Comparison of prognostic performance of scores to predict risk of stroke in ED patients with transient ischaemic attack

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To compare the performance of three risk scores (ABCD, ABCD2 and California) in identification of short-term stroke risk in patients with emergency department (ED) diagnosis of transient ischaemic attack. In the retrospective cohort study, information collected included features of clinical risk scores, demographic, clinical and outcome data. The outcome of interest was new stroke occurrence at 2, 7 and 30 days. Data underwent receiver operating curve analyses. Of 326 patients, 17 patients experienced a new stroke within 30 days (4.9%, 95% confidence interval: 2.9–8.0%). C-statistic for high-stroke risk was not significantly different between scores at 2, 7 or 30 days. Using cutoffs of defined risk score cutoffs, the negative predictive values for stroke within 30 days were 97.4% (California), 99.1% (ABCD) and 98.9% (ABCD2), respectively. All three risk scores predict short-term risk of stroke in patients with an ED diagnosis of transient ischaemic attack and could be an effective tool to guide clinical decision making. ***European Journal of Emergency Medicine*** **17:346–348 © 2010 Wolters Kluwer Health | Lippincott Williams & Wilkins.**

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Introduction

Transient ischaemic attack (TIA) has an estimated incidence of 1.08 per thousand population [1]. With a rate of subsequent stroke as high as 14% within 30 days [2], a TIA presentation is an important opportunity for risk stratification. The California [3], ABCD [4] and ABCD2 [5] clinical risk scores have been proposed to identify patients at high early risk of stroke so that they can be prioritized for urgent investigation and management.

Our aim was to compare the performance of three risk scores (ABCD, ABCD2 and California) in identification of patients at high short-term risk of stroke in emergency department (ED) patients with probable or definite TIA.

Methods

This was an observational study conducted using retrospective medical record review methodology set in ED of Western Hospital (census 35 000 adult patients), a metropolitan university teaching hospital in Melbourne Australia.

Participants were identified from the ED management database (HASS) using the ED discharge diagnosis of TIA for the period 1 January 2006 to 30 June 2008. Patients were excluded if they were aged under 18 years, were transferred from another institution, had symptom duration > 24 h, there was miscoding of diagnosis or records were unavailable. Although some patients with a clinical diagnosis of TIA in the ED will later have a different definitive diagnosis made, we included all patients with the clinical diagnosis of TIA at ED discharge as this represents the 'real world' challenge facing ED clinicians.

Data was collected onto an explicit data form and by scripted telephone follow-up. Information included features of the clinical risk scores, demographic, clinical, final diagnosis and outcome data. The California, ABCD and ABCD2 scores were calculated retrospectively. Interrater agreement for sex, diabetes, motor weakness and duration of symptoms were performed on 10% of the sample and 100% agreement was obtained for each comparator, $\kappa = 1.00$.

The main outcome of interest was new stroke occurrence within 2, 7 and 30 days of index TIA in relation to the clinical risk scores. Secondary analysis investigated the prognostic performance of predefined low risk score groups. We defined a low risk California score as less than 3 and low risk ABCD and ABCD2 score as less than 4. A low-risk group was not defined by the developers of the California score [3]. The definitions for the ABCD and ABCD2 scores are those proposed by their developers [4,5].

Data was analyzed using Stata (version 8). Primary analysis was descriptive, including comparison of sensitivity, specificity and negative predictive values at 2, 7 and 30 days. Chi-square tests were performed for proportions. Area under the curve (c-statistic) for receiver operator curve (ROC) was calculated using Analyze-It

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for Excel with Delong-Delong comparison for c-statistic. The c-statistic integrates measures of sensitivity and specificity of the range of a variable. Ideal prediction yields a c-statistic of 1.00 whereas prediction no better than chance is associated with a c-statistic of 0.5.

Western Health approved this research under the National Health and Medical Research Council (Australia) Quality Assurance Project Guidelines and approval was obtained from the Western Health Low Risk Ethics Panel for telephone follow-up.

Results

Four hundred and nineteen cases were identified. Fifty-six were excluded (miscoding 48, transfer one, missing records seven), leaving a sample for analysis of 363. The median age was 72 years (interquartile range: 50–94) and 53% of the sample was male. With respect to risk factors for atherosclerosis, hypertension was present in 66%, hyperlipidaemia in 47%, diabetes in 22% and 22% were current smokers. Thirty-four percent reported a previous TIA and 29% had a previous cerebrovascular accident (CVA). Twenty-nine percent had known coronary artery disease, 21% were in atrial fibrillation and 45% were already taking aspirin. On clinical assessment, 53% presented with unilateral weakness, 51% with speech disturbance and 47% with sensory disturbance. In 45% of patients, symptoms had lasted more than 1 h. About 69% of patients were admitted to hospital. Of those admitted, TIA was confirmed in 156 patients (62.7%) with a further 47 patients (18.9%) having a final diagnosis of CVA.

Follow-up data was available for 326 patients. The rate of CVA was 3.1% within 2 days of index TIA [$N = 10$, 95% confidence interval (CI): 1.7–5.6%], 4.3% within 7 days ($N = 14$, 95% CI: 2.6–7.1%) and 5.2% within 30 days ($N = 17$, 95% CI: 3.3–8.2%).

C-statistic for distinguishing high-stroke risk was high and not significantly different between scores at 2, 7 or 30 days ($P > 0.1$ for all comparisons) (Table 1).

Sensitivity, specificity and negative predictive values at 2, 7 and 30 days are shown in Table 2. A defined low score on all clinical risk scores had very high-negative predictive value for CVA within 30 days. ABCD and ABCD2 scores had higher sensitivity than the California score at all intervals, but specificity for all scores was low.

Table 1 Predictive ability (c-statistic) of clinical risk scores at 2, 7 and 30 days

Score	C-statistic for CVA at 2 days (95% CI)	C-statistic for CVA at 7 days (95% CI)	C-statistic for CVA at 30 days (95% CI)
California	0.68 (0.5–0.85)	0.66 (0.51–0.80)	0.69 (0.56–0.81)
ABCD	0.65 (0.51–0.79)	0.64 (0.53–0.75)	0.68 (0.58–0.79)
ABCD2	0.69 (0.53–0.85)	0.69 (0.56–0.81)	0.73 (0.61–0.83)

CI, confidence interval; CVA, cerebrovascular accident.

Table 2 Comparison of sensitivity, specificity and NPV using defined high and low-risk cutoffs for California, ABCD and ABCD2 clinical risk scores

Score	Sensitivity	Specificity	NPV
2 day CVA outcome			
California	80.0 (44.2–96.5)	36.4 (31.1–42.0)	98.3 (93.3–99.7)
ABCD	90.0 (54.1–99.5)	33.9 (28.7–39.4)	99.1 (94.2–100)
ABCD2	90.0 (54.1–99.5)	28.5 (23.6–33.9)	98.9 (93.1–99.9)
7 day CVA outcome			
California	78.6 (48.8–94.3)	36.5 (31.2–42.3)	97.4 (92.1–99.3)
ABCD	92.9 (64.2–99.6)	34.3 (29.1–39.9)	99.1 (94.2–100)
ABCD2	92.9 (64.2–99.6)	28.8 (24.0–34.3)	98.9 (93.2–99.9)
30 day CVA outcome			
California	82.4 (55.8–95.3)	36.9 (31.5–42.6)	97.4 (92.1–99.3)
ABCD	94.1 (69.2–99.7)	34.6 (29.4–40.3)	99.1 (94.2–100)
ABCD2	94.1 (69.2–99.7)	29.1 (24.2–34.6)	98.9 (99.9)

CVA, cerebrovascular accident; NPV, negative predictive value.

Discussion

TIA can be the portent of a serious, disabling event. The stroke rates after TIA found in this study are similar to those reported by others. A recent meta-analysis reported pooled stroke rates of 3.1% (95% CI: 2.0–4.1) at 2 days and 5.2% (95% CI: 3.9–6.5%) at 7 days [6]. Another meta-analysis calculated pooled risk of 8.0% (95% CI: 5.7–10.2%) at 30 days and 9.2% (95% CI: 6.8–11.5%) at 90 days [7].

Clinical risk scores have been developed to identify the subgroup of TIA patients at high risk of early CVA and thus for whom aggressive intervention and treatment strategies may avert a stroke. In this study, the California, ABCD and ABCD2 score all had good predictive performance (c-statistic California, ABCD, ABCD2 0.675, 0.650, 0.692 at 2 days; 0.655, 0.640, 0.687 at 7 days and 0.687, 0.684 and 0.725 at 30 days, respectively). This is similar to the performance of the California score in other validation studies [5] (c-statistic 0.60–0.75, 2-day risk and 0.60–0.79, 7-day risk). It is slightly lower than the predictive performance of the ABCD and ABCD2 scores reported in a meta-analysis of validation studies which found c-statistics of 0.74 (95% CI: 0.68–0.81) and 0.77 (0.63–0.91) for 7-day-stroke risk for the ABCD and ABCD2 scores, respectively [8]. This difference may be because of differences in the populations studied. We did not find a statistically significant difference in predictive ability between scores, in common with a previous validation study [5].

The effectiveness of a clinical risk score depends on a number of factors including its statistical accuracy in the 'real world' clinical setting, its usefulness in providing timely, relevant information to clinicians and the degree of uptake. All three clinical risk scores studied appear to have acceptable statistical accuracy in a variety of settings [5,8]. The data required for calculation is readily available, the scores are easily calculated and the result provided is highly relevant to management decisions.

This study has some limitations that should be considered when interpreting the results. Data was collected

retrospectively with the well-known limitations of that method [9]. We attempted to minimize these by explicit data collection procedures and testing of interrater reliability. Follow-up included a telephone interview with patients. It is possible that some self-report was wrong about whether they had suffered a further stroke. Where the patient had not had subsequent care at the study health service, we were unable to verify patient's reports. The sample is modest in comparison to other studies and limited to one hospital, which may challenge its generalizability.

Conclusion

The California, ABCD and ABCD*2* risk scores were predictive of short-term risk of stroke in patients with an ED diagnosis of TIA and could be an effective tool to guide clinical decision making.

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