

## Clinical Application of ABCD<sup>2</sup> Score System

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### Abstract

There is a high early risk of stroke after a transient ischemic attack (TIA). ABCD<sup>2</sup> score system is a useful tool to predict the risk of stroke for the patients with TIA. It's necessary to make validation in different ethnic groups. In this study, we prospectively recruited 136 TIA patients in Henan province. Nine patients with ischemic stroke at 2-day follow-up and sixteen patients at 7-day follow-up were recorded. The risk of stroke increases with the increasing of the score. 2-day and 7-day Area Under Receiver Operating Characteristic Curve (AUROCC) of ABCD<sup>2</sup> score is 0.804 and 0.764 respectively. The cut-off point is at 4. The sensitivity of ABCD<sup>2</sup> score at 2-day and 7-day was 88.9% and 87.5% respectively. The specificity of ABCD<sup>2</sup> score at 2-day and 7-day was 55.9% and 58.3%. Multivariate Logistic regression analyses demonstrated that ABCD<sup>2</sup> score of 4 to 7 was the independent predictive factor of stroke after TIA (2-day multivariate Logistic regression analyses: OR9.578, 95%C.I. 1.146-80.059, P=0.037; 7-day multivariate Logistic regression analyses: OR13.458, 95%C.I. 2.516-71.978, P=0.002). Thus, ABCD<sup>2</sup> score could be validated in identifying patients at high risk of stroke after TIA in Henan Chinese population. [Life Science Journal. 2009; 6(3): 23 – 26] (ISSN: 1097 – 8135).

**Key Words:** ABCD<sup>2</sup> score; transient ischemic attack; stroke; risk

### 1 Introduction

High early risk of stroke after a transient ischemic attack (TIA) has been reported<sup>[1,2,3]</sup>. Johnston et al proposed ABCD<sup>2</sup> Score to predict well of the risk of stroke in 2 days after TIA<sup>[4]</sup>. Since the ABCD<sup>2</sup> Score was published in January 2007, validation for different ethnic group is not completed yet. To validate ABCD<sup>2</sup> score in identifying high early risk of stroke in China, we studied the patients prospectively with ABCD<sup>2</sup> score by 2-day and 7-day follow-up after TIA being registered outpatient and inpatient in neurology department of the First Affiliated Hospital of Zhengzhou University..

### 2 Methods

The TIA diagnosis is based on the TIA diagnostic criteria

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of World Health Organization 1976<sup>[5]</sup>. The elapsed time from last episode to registry was less than 48 hours. Patients who could not describe the situation of the attack or provide the past history due to cognition impairment or other causes and patients who rejected participating in the research as well as patients who could not cooperate to accomplish the follow-up were excluded.

Consecutive TIA patients were registered prospectively. ABCD<sup>2</sup> scores were documented. Meanwhile, TIA registry forms were filled by neurological physicians with unified training. ABCD<sup>2</sup> score is graded by the following: Age ( $\geq 60$  years=1,  $< 60$  years=0 ; Blood pressure(systolic $\geq 140$ mmHg and/or diastolic $\geq 90$  mmHg=1, systolic $< 140$  mmHg and diastolic $< 90$  mmHg=0; Clinical manifestation(unilateral weakness=2, speech impairment without weakness=1, other symptom=0); duration of symptom( $\geq 60$ minutes=2, 10 to 59minutes=1,  $< 60$ minutes=0; diabetes(yes=1, no=0). Patients were followed-up to document subsequent stroke and medication at 2 and 7 days respectively.

Differences in stroke-free survival between groups stratified by ABCD<sup>2</sup> score were assessed for statistical significance with the log-rank test. Sensitivities and specificities of prediction were determined at each cut-off of the score and the receiver operating characteristic curve (ROC) was plotted. Logistic regression analysis was used to identify factors that increased the risk of subsequent stroke after TIA. Factors that contributed to the outcome in the initial univariate analyses at  $P < 0.1$  were included in the multivariate model. In the final multivariate analyses, statistical significance was achieved if  $P < 0.05$ . The Statistic Package for Social

Science version 10.0 was used for statistical analysis.

### 3 Results

136 TIA patients participated in the study. The distribution of the ABCD<sup>2</sup> score was shown in Table 1. Within 2 days of TIA, 9 (6.6%) patients had a subsequent ischemic stroke and within 7 days of TIA, 16 (11.8%) patients had a subsequent ischemic stroke.

The 2- and 7-day risk of stroke stratified according to ABCD<sup>2</sup> score were presented in Table 1. The risk of stroke increased according to the increase of the score.

Table 1. 2- and 7-day risk of stroke stratified according to ABCD<sup>2</sup> score

ABCD <sup>2</sup> score	Patients	2 days		7 days	
		Strokes	Risk * (%, 95%CI)	Strokes	Risk * * (%, 95%CI)
0	4	0	0	0	0
1	12	0	0	0	0
2	20	0	0	1	5.0(0-25.0)
3	36	1	2.8(0-15.0)	1	2.8(0-15.0)
4	40	3	7.5(2.0-21.0)	8	20.0(9.0-35.0)
5	18	3	16.7(4.0-41.0)	4	22.2(6.0-48.0)
6	4	1	25.0(1.0-81.0)	1	25.0(1.0-81.0)
7	2	1	50.0(1.0-99.0)	1	50.0(1.0-99.0)
合计	136	9	6.6(2.4-10.8)	16	11.8 (6.4-17.2)

\* Log-rank test=16.57, df=7,  $P=0.0204$ ; \* \* Log-rank test=15.87, df=7,  $P=0.0263$

The receiver operating characteristic curves were plotted (Figure 1 and 2). 2- and 7-day area under receiver operating characteristic curve (AUROCC) of ABCD<sup>2</sup> score is 0.804 and 0.764 respectively. The cut-off point

was determined by presetting the sensitivity (low limit is 80%) and the cut-off point is 4. Validation of the cut-off point was seen in table 2.

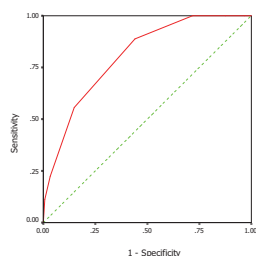


Figure 1. 2-day ROC

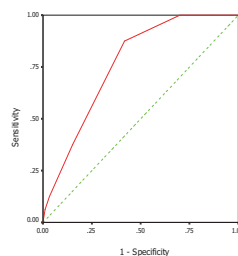


Figure 2. 7-day ROC

**Table 2.** Validation of the cut-off point

	2-day	7-day
sensitivity	88.9%	87.5%
false negative rate	11.1%	12.5%
specificity	55.9%	58.3%
false positive rate	44.1%	41.7%

The association of the gender, ABCD<sup>2</sup> score (4-7 versus 0-3), stroke risk factors and secondary prevention therapies with the risk of subsequent stroke was evaluated using univariate Logistic regression analyses. The variables which were significantly (P<0.1) related to

subsequent stroke were selected for entry into the final multiple-variable model. The results of multivariate Logistic regression analyses were seen in table 3 and 4.

**Table 3.** 2-day Logistic regression analyses

	B	SE	Wald	Sig	Exp(B)	95%C.I.for Exp(B)	
						Lower	Upper
ABCD <sup>2</sup> score	2.259	1.083	4.350	0.037	9.578	1.146	80.059

**Table 4.** 7-day Logistic regression analyses

	B	SE	Wald	Sig	Exp(B)	95%C.I.for Exp(B)	
						Lower	Upper
ABCD <sup>2</sup> score	2.600	0.856	9.233	0.002	13.458	2.516	71.978
hypertension	1.531	0.719	4.536	0.033	4.624	1.130	18.921
hyperlipidemia	1.739	0.804	4.683	0.030	5.691	1.178	27.487

#### 4 Discussion

The short-term stroke risk after a TIA is very high. The research of the Oxfordshire Community Stroke Project reported a 7-day stroke risk of 8.6% and a 30-day stroke risk of 12.0% in patients with TIA. Analyses of the Greater Cincinnati/Northern Kentucky stroke study found the risk of stroke after TIA was 3.9% at 2days, 7.0% at 7days, and 14.6% at 90 days. This study showed a 6.6% risk of stroke at 2 days and an 11.8% risk at 7 days, revealing a high early risk of stroke after a TIA. Therefore TIA should be considered as “minor stroke, high risk”.

The risk of stroke was higher according to the increase of the score. 2-day and 7-day AUROCC of ABCD<sup>2</sup> score was in the range from 0.7 to 0.9 which indicated moderate predictive value of ABCD<sup>2</sup> score. The sensitivity and specificity was about 85% and 56% respectively, and the high sensitivity met the principle of

screening test. After adjustment for the other factors, an ABCD<sup>2</sup> score of 4 to 7 was independently associated with 9.5-fold and 13-fold greater 2-day and 7-day risk of stroke respectively.

Guideline recommendations for hospital admission of TIA are vague and practice is highly variable<sup>[6]</sup>. Some examinations and interventions for TIA patients are expensive and may not be cost effective if used in all TIA patients. ABCD<sup>2</sup> score might help clinicians to stratify TIA patients and determine which patients should be admitted, assessed and treated as soon as possible. A cost-utility analyses showed an ABCD<sup>2</sup> score of 4 to7 might justify 24h hospital admission on the basis of a greater chance to administer thrombolysis given the subsequent stroke<sup>[7]</sup>. Cut-off points of different interventions might vary. Same intervention also might has different cut-off in different regions. However, high risk TIA patients (ABCD<sup>2</sup> score: 6-7) benefit from urgent assessment and treatment. Low risk patients (ABCD<sup>2</sup>

score: 0-3) are not need for hospital admission. And the need of admission for moderate risk patients (ABCD<sup>2</sup>

score: 4-5) depends on specific individual conditions and medical system<sup>[4]</sup>. The stratification of TIA patients can decrease stroke risk and abuse of medical resources. ABCD<sup>2</sup> score is easy for clinical practice and helpful to identify the high risk TIA patients.

#### Reference

1. Johnston SC, Gress DR, Browner WS, et al. Short-term prognosis after emergency-department diagnosis of transient ischemic attack [J]. *JAMA*, 2000, 284: 2901–2906.
2. Lovett JK, Dennis MS, Sandercock PA, et al. Very early risk of stroke after a first transient ischemic attack [J]. *Stroke*, 2003, 34: 138–140.
3. Kleindorfer D, Panagos P, Pancioli A, et al. Incidence and short-term prognosis of transient ischemic attack in a population-based study [J]. *Stroke*, 2005, 36: 720–723.
4. Johnston SC, Rothwell PM, Nguyen-Huynh MN, et al. Validation and refinement of scores to predict very early stroke risk after transient ischemic attack [J]. *Lancet*, 2007, 369: 283–292.
5. Hatano S. Experience from a multicentre stroke register: a preliminary report [J]. *Bull WHO*, 1976, 56: 541–553.
6. Johnston SC, Smith WS. Practice variability in management of transient ischemic attacks [J]. *Eur Neurol*, 1999, 42: 105–108.
7. Nguyen-Huynh MN, Johnston SC. Is hospitalization after TIA cost-effective on the basis of treatment with tPA? [J] *Neurology*, 2005, 65: 1799–1801.