



Original article

Causes of prehospital delay in stroke patients in an urban aging society



Tomoko Yanagida, LPN, Shigeru Fujimoto, MD, PhD, Takuya Inoue, MD, PhD,
Satoshi Suzuki, MD, PhD*

Stroke Center, Steel Memorial Yawata Hospital, Yahatahigashiku, Kitakyushu, Japan

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ABSTRACT

Purpose: Prehospital delay is the major cause of treatment delay in cerebrovascular disease (CVD). An increasing number of elderly people reside alone or with their spouse with limited support from younger generations. The aim of this study was to identify the factors that may affect prehospital delay in our aging society, and examine the role of lifestyle on prehospital delay.

Methods: We retrospectively analyzed data for 469 consecutive patients who were hospitalized within 2 weeks of the onset of CVD between May 2007 and March 2009. Prehospital delay was defined as the time from the onset to arrival at our hospital.

Results: There was no significant difference in prehospital delay between 91 patients who lived alone and 378 patients who lived with other people. We also analyzed whether lifestyle factors were causes of prehospital delay in the 378 patients who lived with other people. Living with a spouse was associated with a significant prehospital delay compared with patients living in a nursing home or those living with two or more generations. There were significant differences in prehospital delay between those living alone or with other people, and between those living with a spouse or with other people. Living with a spouse and living alone were associated with the prehospital delay. Knowledge of recombinant tissue plasminogen activator and the use of emergency medical systems were associated with a shorter prehospital delay, whereas visiting local doctors and the patient's recognition of symptoms increased the prehospital delay. The onset of CVD after office hours, National Institute of Health Stroke Scale score ≤ 4 at the initial visit, and prior stroke did not affect the prehospital delay.

Conclusion: Health care promotion should target patients living alone as well as patients living with a spouse, especially in aging societies.

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1. Introduction

Stroke is the leading cause of disability and the fourth most common cause of death in Japan. To improve the outcomes of acute stroke and transient ischemic attack (TIA) it is important to minimize the delay in starting treatments, including thrombolytic therapy for ischemic stroke¹ or blood pressure control for hemorrhagic stroke.² It has also been reported that hyperglycemia causes a deterioration of clinical symptoms in stroke patients and correction of the patient's nutritional condition should be started as early as possible to prevent severe complications, such as

pneumonia.^{3,4} Maintenance of the patient's general condition is essential to achieve favorable outcomes, especially in elderly patients. Admittance to an emergency room as soon as possible may allow the use of therapeutic agents, such as recombinant tissue plasminogen activator (rt-PA) or edaravone, a free radical scavenger that is approved in Japan for administration within 24 hours after the onset of stroke.⁵ Furthermore, oral administration of 160–300 mg aspirin within 48 hours after the onset of cerebral infarction was associated with improved outcomes.⁶

Prehospital delay, the time from the onset of stroke to the hospital visit, is the greatest contributor to the delay from the onset of acute stroke to starting treatment.⁷ Consequently, many studies have sought to identify the factors responsible for prehospital delay following acute stroke.^{7–11} Many factors are reported to be associated with prehospital delay, including economic status, race, use of emergency medical systems (EMS), knowledge of rt-PA, severity

* Corresponding author. Stroke Center, Steel Memorial Yawata Hospital, 1-1-1 Harunomachi, Yahatahigashiku, Kitakyushu 805-8508, Japan.

E-mail addresses: sasuzuki-nsu@umin.ac.jp, suzukis710@gmail.com (S. Suzuki).

of stroke, and hemorrhagic stroke.^{7–11} However, the role of the patient's lifestyle on prehospital delay has not been examined.

Aging is progressing rapidly in Japan, and 23.7% of the population is aged ≥ 65 years. The city of Kitakyushu has the highest rate of aging (25.5%) among 20 Government-ordinance-designated cities and the Tokyo metropolitan area. Lifestyle has dramatically changed in recent decades, partly because of the aging of society. An increasing number of elderly people reside alone or with their spouse with limited support from younger generations. The aim of this study was to identify the factors that may affect prehospital delay in our aging society, and examine the role of lifestyle factors on prehospital delay.

2. Methods

2.1. Study design

A database of patients with acute cerebrovascular disease (CVD) was established prospectively at the Stroke Center of Steel Memorial Yawata Hospital, Kitakyushu, Japan. Patients were included in this database if they visited our outpatient department or emergency room within 2 weeks of the onset of stroke or TIA and were then admitted to our hospital because of CVD. Patients who developed CVD during admission as a result of diseases other than stroke were excluded from the database. Prehospital delay was defined as the time from the onset of stroke or TIA to arrival at hospital. A total of 469 consecutive patients were registered in this database between May 2007 and March 2009, 373 (79.5%) of whom were ≥ 65 years. Steel Memorial Yawata Hospital, which is affiliated to Kyushu University Hospital, is a core hospital in the western part of Kitakyushu, a city with a population of 0.97 million. Steel Memorial Yawata Hospital is a training hospital accredited by The Japan Stroke Society and The Japan Neurosurgical Society.

Neurological examinations were performed and recorded at the outpatient department or in the emergency room. Diagnosis of CVD and assessment of National Institute of Health Stroke Scale (NIHSS) scores were confirmed by board-certified stroke specialists or a board-certified neurosurgeon. Imaging, including computed tomography angiography, magnetic resonance imaging, and digital subtraction angiography, is available 24 hours/day and on 365 days/year at our hospital.

Patients and/or bystanders were interviewed to determine whether they knew that intravenous administration of rt-PA as soon as possible after the onset of ischemic stroke can improve the patient's outcome.

The EMS are provided by the fire department of each regional government and are not charged to the patient in Japan. People can directly contact the fire department by calling 119. If the request is deemed appropriate, an ambulance is dispatched immediately.

There are several ways for stroke patients to reach medical care. If they are outpatients of our hospital, they are usually transported to our hospital by an EMS or other transport methods. More than 150 doctors in private clinics have registered with our hospital and these clinics serve as outpatient departments for our hospital. These doctors usually send stroke patients to our hospital. If the stroke patient requests an EMS without giving a preferred hospital, the EMS staff will attempt to reach the nearest emergency room with facilities that are thought to be needed for the individual patient. EMS staff are trained to recognize stroke symptoms and they usually send the patients to a hospital with the required facilities.

Prehospital delay and NIHSS were compared in univariate analyses between patients classified by age (≥ 75 years), sex, living alone, prehospital living conditions, prestroke knowledge of rt-PA, use of EMS, prestroke modified Rankin scale (mRS) score ≤ 2 , NIHSS

score ≤ 4 at the initial outpatient/emergency room visit, onset of stroke after office hours, those who recognized the symptoms, visiting a local doctor prior to admission to our hospital, prior stroke, and subtype of stroke. After office hours was defined as 5:00 PM to 9:00 AM the following morning, and holidays.

Multivariate analyses were carried out to identify which factors were significantly associated with prehospital delay. Visiting the hospital within 4 hours was defined as an early hospital visit because the optimal timing of intravenous rt-PA administration is up to 4.5 hours after the onset of ischemic stroke, and 30 minutes is sufficient for consultation and rt-PA injection at our hospital. We also used a cutoff value of ≤ 12 hours for timely visitation because the median prehospital delay was 12.7 hours. Factors that may affect prehospital delay were also analyzed, including age ≥ 75 years, sex, knowledge of rt-PA, use of EMS, prestroke mRS ≤ 2 , NIHSS ≤ 4 , hemorrhagic stroke, onset of stroke after office hours, symptoms recognized by the patients themselves, visiting a local doctor prior to admission to our hospital, prior stroke, and pre-stroke living conditions. Prestroke living conditions were classified as living alone, living with a spouse, and living with other people.

The Institutional Review Board at our hospital reviewed and approved this retrospective study.

2.2. Statistical analysis

Descriptive statistics are presented as the median and interquartile range (IQR). Analyses were performed using JMP 10 (SAS Institute Inc., Cary, NC, USA) and MedCalc version 12.3.0.0 (MedCalc Software bvba, Ostend, Belgium). The Chi-square test and Wilcoxon's nonparametric analyses were used to test for differences in prehospital delay and NIHSS within each factor. Multivariate logistic regression was used to identify the factors that were independently associated with visiting the hospital within 4 hours or 12 hours of the onset of stroke. The Chi-square test was used to compare the frequencies of each category of lifestyle factors. Values of $p < 0.05$ were considered statistically significant.

3. Results

3.1. Basic characteristics of patients

In total, 469 patients were enrolled in the present study. The median prehospital delay was 12.7 hours (IQR, 2.1–46.6 hours). The median NIHSS at the first neurological examination was 4 (IQR, 1–8). The median age of patients was 75 years (IQR, 67–81 years). The median prestroke mRS was 0 (IQR, 0–1). Table 1 shows the baseline characteristics of patients, prehospital delay, and NIHSS at initial visit. Overall, 236 patients (50.3%) were aged ≥ 75 years, 247 patients (52.7%) were men, 91 patients (19.4%) were living alone, 36 patients (7.7%) had knowledge of rt-PA, 251 patients (53.5%) had used an EMS, 390 patients (83.2%) showed independence in their daily activities (mRS ≤ 2), 310 patients (66.1%) experienced onset of stroke after office hours, 123 patients (26.2%) visited a local doctor prior to visiting our hospital, and 154 patients (32.8%) had prior stroke. NIHSS score was ≤ 4 in 255 patients (54.4%). In terms of living conditions, 91 patients (19.4%) lived alone, 160 patients (34.1%) lived with their spouse, 175 patients (37.3%) lived with two or more generations, 32 patients (6.8%) lived in a nursing home, and 11 patients (2.3%) had other lifestyles. Overall, 288 patients (61.4%) recognized their CVD-related symptoms. Of the remaining patients, the symptoms were recognized by a spouse for 46 patients (9.8%), by other family members or relatives for 55 patients (11.7%), and by other people for 80 patients (17.1%). Stroke subtypes were ischemic stroke in 342 patients (72.9%), intracerebral hemorrhage (ICH) in 74 patients (15.8%), subarachnoid hemorrhage (SAH) in 23 patients

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