

# Stroke Risk Is Low after Urgently Treated Transient Ischemic Attack

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*Background:* Over the last decades, the approach to patients with transient ischemic attack (TIA) has shifted from treating only patients considered at high risk of recurrent stroke, to referring all patients with TIA to urgent assessment and immediate initiation of preventive treatment. The data on how this change has influenced the stroke rate after TIA are limited. Thus, the primary aim of this study was to identify the incidence of stroke recurrence after TIA. Second, we wanted to evaluate the ABCD2 score as a predictor of recurrent stroke. *Methods:* Patients discharged with a diagnosis of TIA from the Stroke Unit at Akershus University Hospital between January 1, 2013 and December 31, 2013 were included in the study. Data were obtained from the electronic medical records. Readmission data to capture recurrent strokes were registered until December 31, 2015. *Results:* In total, 261 patients were included. Mean age was 70.7 years. Stroke incidence at 1 month, 1 year, and the end of follow-up was 1.5% (n = 4), 3.4% (n = 9), and 4.2% (n = 11), respectively. Median time from TIA until recurrent stroke was 90 days. The ability of the ABCD2 score to predict recurrent stroke was low. *Conclusions:* Urgent admission of patients with TIA is followed by a very low risk of early and late recurrent stroke. The ABCD2 score did not identify patients at high risk of recurrent stroke. **Key Words:** Ischemic attack—transient—emergency—cerebrovascular diseases—recurrent stroke.

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## Background

Cerebrovascular disease is one of the most frequent causes of death and disability in the Western world.<sup>1</sup> With an aging population, the human and economic impact of the disease is expected to increase. The effectiveness

of acute stroke treatment is modest, as the narrow treatment window for reperfusion therapy limits its usage. However, all patients with stroke can obtain effective secondary prevention, particularly if initiated early after a transient ischemic attack (TIA) or stroke, when the risk of a recurrence is at its highest. Immediate recognition of a TIA, followed by urgent examination and treatment, is therefore a prerequisite to reduce the risk of another stroke.

TIA admission policies have hitherto been influenced by an underestimation of the risk of early stroke recurrence<sup>2,3</sup> and confidence in the ability of risk prediction scores to select high-risk patients. Previous guidelines have therefore recommended urgent treatment only of high-risk patients.<sup>4,5</sup> To identify these patients, several clinical risk prediction scores have been developed, and the ABCD2 score has been the most frequently used.

The policy of urgent treatment only of high-risk patients has been challenged over the last decade because of studies reporting a risk of cardiovascular events after

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TIA of up to 20% per year, with the highest risk within the first few days after the initial event.<sup>6-8</sup> In addition to this, the ability of the ABCD2 score to identify high-risk patients has been questioned.<sup>9</sup> As a result, studies evaluating urgent admission of all patients with TIA, regardless of ABCD2 score, have been performed. Hospital-based studies with fast-track examination of all patients with TIA have revealed a much lower incidence of recurrent cardiovascular events.<sup>10-12</sup> In particular, the Express study from 2007 showed a reduction in the 90-day risk of stroke recurrence from 10% to 2% after establishing a policy of urgent admission of patients with TIA to a stroke clinic.<sup>13</sup> New guidelines therefore tend to support urgent admission of all patients with TIA.

Because most studies evaluating stroke recurrence after TIA were performed when urgent assessment was not mandatory, the aim of this study was to obtain real-life data on the risk of recurrent stroke in a Norwegian TIA population urgently admitted to an acute stroke unit. In addition, we wanted to evaluate the ability of the ABCD2 score to predict risk of recurrent stroke after TIA.

## Methods

The study was conducted at the Stroke Unit, Akershus University Hospital, Norway. The hospital serves a well-defined catchment area of 500,000 people, which is the highest population figure served by 1 stroke unit in Norway. All patients with suspected cerebrovascular disease are admitted to the hospital's stroke unit. The hospital has implemented a process of care for patients with TIA that include immediate hospitalization, examination, and treatment by a stroke physician, standardized investigations with computed tomography (CT) or diffusion-weighted magnetic resonance imaging (MRI), vascular examination with ultrasound or angiography, electrocardiogram and Holter examination, when indicated. The medical records are electronic.

We retrospectively identified all acute admitted patients discharged with a diagnosis of TIA who were hospitalized as emergency patients from January 1, 2013 to December 31, 2013. Patients were identified through the diagnosis code in the medical records using the International Classification of Diseases, Tenth Revision code G45.x. Two experienced neurologists and stroke experts reviewed the medical records. When there was uncertainty regarding the TIA diagnosis, the medical record was re-evaluated before the patient was included into the study. Readmission data were registered until December 31, 2015. Patients with recurrent stroke were identified, and the time from the qualifying TIA to the stroke was recorded in number of days. Recurrent stroke was defined as new onset of symptoms  $\geq 24$  hours after the incident event not caused by other systemic or neurologic causes other than stroke.<sup>2</sup> Data to calculate the ABCD2 score (age, blood pressure, clinical features, diabetes, and duration of

symptoms) were collected from the medical records. Patients suffering from a stroke during hospitalization for initial TIA are routinely treated with thrombolysis. To include these patients in the study, the 2013 register for thrombolysis was also reviewed. Definite TIA was defined, based on World Health Organization criteria, as rapidly developed clinical signs of focal or global disturbance of cerebral function, including amaurosis fugax, lasting less than 24 hours with no apparent nonvascular cause.<sup>14</sup> CT and MRI were performed to record any new or old ischemic lesion or cerebral hemorrhage. Patients with transient cerebral symptoms because of cerebral hemorrhage were not included in the study. Patients with a probable or possible new ischemic lesion on CT or MRI were not excluded if they met the clinical TIA definition. Atrial fibrillation was registered when confirmed by electrocardiogram or reported in the medical history. The Trial of Org 10172 in Acute Stroke Treatment classification was used to determine TIA etiology.<sup>15</sup> Patients with TIA and symptomatic carotid stenosis ( $\geq 70\%$  stenosis) had a carotid endarterectomy as fast as possible during the stay, usually within 4-5 days. Physiological parameters such as blood pressure, heart rate, temperature, and oxygen saturation were registered and corrected according to guidelines for acute stroke treatment. All patients were discharged with secondary prevention in accordance with national guidelines.<sup>5</sup>

The study was approved by the Regional Committee for Ethics in Medical Research (approval number [2017/93]) and by the Data Protection Authorities at Akershus University Hospital.

## Statistical Analyses

The statistical analyses were performed using SPSS Statistics 22 (SPSS Inc., Chicago, IL). Continuous variables are presented as mean and standard deviation. Categorical data are presented as frequencies and percentages. Comparisons between groups were performed with Mann-Whitney *U* for skewed continuous data, or independent sample *t* test for normally distributed continuous variables. Normality of continuous variables was assessed by inspecting the histograms. For the categorical variables we used chi-square test or Fisher's exact test (as appropriate). All significance tests were 2-tailed, and a *P* value of  $<.05$  was considered significant. To determine independent predictors of recurrent stroke, univariate and multivariate logistic regression analyses were performed. Predictive variables explored were age, gender, hypertension, atrial fibrillation, diabetes, and earlier ischemic events.

## Results

In total, 270 patients with the TIA diagnosis were identified. After re-evaluation of the medical records 9 were classified as stroke mimics, leaving 261 patients for the final analyses. Mean age was 70.7 years (range 21-102),

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