Does ABCD² Score Below 4 Allow More Time to Evaluate Patients With a Transient Ischemic Attack?

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Background and Purpose—The National Institute for Clinical Excellence (NICE) recommends that patients with a transient ischemic attack and ABCD² score ≥4 and those with ≥2 transient ischemic attacks within 1 week be admitted for urgent complete etiologic evaluation within 24 hours and that those with an ABCD² score <4 be evaluated less urgently within 1 week.

Methods—Using data from 1176 patients with a definite or possible transient ischemic attack or minor stroke included in the SOS-TIA registry (January 2003 to June 2007), we studied the usefulness of the conventional ABCD² score cutoff as well as the NICE criteria for urgent admission to a stroke unit defined as presence of symptomatic internal carotid artery stenosis ≥50%, symptomatic intracranial artery stenosis ≥50%, or major cardiac source of embolism.

Results—Among 697 patients with an ABCD² score <4, 20% required immediate consideration for emergency treatment (eg, symptomatic internal carotid stenosis ≥50% in 9.1% of patients, symptomatic intracranial stenosis in 5.0%, atrial fibrillation in 5.9%, other major cardiac source of embolism in 2.1%) in comparison to 31.6% of 497 patients with an ABCD² score ≥4. The sensitivity and specificity of ABCD² score <4 or NICE criteria for discriminating between patients requiring admission or not were <62% with low positive predictive values (<30%) and high negative predictive values (≥80%).

Conclusions—One in 5 patients with an ABCD² score <4 had high-risk disease requiring urgent treatment decision-making. When triaging on an ABCD² score, we recommend adding systematic carotid ultrasound (or a default angiographic CT scan) and electrocardiography within 24 hours before postponing complete transient ischemic attack evaluation. (Stroke. 2009;40:3091-3095.)

Key Words: ABCD score ■ stroke ■ transient ischemic attack

Rapid assessment and treatment of patients with suspected transient ischemic attack (TIA) can decrease the 90-day risk of stroke by up to 80%.1,2 We have shown previously that TIA clinics with round-the-clock (24-hour) access permit triage of patients based on stroke mechanism and etiology.2 After a 3-hour workup, including carotid ultrasound, brain imaging, blood and cardiac evaluation, only 25% of patients were admitted to the stroke unit; the remaining 75% were discharged home from the “day” hospital (also open at night) and started immediately on recommended secondary prevention treatments.2 Another approach is to base the patient’s admission to a stroke unit on an ABDC² score ≥4 or crescendo TIA within the previous 7 days as recommended by the National Institute for Clinical Excellence (NICE) guidelines.3 An ABCD² score ≥4 predicts a 90-day stroke risk between 8% and 22%.4 With this scoring system, NICE guidelines recommend that the remaining patients, with an ABCD² score <4, be evaluated within 1 week.3 This is based on the fact that patients with an ABCD² score <4 have a 90-day stroke risk of <3%.3 This provision of care would be valid if no patient, or a minimum number of patients, with an ABCD² score <4 has an underlying pathology needing urgent (ie, immediate) treatment decision-making. Indeed, immediate assessment of stroke mechanism and etiology may better identify patients at risk of stroke as opposed to the combination of age, risk factors, duration, and type of symptoms.5

We analyzed data from the SOS-TIA cohort, which now includes 1176 patients with proven TIAs, 679 with an ABCD² score <4 and 497 with a score ≥4, to determine differences in underlying pathologies. We paid particular attention to ipsilateral carotid and intracranial stenoses ≥50% and a cardiac source of embolism requiring urgent treatment decision-making.
Methods

Patients
The SOS-TIA methods have been described in detail previously. Briefly, SOS-TIA is a TIA clinic with round-the-clock (24-hour) access located in a "day" hospital (also open at night) nested in a neurology department that also has a stroke unit. Primary care physicians (ie, general practitioners, cardiologists, neurologists, and ophthalmologists) and emergency department physicians in Paris and its administrative regions can contact the SOS-TIA clinic through a toll-free telephone number. Patients are admitted to the SOS-TIA clinic if the suspicion of TIA is confirmed by a trained nurse or vascular neurologist after a brief phone interview. After triage based on etiologic workup performed in <3 hours, patients are either discharged home from the day hospital or further admitted to the stroke unit according to published criteria. This report concerns all patients admitted to the SOS-TIA clinic between January 2003 and June 2007.

Investigations
The SOS-TIA clinic was organized to provide an initial, standardized evaluation within 4 hours of admission, including clinical evaluation and diagnostic testing.

Carotid Ultrasonography
Cervical duplex ultrasonography was performed systematically and immediately by a fully trained senior vascular neurologist to evaluate the presence of plaques and quantify the degree of stenosis. The carotid bifurcation and the internal carotid artery were assessed on both sides of the neck. Carotid stenosis was measured on cross-sections at the level of maximum stenosis. Patients were classified into 2 groups: no atherosclerosis or internal carotid artery atherosclerosis defined by the presence of plaque regardless of the degree of stenosis or carotid occlusion. Significant internal carotid artery atherosclerosis was defined by a stenosis ≥50% (longitudinal section on ultrasound, a proxy to the North American Surgical Carotid Endarterectomy Trial (NASCET) method, or measured on an angiogram) or carotid occlusion. Stenoses ≥50% were considered symptomatic when they were ipsilateral to the ischemic field. Transcranial Doppler was conducted systematically to evaluate the presence of intracranial stenosis. Middle cerebral artery, carotid siphon, and basilar trunk velocities were used for stenosis quantification.

Other Investigations
Other examinations included medical history, physical examination, routine blood biochemistry (including lipid and glycemic profile), brain MRI (or CT scan as a default, 100%), transcranial Doppler (99%, n=1159), electrocardiography (98%, n=1154), and echocardiography (78%, n=917, including 812 transesophageal echocardiograms). Echocardiography was performed the same day in case a high-risk cardiac source of embolism was clinically suspected and later in other cases.

Diagnosis
Patients were classified according to 5 final diagnoses: definite TIA with a new lesion corresponding to clinical deficit on brain imaging; definite TIA without a new lesion on brain imaging; minor stroke; possible TIA; and nonischemic diagnosis.

Statistical Analysis
Data are presented as mean (SD) for continuous variables and percentage (count) for dichotomous variables. We calculated the ABCD² score in 1176 patients with definite or possible TIA or minor stroke who had complete information on the score components: age (≥60 years = 1 point), blood pressure (≥140/90 mm Hg = 1), diabetes (yes = 1), clinical features (unilateral weakness = 2; speech disturbance without weakness = 1), and duration of symptoms (≥60 minutes = 2; 10 to 59 minutes = 1). Patients were divided into 2 groups according to the conventional ABCD² score cutoff of 4. Patients’ characteristics, major examination findings, and processes of care were compared between 2 groups using the x² tests for categorical variables and Student t test for continuous variables. We calculated the sensitivity, specificity, positive predictive value, and negative predictive value for an ABCD² score ≥4 and for the NICE criteria (ABCD² score ≥4 or crescendo TIA for patients seen within 1 week of symptom onset) for discriminating patients requiring urgent admission, defined as the presence of symptomatic internal carotid stenosis ≥50%, symptomatic intracranial stenosis ≥50%, or major source of cardioembolism. Sensitivity analyses were restricted to patients seen within 24 hours of symptom onset. Statistical testing was done at the 2-tailed a level of 0.05. Data were analyzed using the SAS package, Release 9.1 (SAS Institute, Cary, NC).

Results
Among 1622 patients seen at the TIA clinic, 1176 had a definite or possible TIA or minor stroke and had complete information on ABCD² score components (Figure). Of these, 57% (n=670) were seen within 24 hours of symptom onset. Table 1 describes selected baseline characteristics of the study sample according to the conventional ABCD² score cutoff. Of the clinical characteristics other than ABCD² score components, history of coronary disease, atrial fibrillation, and stroke were more frequent in patients with an ABCD² score ≥4, whereas visual deficit and previous TIA within 1 week of the last symptom onset were less frequent in comparison to patients with an ABCD² score <4. Diagnosis of definite TIA with new ischemic lesions and of minor...
stroke was more frequent in patients with an ABCD² score ≥4 (29.2%) versus those with a score <4 (10.2%, P<0.001).

### Major Examination Findings

Table 2 describes the main findings dichotomized according to ABCD² cutoff. Internal carotid stenosis ≥50% (including complete occlusion) was more frequently diagnosed by duplex ultrasonography in patients with an ABCD² score ≥4 (20.9%, n=102) versus patients with a score <4 (14.2%, n=95, P=0.003). Of the 197 diagnoses of internal carotid stenosis ≥50%, 63.5% (n=125) were considered symptomatic. Five additional symptomatic carotid stenoses ≥50% were diagnosed by MR angiography, giving a prevalence of symptomatic internal carotid stenosis of 11.1% with a significant difference between patients with and without ABCD² score ≥4 (Table 2; P=0.014). Among the 1159 patients with at least one intracranial artery assessed by transcranial Doppler ultrasound, stenosis ≥50% (including complete occlusion) was found in 8.6% (n=59) of patients with an ABCD² score <4 and in 11.9% (n=59) of patients with a score ≥4 (P=0.07). Of the 118 diagnoses of intracranial stenosis ≥50%, 53.4% (n=63) were considered symptomatic and 9 additional symptomatic stenoses were diagnosed by MR angiography. The prevalence of symptomatic intracranial carotid stenosis was 5.0% in patients with an ABCD² score <4 and 7.7% in those with a score ≥4 (P=0.06; Table 2).

Fifty-eight (4.9%) patients had a clinical history of atrial fibrillation (Table 1). The admission electrocardiogram diagnosed atrial fibrillation in an additional 20 patients. Atrial fibrillation was diagnosed in a further 15 patients by examination during follow-up. Overall, 5.9% of patients with an ABCD² score <4 had atrial fibrillation versus 10.7% with a score ≥4 (P=0.003; Table 2). Other major cardiac sources of embolism (mural thrombus, dilated cardiomyopathy, fibroelastoma, mitral stenosis, prosthetic heart valve, recent myocardial infarction) detected by echocardiography at admission or during the second set of investigations were diagnosed more frequently in patients with an ABCD² score ≥4 (3.7%, n=14) than in patients with a score <4 (1.3%, n=7, P=0.017). Ten patients had a prosthetic heart valve and one had a recent myocardial infarction (within 3 weeks). Overall, major cardiac sources of embolism other than atrial fibrillation were detected in 2.1% of patients with an ABCD² score <4 and in 3.2% of patients with a score ≥4 (Table 2). A similar prevalence of major findings was found when the analysis was restricted to patients seen within 24 hours of symptom onset (Table 2).
Table 3. Sensitivity, Specificity, Positive and Negative Predictive Values of Conventional ABCD² Score Cutoff and NICE Recommendations to Identify Patients Fulfilling Criteria for Urgent Admission to Stroke Unit (defined as symptomatic carotid stenosis ≥50%, and/or a symptomatic intracranial stenosis ≥50%, and/or a major cardiac source of embolism)

<table>
<thead>
<tr>
<th>Diagnostic Test (95% CI)</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Positive Predictive Value</th>
<th>Negative Predictive Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total study sample (n=1176)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABCD² score ≥4 (n=497)</td>
<td>54.0 (48.2–59.7)</td>
<td>61.6 (58.4–64.8)</td>
<td>31.6 (27.5–35.7)</td>
<td>80.3 (77.3–83.3)</td>
</tr>
<tr>
<td>NICE criteria* (n=561)</td>
<td>57.7 (52.1–63.5)</td>
<td>55.6 (52.3–58.9)</td>
<td>30.0 (26.2–33.7)</td>
<td>80.0 (76.8–83.2)</td>
</tr>
<tr>
<td>Patients seen at TIA clinics within 24 hours of symptom onset (n=670)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABCD² score ≥4 (n=324)</td>
<td>58.2 (50.7–65.7)</td>
<td>54.9 (50.5–59.2)</td>
<td>29.6 (24.7–34.9)</td>
<td>80.0 (75.9–84.3)</td>
</tr>
<tr>
<td>NICE criteria* (n=421)</td>
<td>74.6 (67.9–81.2)</td>
<td>41.0 (36.7–45.3)</td>
<td>29.2 (24.9–33.6)</td>
<td>83.1 (78.5–87.8)</td>
</tr>
</tbody>
</table>

*ABCD² score ≥4 or crescendo TIA (2 or more TIA in 1 week) for patients seen within 1 week of symptom onset.

Criteria for Urgent Admission to a Stroke Unit

Among the 1176 patients with definite or possible TIA or minor stroke, 24.7% (n=291) fulfilled the criteria for emergency treatment, defined as the presence of symptomatic internal carotid stenosis ≥50%, symptomatic intracranial stenosis ≥50%, or a major cardiac source of embolism. The criteria for emergency treatment were more frequently diagnosed in patients with an ABCD² ≥4 (31.6%, n=157) compared with patients with a score <4 (19.7%, n=134, P<0.001). The sensitivity of the conventional ABCD² score cutoff of 4 was 54.0% (95% CI, 48.2 to 59.7) and the specificity was 61.6% (95% CI, 58.4 to 64.8). Similar diagnostic values were found using the NICE criteria and when the analysis was restricted to patients seen at the TIA clinic within 24 hours of symptom onset (Table 3).

Process of Care

Admission to a stroke unit occurred more frequently in patients with versus without an ABCD² ≥4 (Table 4). At discharge, patients with a score ≥4 were more frequently treated for hypertension and hypercholesterolemia than patients with a lower score. New prescription of blood pressure-lowering and anticoagulant drugs was more frequent in patients with an ABCD² ≥4, whereas antiplatelet drugs were less frequently prescribed. Urgent cerebral revascularization was performed in 3.5% of patients with an ABCD² <4 and in 5.6% of those with a score ≥4 (P=0.09).

Table 4. Process of Care According to the Conventional ABCD² Score Cutoff

<table>
<thead>
<tr>
<th>ABCD² Score</th>
<th>Admitted to stroke unit</th>
<th>Secondary prevention therapy</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;4 (n=679)</td>
<td>28.8 (195)</td>
<td>40.6 (202)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>≥4 (n=497)</td>
<td>40.6 (202)</td>
<td>40.6 (202)</td>
<td></td>
</tr>
</tbody>
</table>

*Including 5 angioplasty/stenting of carotid stenosis and 4 angioplasty/stenting of intracranial stenosis.

Discussion

In this analysis of a large cohort of patients with suspected TIA, a substantial proportion of cases with definite or possible TIA or minor stroke and an ABCD² score <4 had underlying disease (eg, carotid stenosis >50%, severe intracranial stenosis, or atrial fibrillation) associated with a high risk for stroke recurrence.

In July 2008, NICE recommended immediate evaluation (within 24 hours) of patients with a TIA in a TIA clinic when their ABCD² score was ≥4 or when the patient had had at least 2 TIAs in the previous week. Triage of patients in many TIA clinics is also based on an ABCD² score ≥4 and the NICE criteria had a 61.6% (95% CI, 58.4 to 64.8) sensitivity and specificity for identification of patients fulfilling the criteria for admission to a stroke unit. These criteria form part of the National Stroke Association guidelines for stroke unit admission in patients with a TIA.

In this analysis, we have focused on causes such as extracranial carotid artery stenosis ≥50% or atrial fibrillation...
for which potential therapeutic interventions (e.g., carotid endarterectomy) has been proven effective. However, a state-of-the-art neurosonography or CT angiography can detect other location of atherosclerosis (e.g., vertebral artery origin stenosis) that might benefit from therapeutic intervention not yet proven effective.

In conclusion, no patients with ipsilateral symptomatic carotid stenosis ≥50% or with atrial fibrillation should be missed or overlooked regardless of ABCD² score. Based on our data, when triaging patients based on ABCD² score above or below 4, clinicians should perform immediate (within 24 hours) carotid ultrasound examination (or default angiographic CT scan) and an electrocardiogram in patients with a TIA before deciding to postpone the workup beyond the 24-hour window.

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Disclosures
None.

References
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