of the patient can diagnose previous anterior wall myocardial infarction. Nevertheless, only transthoracic echocardiography can determine the degree of anterior wall motion abnormalities. The remaining findings, although possible to suspect on clinical grounds, needed transthoracic echocardiography for confirmation.

In conclusion, in our study population, the performance of transthoracic echocardiography on acute ischemic stroke patients without atrial fibrillation had therapy implications in 37.2%. Although these results must be confirmed in other ischemic stroke populations, we believe these results support the transthoracic echocardiogram as a compulsory examination on all acute ischemic stroke patients.

Acknowledgments
Thanks to Marie Helen Curry for reviewing this manuscript.

References

TABLE 1. Demographic Characteristics of the Study Patients (n=435)

<table>
<thead>
<tr>
<th>Age (mean, SD, minimum-maximum)</th>
<th>73.6, ±8.7, 52–96 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male sex (%)</td>
<td>229 (52.6)</td>
</tr>
<tr>
<td>Hypertensive (%)</td>
<td>283 (65.1)</td>
</tr>
<tr>
<td>Diabetic (%)</td>
<td>98 (22.5)</td>
</tr>
<tr>
<td>Dystlipidemic (%)</td>
<td>70 (16.1)</td>
</tr>
<tr>
<td>Smoker (%)</td>
<td>18 (4.1)</td>
</tr>
<tr>
<td>Former smoker (%)</td>
<td>36 (8.3)</td>
</tr>
</tbody>
</table>

TABLE 2. Echocardiography Findings (n=435)

<table>
<thead>
<tr>
<th>Findings</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No findings suggesting need of anticoagulation</td>
<td>273 (62.8)</td>
</tr>
<tr>
<td>Dilated cardiopathy</td>
<td>83 (19.1)</td>
</tr>
<tr>
<td>Anterior wall dyskinesis</td>
<td>27 (6.2)</td>
</tr>
<tr>
<td>Left ventricle ejection fraction &lt;35%</td>
<td>16 (3.7)</td>
</tr>
<tr>
<td>Mitral valve stenosis with left atria &gt;55 mm</td>
<td>9 (2.1)</td>
</tr>
<tr>
<td>Intracardiac masses</td>
<td>2 (0.5)</td>
</tr>
<tr>
<td>Valve prosthesis</td>
<td>1 (0.2)</td>
</tr>
<tr>
<td>Mitral valve stenosis with left atria &gt;55 mm and dilated cardiopathy</td>
<td>7 (1.6)</td>
</tr>
<tr>
<td>Dilated cardiopathy - anterior wall dyskinesis</td>
<td>9 (2.1)</td>
</tr>
<tr>
<td>Dilated cardiopathy - left ventricle ejection fraction &lt;35%</td>
<td>8 (1.8)</td>
</tr>
<tr>
<td>Total</td>
<td>435 (100.1)</td>
</tr>
</tbody>
</table>
Therapy Implications of Transthoracic Echocardiography in Acute Ischemic Stroke Patients
Tiago Tribolet de Abreu, Sónia Mateus and José Correia

Stroke. published online June 9, 2005;
Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2005 American Heart Association, Inc. All rights reserved.
Print ISSN: 0039-2499. Online ISSN: 1524-4628

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://stroke.ahajournals.org/content/early/2005/06/09/01.STR.0000170636.08554.49.citation

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Stroke can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Stroke is online at:
http://stroke.ahajournals.org//subscriptions/