Score for the Targeting of Atrial Fibrillation (STAF)
A New Approach to the Detection of Atrial Fibrillation in the Secondary Prevention of Ischemic Stroke

Laurent Suissa, MD; David Bertora, MD; Sylvain Lachaud, MD; Marie Hélène Mahagne, MD, PhD

Background and Purpose—The high risk of recurrence and comorbidity after a stroke associated with atrial fibrillation (AF) justifies an aggressive diagnostic approach so that anticoagulant treatment can be initiated.

Methods—The clinical and paraclinical characteristics of consecutive ischemic stroke patients with and without documented AF were recorded. Independent predictive factors were then used to produce a predictive grading score for diagnosing AF, derived by logistic regression analysis: Score for the Targeting of Atrial Fibrillation (STAF).

Results—STAF, calculated from the sum of the points for the 4 items (possible total score 0 to 8): age >62 years (2 points); NIHSS ≥8 (1 point); left atrial dilatation (2 points); absence of symptomatic intraor extracranial stenosis ≥50%, or clinico-radiological lacunar syndrome (3 points). STAF ≥5 identified patients with AF with a sensitivity of 89% and a specificity of 88%.

Conclusions—STAF can be used as part of a novel and simple strategy for the targeting of AF in the secondary prevention of ischemic stroke. A multicenter study is now required to validate STAF in a larger number of patients. (Stroke. 2009; 40:2866-2868.)

Key Words: atrial fibrillation ■ ischemic stroke ■ secondary prevention ■ cardioembolism ■ transthoracic echocardiography

Atrial fibrillation (AF) is a strong independent predictive factor for a first ischemic stroke or recurrence of stroke. It is considered to be the most common cardioembolic etiology in industrialized countries. AF is associated with increased stroke severity and mortality compared to other etiologies. The presentation of arrhythmia as paroxystic or persistent will not modify the cardioembolic risk. In current practice, clinical and radiological methods also lack sensitivity to suspect AF. We therefore attempted to establish a profile of patients with documented AF among a population of consecutive stroke patients, without presuming the etiology of the stroke. The Score for the Targeting of Atrial Fibrillation (STAF) was created using these profiles to help guide clinicians in the choice of diagnostic tests for the detection of paroxystic arrhythmia.

Materials and Methods

Selection of Patients and Experimental Procedure
Consecutive patients admitted to the Neurovascular Unit of the Centre Hospitalier Universitaire, Nice, for the treatment of ischemic stroke between January 2007 and September 2008 were included in this study. Patients presenting with the following criteria were excluded from the study: stroke of undetermined cause because of incomplete investigations, or nonusable transthoracic echocardiography (TTEC). The presence of persistent or paroxystic AF (or atrial flutter) was documented at the 3-month visit based on previous history, initial ECG, ECG monitoring during hospitalization, and 24-hour Holter ECG.

Clinical Data
Demographic data (age and sex), risk factors, and cardiovascular history were compiled according to standard definitions. The severity of the stroke was determined on admission by measurement of the NIHSS score by a neurologist.

Transthoracic Echocardiography Data
Each patient was subjected to a routine TTEC, carried out by a cardiologist, without presuming the etiology of the stroke. TTEC examinations were performed using a portable ACUSON Cypress equipped with a 3V2c echocardiographic. All measurements and calculations were made following the recommendations of the ASE.

Data From Vascular Etiology Investigations
The criterium “absence of vascular etiology” used in this study was based on the absence of TOAST criteria for the diagnosis of large vessel atherosclerosis (intraor extracranial stenosis ≥50% symptomatic), small vessel atherosclerosis (clinico-radiological lacunar syndrome), without presuming a cardioembolic mechanism. Diagnosis of confirmed symptomatic arterial dissection also invalidated this criterium.

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To determine the statistically significant differences in clinical and paraclinical variables between patients with documented AF and others, univariate analysis was carried out using the $\chi^2$ test for comparison of discontinuous variables and Student t test for continuous variables. A threshold value was established for continuous variables (age, NIHSS) using a ROC (receiver-operating characteristic) curve. Variables with $P < 0.1$ in univariate analysis were included in a step-by-step logistic regression model. A continuous predictive score was produced from variables significantly associated with documented AF by logistic regression analysis. A gradual value was attributed to these variables from their coefficient. The predictive ability of this score compared to each category of variable identified was determined by comparison of areas under the ROC curve derived from continuous scores originating from logistic regression analysis.

### Results

Of the 484 stroke patients treated in the neurovascular unit, 456 (94%) were included in this study. The clinical characteristics of these patients are shown in Table 1. Atrial arrhythmia was confirmed in 122 patients at 3 months, including 86 by initial ECG.

The results of univariate analysis comparing the clinical and paraclinical variables between the 2 groups are shown in Table 1. The significant independent parameters in patients with documented AF were as follows: age $\geq$ 62 years (OR: 11.8 [95% CI, 5.3 to 26.0]); NIHSS $\geq$ 8 (OR: 3.8 [95% CI, 2.0 to 7.4]); dilatation of the left atrium (OR: 12.3 [95% CI, 5.2 to 28.9]); and absence of vascular etiology (OR: 36.2 [95% CI, 15.8 to 82.6]).

The score derived from logistic regression analysis is shown in Table 2. The Figure shows the superiority of the score at predicting AF compared to clinical ($P < 0.0001$) or clinico-echographic data ($P < 0.0001$). A total score of $\geq 5$ enabled the identification of patients with AF with a sensitivity of 89% (95% CI, 83 to 94) and a specificity of 88% (95% CI, 84 to 91).

### Discussion

The profile of patients with documented AF, by univariate analysis, agreed with data in the literature on the etiologic parameters and thromboembolic factors associated with AF.5 In multivariate analysis, the predictive power of these parameters was largely inadequate for them to be used in screening for AF. One explanation for this is the close link between these diverse etiologic factors and stroke itself. The
profile of an AF patient can therefore be summarized as follows: an elderly patient presenting with a severe ischemic stroke, in whom no vascular etiology was found and in whom dilatation of the left atrium is diagnosed by TTEC. Although age and severity can define a cardioembolic stroke associated with AF, they are largely insufficient to be used in screening for AF, as shown in the Figure. Detection of dilatation of the left atrium by TTEC may be of significant benefit in this process. The complete score including the results of vascular investigations is statistically superior to combined clinico-echographic data.

A STAF ≥5 targets AF with a sensitivity of 89% and specificity of 88% in the secondary prevention of stroke. The choice of threshold value can be modulated to increase the sensitivity, at risk of a decrease in specificity. A score of ≥3 for example can increase the sensitivity of the test to almost 100%.

There are several limitations to our pilot study. Although the size of the study population was relatively small, it nevertheless allowed us to individualize the profile established using unequivocal statistical links. A selection bias attributable to monocentric recruitment in a dedicated neurovascular unit could be a second limitation.

Summary
STAF can therefore be used as part of a novel strategy in terms of screening for AF in the secondary prevention of stroke. Our study also supports the role of routine TTEC in this strategy. The score is easy use and should help clinicians target patients who might benefit from more aggressive investigations of paroxystic arrhythmia (repetition of ECG in the first 3 days, and repetition or prolongation of Holter ECG time). Validation of STAF in a multicenter study including a larger number of patients is now required.

Disclosures
None.

References

Table 2. Criteria and Scoring Used in STAF

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<td>≥8</td>
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<tr>
<td>&lt;8</td>
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<tr>
<td>No</td>
<td>0</td>
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<tr>
<td>No</td>
<td>3</td>
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Figure. Comparison of ROC curves for different types of data.
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