

# Factors Related to Decision Delay in Acute Stroke

Kashif Waqar Faiz, MD,\*† Antje Sundseth, MD,\*† Bente Thommessen, MD, PhD,†  
and Ole Morten Rønning, MD, PhD\*†

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*Background:* The time from symptom onset to seeking medical assistance (decision delay) accounts for a proportion of prehospital delay in acute stroke. The aims of this study were to identify factors related to decision delay and calling the emergency medical services (EMS) as the first medical contact. *Methods:* Data were prospectively collected from 350 patients with acute stroke or transient ischemic attack. Data on decision delay, prehospital delay, types of first medical contact, and previous stroke knowledge were recorded. Multivariable logistic regression analyses were conducted to identify factors related to decision delay of 1 hour or less and calling the EMS as the first medical contact. *Results:* The median decision delay was 2.0 hours. Decision delay accounted for 62.3% of prehospital delay (median value). Moderate (National Institutes of Health Stroke Scale [NIHSS] score 8-16; odds ratio [OR] 4.16 [95% confidence interval 1.86-9.30]) or severe symptoms (NIHSS score  $\geq$  17; OR 10.38 [2.70-39.90]) and living together (OR 1.84 [1.02-3.43]) were associated with decision delay of 1 hour or less. Moderate (OR 6.31 [2.79-14.29]) or severe symptoms (OR 8.44 [2.64-26.98]) were associated with calling the EMS as the first medical contact. Previous stroke knowledge did not affect an early decision or EMS use. *Conclusions:* The decision to seek medical assistance in acute stroke accounts for more than half of the prehospital delay. Severity of symptoms and living together are related to an early decision ( $\leq$ 1 hour). Previous stroke knowledge does not affect decision delay or EMS use. **Key Words:** Prehospital delay—stroke—thrombolysis—stroke knowledge—behavior—decision.

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## Introduction

Stroke is one of the most common causes of death and long-term disability.<sup>1,2</sup> The use of intravenous thrombolytic therapy with recombinant tissue plasminogen activator (rt-PA) has been demonstrated to improve clinical outcome in selected patients with ischemic stroke.<sup>3</sup> Despite increased use of intravenous thrombolytic therapy in recent

years,<sup>4,5</sup> only a small percentage of patients receive this treatment. Even with the extension of the time window from 3 hours to the first 4.5 hours after symptom onset, there is strong evidence of better outcome the earlier the treatment is started<sup>6,7</sup> as its efficacy is related to the time from symptom onset to treatment.

Numerous factors could explain the limited use of rt-PA, but the most important is prehospital delay, that is, late presentation at the emergency department (ED) after symptom onset. In a comprehensive review of studies examining delay in acute stroke published since 2000,<sup>8</sup> median prehospital delay was between 3 and 4 hours.

A proportion of the prehospital delay consists of the time interval from symptom onset to seeking medical assistance, often referred to as decision delay or patient delay. Several factors are related to decision delay, including failure to recognize stroke symptoms, not regarding symptoms as serious because of a lack of knowledge, a wait-and-see attitude, a hope that symptoms will resolve, and hesitation to contact emergency medical

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From the \*Institute of Clinical Medicine, University of Oslo, Lørenskog; and †Department of Neurology, Akershus University Hospital, Lørenskog, Norway.

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Address correspondence to Kashif W. Faiz, MD, Department of Neurology, Akershus University Hospital, N-1478 Lørenskog, Norway. E-mail: kashifaiz@gmail.com.

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services (EMS). In addition, the awareness that stroke is a medical emergency varies among health-care professionals.<sup>9</sup>

The lack of awareness regarding stroke symptoms is believed to influence prehospital delay in stroke, but public education campaigns to increase knowledge have not reduced the prehospital delay as expected.<sup>10,11</sup> Less is known about the proportion of the delay accounted for by the hesitation to seek medical assistance as a response to the symptoms.

The primary aims of the present study were to identify the most important factors relating to decision delay and the decision to call the EMS as the first medical contact in patients with acute stroke. In particular, we assessed whether previous stroke knowledge influenced decision delay, prehospital delay, and EMS use.

## Materials and Methods

In this prospective study, we included 350 patients from a total of 440 screened patients with a final diagnosis of acute ischemic stroke (AIS), intracerebral hemorrhage (ICH), or transient ischemic attack (TIA) admitted to the stroke unit of the Department of Neurology, Akershus University hospital, Norway, during a 1-year period. In total, 90 (20.5%) patients were excluded as the time of symptom onset was uncertain. Details of the study settings and design have been published previously.<sup>12</sup> We recorded the time from onset of stroke symptoms to arrival at the ED. If symptoms were first noticed on awakening, we considered the time of awakening as the time of symptom onset. In the case of multiple admissions during the study period, only the first admission was included. Patients with in-hospital strokes were excluded.

Demographic data and the presence of stroke risk factors (previous coronary heart disease and cerebrovascular disease, atrial fibrillation, diabetes mellitus, hypertension, hypercholesterolemia, and smoking) were obtained from medical records and/or interview of the patients and their relatives. Stroke severity was assessed on admission by the use of the National Institutes of Health Stroke Scale (NIHSS).<sup>13</sup>

Decision delay was defined as the time from symptom onset to the point when first contact with medical assistance occurred. Types of medical contacts were categorized as (1) phone call to the EMS, (2) phone call to a primary care physician (PCP), (3) visit to a PCP, and (4) directly arriving at the ED by own means (as described previously<sup>12</sup>). Data regarding the time of the first medical contact were obtained from patients and/or their relatives and the EMS and medical records.

Previous stroke knowledge was assessed by asking the patients if they had received any information about stroke before admission (open-ended question). If they answered in the affirmative to that question, they were asked from which source the information was obtained.

The sources of stroke knowledge were categorized as (1) health-care professionals, (2) family/friends, (3) mass media, and (4) other sources.

### Statistical Analysis

Patient characteristics are presented as mean (SD) or median (interquartile range [IQR]) values, depending on whether the variables were normally distributed.

To analyze factors related to decision delay, patients were dichotomized into an early ( $\leq 1$  hour) and a late ( $> 1$  hour) decision group. In addition, factors related to calling the EMS as the first medical contact were analyzed, and patients were dichotomized into an EMS group and a non-EMS group. Differences between groups were assessed by Mann-Whitney *U* test for continuous variables and Pearson  $\chi^2$  test or Fisher exact test (as appropriate) for categorical variables.

Explanatory variables identified from the univariate analyses with a significance level less than .20 were entered into the multivariable logistic regression analyses, together with age and gender. Age was dichotomized to higher or lower than the mean age ( $< 70$  years or  $\geq 70$  years) in the multivariable analyses, and stroke symptoms were categorized as mild (NIHSS score 0-7), moderate (NIHSS score 8-16), or severe (NIHSS score  $\geq 17$ ).

Data were analyzed with SPSS version 18 (SPSS Inc., Chicago, IL).

Oral, informed consent was obtained. The study was approved by the Regional Committee for Ethics in Medical Research.

## Results

Of the 350 patients included in the analysis, 225 (64.3%) had a diagnosis of AIS, 30 (8.6%) had a diagnosis of ICH, and 95 (27.1%) had a diagnosis of TIA. The mean age was 69.9 years (SD 12.9), and 42.0% of the patients were female. Characteristics of the study population are shown in Table 1.

A total of 100 patients (28.6%) woke up with symptoms. A history of cerebrovascular disease was reported in 33.1% of the patients. The median NIHSS score was 2 (IQR 0-5). In the subgroup of patients with AIS and ICH, median NIHSS score was 3 (IQR 1-7). Of the 225 patients with AIS, 16 (7.1%) were treated with intravenous thrombolytic therapy with rt-PA.

The most common way to seek medical assistance was to call the EMS (159 patients; 45.4%). Equal number of patients (93; 26.6%) called or visited a PCP as the first medical contact, whereas 5 patients (1.4%) came directly to the ED by own means.

Overall, 227 patients (64.9%) arrived at the hospital by ambulance.

### Delay

The median decision delay was 2.0 hours (120 minutes [IQR 34-545]), and the total prehospital delay time was

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