Potential and Failure of the ABCD² Score in Stroke Risk Prediction After Transient Ischemic Attack

Georgios Tsivgoulis, MD, FESO; Ioannis Heliopoulos, MD

See related articles, pages 844–850 and 851–856.

Patients with transient ischemic attacks (TIAs) are a heterogeneous group in terms of risk factors, symptomatology, underlying disorders, and prognosis. The importance of recognizing this common condition lies in the high risk of early stroke that TIAs carry (3.1% at 2 days, 5.2% at 7 days, 8.0% at 30 days, and 9.2% at 90 days). Recent evidence suggests that the early stroke risk after a TIA may be estimated from prediction scores based on clinical features, etiology, vascular imaging, or diffusion magnetic resonance imaging. The ABCD system (ABCD/ABCD²: [Age ≥60 years=1 point], Blood pressure [systolic >140 mm Hg and/or diastolic >90 mm Hg=1], Clinical features [unilateral weakness=2, speech disturbance without weakness=1, other symptoms=0], Duration of symptoms [<10 minutes=0, 10 to 59 minutes=1, ≥60 minutes=2], and Diabetes mellitus (yes=1])) is a simple clinical tool that has been recently developed to predict individual risk of stroke and to triage TIA patients on first presentation to medical attention.6,7 Current international guidelines have rapidly adopted the former score in risk stratification of TIA patients, advocating immediate hospitalization and emergent diagnostic evaluation of TIA patients with an ABCD² score of 3 or higher in the United States (American Heart Association recommendations) and of 4 or higher in the United Kingdom (National Institute of Clinical Excellence Guidelines).9

However, after excluding the original derivation studies of the ABCD system using data from the same 2 large, population-based TIA registries in California and Oxfordshire,6,7 multiple external validation studies have yielded inconsistent results, ranging from insignificant to limited to satisfactory to excellent predictive ability. The extremely varied methodology in the different validation studies may contribute to these divergent findings, including a limited number of outcome events (as low as 2 in 1 study).15 The clinical specialty of the initial evaluation (neurologists vs emergency department physicians)10–13,15–17 retrospective data collection by chart review,8,10,14,19 and lack of follow-up after the first 7 days.9,19 Notably, a recent systematic review and meta-analysis of 11 studies reporting the performance of the ABCD system in a total of 5938 TIA patients has reported a satisfactory predictive ability for both the ABCD (pooled estimate of the area under the curve [AUC] for prediction of 7-day risk=0.74; 95% CI, 0.68 to 0.81) and the ABCD² (pooled estimate of the AUC for prediction of 7-day risk=0.77; 95% CI, 0.63 to 0.91) scores.22

In this issue of Stroke, Sheehan et al23 and Chandratheva et al24 report the results of 2 independent, relatively large, prospective, population-based studies investigating the diagnostic utility of ABCD² for prediction of early stroke risk after TIA. More specifically, Sheehan and colleagues23 used data from the North Dublin TIA Study (including all TIA cases identified during a 3-year period in a prospective, population-based cohort of 294 529 inhabitants of North Dublin city) to externally validate the ABCD² score and to evaluate whether carotid stenosis or atrial fibrillation might add to the prognostic information yielded by the ABCD² score. Interestingly, they noted that the degree of carotid stenosis was linearly associated with increased stroke risk after TIA, whereas atrial fibrillation was not. In addition, they documented an agreeable predictive utility of the score in non-specialist-suspected TIA patients (n=700; AUC for prediction of the 90-day risk=0.61; 95% CI, 0.52 to 0.71). In contrast, they showed that the predictive ability of the ABCD² score was no better than chance in TIA cases confirmed by stroke specialists (n=443, AUC for prediction of the 90-day risk=0.55; 95% CI, 0.45 to 0.64), largely related to the 24.2% (8/33) of recurrences documented in patients with low ABCD² scores. (0–3) These findings are at odds with the currently supported notion that TIA patients with low ABCD² scores carry an insignificant risk of stroke and highlight the importance of emergent carotid evaluation in all TIA patients, independent of the presenting ABCD scores. The main strengths of this timely study are related to the prospective and population-based design, the large sample size, the “hot pursuit” strategy used for TIA identification, and the regular follow-up assessments. On the other hand, certain methodological shortcomings need to be acknowledged: (1) the lack of brain imaging data in a substantial portion of confirmed TIA patients (14.4%); and (2) the absence of a uniform predefined protocol regarding secondary prevention strategies, which were delivered according to the practice of the treating physician and patient preference. Therefore, potential variations in TIA clinical management may have accounted for the higher risk of stroke documented in the low-ABCD²-score group who fared poorly. Third, previous investigators have indicated that the ABCD system appears to identify TIA patients with ≥50% carotid artery stenosis or atrial fibrillation who are at high risk of early stroke.25 However, in the present series, the potential interaction between ABCD² score and the degree of carotid artery...
stenosis in early stroke prediction after TIA was not investigated, whereas the reported hazard ratios depicting the association between carotid artery stenosis and stroke risk were only adjusted for age and sex without taking into account potential confounders, including stroke risk factors and ABCD² scores.

Chandratheva and colleagues²⁴ capitalized on the large, prospective, population-based dataset of the Oxford Vascular Study and evaluated the association of ABCD² score with stroke severity and recurrent TIs in a sample of 500 TIA patients collected in a 5-year period in Oxfordshire. They demonstrated that the ABCD² score was highly predictive (AUC for prediction of the 7-day risk=0.80; 95% CI, 0.72 to 0.87) of major stroke (National Institutes of Health Stroke Scale Score >3). In contrast, the predictive ability of the score to detect minor stroke after TIA was limited (AUC for prediction of the 7-day risk=0.57; 95% CI, 0.43 to 0.71), whereas an inverse relation was documented between ABCD² score and risk of recurrent TIs (ie, with TIA patients presenting with lower ABCD² scores being more likely to experience recurrent TIs). Interestingly, higher ABCD² scores predicted not only stroke severity but also stroke-related disability, length of hospitalization for recurrent stroke, and overall acute hospital care costs. These results corroborate current international guidelines⁶⁻⁷ advocating immediate hospitalization of TIA patients presenting with moderate to high ABCD² scores to maximize preventive treatment and facilitate early thrombolysis if a stroke occurs during the first days after a TIA. The main advantages of this elegant study are related to the prospective and population-based design, the thorough methods for TIA identification, the comprehensive statistical analyses, and the strict criteria used for case ascertainment of recurrent strokes and TIs. The major study limitations are the lack of neuroimaging data in recurrent TIA cases, potential recall bias (TIs being identified retrospectively by asking presenting stroke patients about recent TIA symptoms), and the absence of any underlying mechanism for the documented inverse association between ABCD² score and risk of recurrent TIA. Moreover, given the limited number of minor strokes after TIA (n=22), it should be noted that the study may not have been adequately powered to investigate the predictive ability of the score for minor recurrent strokes.

In conclusion, the present 2 studies add to the mounting literature underscoring the importance of emergent diagnostic evaluation and early instigation of secondary prevention strategies in TIA patients in specialist centers that may be associated with a stroke risk reduction by up to 80%²⁶,²⁷. They also highlight the potential (simplicity, applicability, extensive external validation, and both diagnostic and prognostic predictive ability; Table) and failure (inability to take into account stroke and vascular mechanisms, inability to incorporate vascular and brain imaging data; Table) of the newly introduced ABCD² score in triaging TIA patients with a high risk of early stroke. Despite its shortcomings, the ABCD² score appears to be the best clinical tool available to stratify high-risk TIA patients and may assist in developing admission recommendations in cooperation among neurologists, internists, and emergency department physicians for

### Table. Strengths and Limitations of the ABCD² Score

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<tr>
<th>Strengths</th>
<th>Limitations</th>
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<tr>
<td>Simplicity</td>
<td>No reliability assessments of the individual clinical variables of the score were conducted</td>
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<tr>
<td>Applicability</td>
<td>Does not take into account stroke mechanism(s)</td>
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<tr>
<td>Yields both diagnostic (detects “true” TIs) and prognostic (stratifies stroke risk) information</td>
<td>Does not incorporate brain imaging data (presence of old or new infarction on brain computed tomography, leukoaraiosis, diffusion-weighted imaging lesions)</td>
</tr>
<tr>
<td>Extensive and independent validation</td>
<td>Does not incorporate ultrasound data (extra- or intra-cranial hemodynamically significant stenosis or occlusion)</td>
</tr>
<tr>
<td>Prediction of stroke risk and stroke severity</td>
<td>Does not take into account vessel territory (anterior vs posterior circulation stroke)</td>
</tr>
<tr>
<td>Moderate association between ABCD² score and presence of acute infarct on brain magnetic resonance imaging</td>
<td>Limited predictive ability in TIA patients evaluated by neurologists (greater predictive utility in TIs evaluated by nonspecialists)</td>
</tr>
<tr>
<td>Predictive of stroke risk in TIA patients with atrial fibrillation or carotid stenosis</td>
<td>The clinical benefit in triaging TIA patients with high scores (&gt;3) to inpatient management has not been tested</td>
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patients presenting with TIs. However, it should be kept in mind that the ABCD² score has not been developed as a substitute for individualized clinical judgment and that the most important aspect in the optimal management of a TIA patient is not the calculation of the individual score but the accurate identification of the underlying TIA mechanism and vascular pathology.

### Disclosures

None.

### References


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Stroke. 2010;41:836-838; originally published online March 18, 2010; doi: 10.1161/STROKEAHA.110.579169

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