Value of ABCD$^{2\text{-}F}$ in Predicting Cerebral Ischemic Attacks: Three Months Follow-Up after the Primary Attack

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Abstract- Cerebrovascular attack (CVA) and transient ischemic attack (TIA) are major causes of emergency department visits around the globe. A significant number of these patients may experience repeat attacks if left untreated. Several risk stratifying scoring systems have been developed in recent years to point out the high risk patients. ABCD^2 is based on age, blood pressure, clinical status, diabetes mellitus, and duration of symptoms and is used commonly for this purpose. In this study, we were to enhance its sensitivity and specificity with the addition of another criterion namely atrial fibrillation and making ABCD$^{2\text{-}F}$. A prospective study in two hospitals was performed and 138 patients diagnosed with TIA/CVA were enrolled. Demographic, clinical, and paraclinical data of all patients were registered. All patients were followed for three months for any sign or symptom of a recurrent ischemic attack. Recurrent ischemic attacks happened in 9.4% of the patients. None of the criteria of ABCD$^{2\text{-}F}$ was associated with higher chance of ischemic attacks. Similarly, ABCD$^{2\text{-}F}$ was not different between patients with or without repeat cerebral ischemia. The addition of atrial fibrillation to ABCD^2 did not enhance the accuracy of this scoring system to detect patients high risk for repeat cerebral ischemia. More studies in the future to improve sensitivity and specificity of this test are warranted.

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Keywords: ABCD^{2F}; ABCD^2; Stroke; Transient ischemic attack

Introduction

In spite of advances in diagnostic and therapeutic approaches, cerebral vascular accident (CVA) is still a leading cause of morbidity and mortality worldwide (1,2). Patients diagnosed with transient ischemic attack (TIA) are prone to developing CVA in the near future, and several attempts have been made to diagnose this high risk group and start preventive measures as early as possible (3). Differentiating those at risk to develop CVA from the others helps the physician to limit the duration of hospitalization and unnecessary treatments in low risk patients.

For this purpose, several risk stratifying methods have been proposed in the last decade. ABCD^{-a} mnemonic standing for age, blood pressure, clinical status, and duration of symptoms – was used to stratify these patients according to simple clinical and para-clinical findings (4). Several modifications of this scoring system such as ABCD^2, ABCD^3, and ABCD$^{3\text{-}I}$ were made to improve its accuracy in detecting high risk patients (5,6).

In our previous report, we examined the accuracy of ABCD^2 in predicting the occurrence of TIA/CVA where sensitivity and specificity of ABCD^2 score for predicting CVA/TIA at the cut-off point of 4 turned out to be 72.7% and 52.8%, respectively (7). So, it seems that low risk patients according to ABCD^2, still harbor the considerable risk of developing CVA/TIAs. As atrial fibrillation (AF) is a well-known risk factor for CVA/TIA, in the next step of our studies we decided to add this criterion to ABCD^2 – making ABCD$^{2\text{-}F}$ scoring - to enhance its accuracy in predicting ischemic events in the future.

Materials and Methods

Patients diagnosed with CVA/TIA referred to the

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Emergency Department (ED) of Rasoul Akram or Sina Hospitals in Tehran were enrolled. The study was approved by the Ethics Committee of Tehran University of Medical Sciences. All demographic information, past medical and drug histories, physical examinations of the patients were registered by the physicians. All the patients underwent paraclinical studies including ECG, echocardiography, color-Doppler of cervical vessels, MRI and CT-scan findings, and laboratory data. Patients with hemorrhagic stroke were excluded. The final goal of the study was defined as any neurological deficits within 90 days from the first symptoms. Follow-up visits of the patients were registered. All the patients were contacted by telephone 90 days after the first event and asked for symptoms of TIA/CVA. All the forms were filled by residents of emergency medicine. TIA was defined as neurological event resolving in less than 24 hours while longer deficits were considered CVA. Patients presenting with an only headache or dizziness were not included. The final diagnosis was made by a neurologist in all cases based on clinical data. As reperfusion therapies for stroke have not become a common practice in our center, none of the patients underwent such treatment.

Indices of ABCD^{2-F} were scored as follow: 1 point for age>60, 1 point for systolic blood pressure>140 mm-Hg and/or diastolic blood pressure>90 mm-Hg, 1 point for any clinical symptoms, 1 point for isolated speech disturbance or 2 points for unilateral weakness, 1 point for history of diabetes, 1 point for duration of symptoms between 10–59 minutes or 2 points for longer duration, 1 point for atrial fibrillation on ECG. Time to discharge the patient and prescribed medications were left to the physician's discretion.

Collected data were analyzed with SPSS (Version 18.0, IBM). Kolmogorov-Smirnov test was used to evaluate the normal distribution of the data and Independent-samples T test, Mann-Whitney U (MWU), or Chi-square ($\chi 2$) tests were used where indicated. Data throughout the manuscript are presented as mean±standard error of the mean. Statistical significance was defined as *P*.values less than 0.05.

Results

This study included 138 patients of which 106 (76.8%) were diagnosed with CVA and the others with TIA (23.2%). The mean age of the patients was 65.48±12.03 years, and 89 patients were male (64.5%). Forty four patients (31.8%) were younger than 60, and the others were older. Of all the patients, 44 patients (31.8%) showed any type of cardiac dysrhythmia, arterial fibrillation (AF), block, or ischemic changes in their ECG where 9 of them (6.5%) had AF. Thirty two patients (23.2%) used to smoke. Past medical history of hypertension was positive in 78 (56.5%), CVA or TIA in 20 (14.5%), ischemic heart diseases in 34 (24.6%), diabetes in 39 (28.2%), dyslipidemia in 21 (15.2%) of patients. Drug history was positive in 34 (24.6%) patients for antiplatelets (aspirin, clopidogrel, or both), in 5 (3.6%) for warfarin, and in three (2.1%) for a combination of them. Systolic blood pressure at presentation was 146.8±25.8 mmHg. Forty eight patients (34.7%) had an initial blood pressure of less than 140/90 mmHg, and the others (65.4%) had higher blood pressure.

Isolated speech disturbances were observed in 17 (12.3%), isolated posterior circulation symptoms in 22 (15.9%), and hemiparesis in 99 (71.7%), of the patients. Of 32 patients with TIA, duration of signs and symptoms was less than 10 minutes in 6 (4.3%) patients, between 10-59 minutes in 9 (6.5%), and longer time period in the other patients.

Echocardiography was performed in 122 patients whose findings were normal in 86 (70.5%) patients whereas some abnormalities including thrombosis in the left ventricle, abnormal wall movement, aneurysmal wall, or considerable valvular abnormalities were seen in the others. Ejection fraction was 50.5±9.5 % on average.

All patients underwent brain CT-scan while MRI was performed in only 72 subjects. Brain CT-scan and MRI showed some degree of abnormalities in 76(55.1%) and 52 (72.2%) of cases, respectively. The mean of NIHSS (National Institutes of Health Stroke Scale) was 1.0±0.3 in TIA patients and 8.3±0.5 in CVA. TIA patients were hospitalized for 5.3±0.5 days while CVA patients for 8.9±0.8 days.

Follow-up phone calls, outpatient, and ED visits revealed that 13 (9.4%) patients experienced at least one attack of CVA/TIA within 90 days from the first symptoms. There was no significant difference in age of the patients with and without repeat CVA/TIA (T-test, $P>0.05$). Also, of those younger than 60, 3 patients (6.8%) and of those older than 60, 10 patients (10.6%) experienced new CVA/TIAs where this difference was not statistically significant ($\chi 2$, $P>0.05$). Of patients with normal electrocardiography (ECG), AF rhythm, and other abnormalities in ECG, 6 (6.4%), 2 (22.2%), and 5 (14.3%) cases developed new CVA/TIAs in their follow-up, respectively. However, these differences were not significant ($\chi 2$, $P>0.05$).

Among the patients with initial blood pressure of less than 140/90 mm-Hg, 4 (8.3%) had new stroke symptoms while this happened in 8 (9.1%) of patients with higher blood pressure at presentation. Again, the difference was not significant ($\chi 2$, $P>0.05$).

Three (7.7%) of the diabetic patients 3 (7.7%) and 10 (10.1%) of non-diabetic subjects developed new TIA/CVA ($\chi 2$, $P>0.05$).

There was no significant difference in the development of new TIA/CVAs in patients with hemiparesis (7.0%) compared with patients with other symptoms (15.3%) ($\chi 2$, $P>0.05$).

In TIA patients with their duration of symptoms less than 10 minutes, between 10-60 minutes, and longer than 60 minutes, 1 (16.7%), 2 (22.2%), and 10 (8.1%) developed new CVA/TIAs, respectively. These differences were not statistically significant ($\chi 2$, $P>0.05$).

$ABCD^2$ and $ABCD^2F$ did not show any significant differences between those with or without repeat TIA/CVA (MWU, $P>0.05$).

Discussion

Although several attempts have been made in the last decade to stratify the risk of developing TIA/CVA after an initial attack with the help of ABCD or its variants, based on our recent studies, this scoring system seems unlikely to roughly differentiate high risk patients. Maybe adding or changing some criterion in this classification system improves its accuracy in the future studies.

In our study, the chance of repeat TIA/CVA within the first 3 months after the primary attack was 9.4% (13 patients) which is similar to other studies (8,9). So, non-significant results of our study cannot be attributed to a lower or higher incidence of stroke in our series.

In contrast with first reports of ABCD scoring, later studies did not show consistent results and cast some doubts over its reliability to predict early ischemic events after TIA/CVA. A multi-centre prospective study with 1667 patients included showed that $ABCD^2$ is a poor predictor of recurrent ischemic attacks (10). Also, another multi-centre study from Canada, which included 2056 patients, demonstrated $ABCD^2$ as an inaccurate predictor of early ischemic stroke (11).

Considering the above mentioned studies which undermined the accuracy of $ABCD^2$ to predict ischemic strokes, several modifications with the addition of laboratory or imaging studies were evaluate to improve its prognostic accuracy. In a recent study by Kiyohara *et al.*, the authors found that $ABCD^3$ and $ABCD^{3\text{-}I}$ were better prognostic scoring systems than $ABCD^2$ (6). In $ABCD^3$, third "D" is related to dual TIA (i.e. two episodes of TIA within 1 week) is added to $ABCD^2$. In $ABCD^{3\text{-}I}$, "I" stands for imaging and requires MRI or MR Angiography, which is not available in all centers and looks impractical. On the other hand, the addition of biomarkers to ABCD systems has also been investigated by some authors. In another multicentric prospective study, Copeptin enhanced the prognostic value of $ABCD^2$ and $ABCD^{3\text{-}I}$ and (8). Although it was not associated with recurrent TIA or ischemic events on the whole, it was significantly associated with stroke. Ottaviani *et al.*, showed that carotid ultrasound and brain CT-scan can improve the value of $ABCD^2$ to predict 30 day ischemic stroke after TIA (9).

In our patients, none of the six criteria used in $ABCD^{2\text{-}F}$ was significantly different between those with or without TIA/CVA in 3 month follow-up. Also, neither $ABCD^2$ nor $ABCD^{2\text{-}F}$ was significantly higher in the group of patients who experienced repeat TIA/CVA. Association of AF and stroke has been widely discussed in the literature (12). Therefore, it is rational to consider it a useful predictive factor. However, our results showed that AF neither on its own nor in combination with $ABCD^2$ is capable of predicting repeat TIA/CVA.

After analyzing our findings in the last two studies and reviewing the literature, we should conclude that ABCD scoring and its variants are not capable of predicting low risk group of patients to be discharged earlier or excluded from medical treatment. However, new modifications with the addition of ultrasound, imaging, or laboratory studies might be promising in the future.

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