Improving Call-to-Door Time Using School-Based Intervention by Emergency Medical Technicians: The Akashi Project

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Background: Identification of stroke signs by emergency medical technicians (EMTs) is important for initiating the "stroke chain of survival." The aim of the present study was to clarify the effect of EMT-led lessons on stroke awareness for school-children in the Akashi project on the transportation time to arrive at the hospital. *Methods:* Stroke lessons were given by EMTs to 887 elementary school children in elementary schools between September 2014 and October 2015. Data on transportation times from prehospital records and final diagnoses at discharge were collected from both pre- (period 1; January-June 2014) and posteducation (period 2; January-June 2016) periods. Transportation time or onset-to-door time was divided into two parts: the onset-to-call time and the call-to-door time. *Results:* One hundred forty-four patients in period 1 and 143 in period 2 were transported with potential strokes identified by EMTs. Among these, 119 (83%) in period 1 and 114 (80%) in period 2 had final diagnosis of stroke or transient ischemic attack. The mean age in period 2 was older than that in period 1 (75 years old versus 72 years old); however, there were no significant differences in gender and consciousness level between the 2 periods. The median call-to-door time of 28 minutes for period-2 patients was significantly shorter than that for period-1 patients (32 minutes, $P = .0057$). There were no differences in median onset-to-door times and onset-to-call times between the 2 periods. *Conclusions:* School-based education about stroke conducted by EMTs may be a promising strategy to cut the prehospital delay and to widely spread stroke awareness via school children and EMTs. **Key Words:** School children—education—stroke awareness—firefighting headquarter.

Introduction

Emergency medical technicians (EMTs) play a critical role in initiating the "stroke chain of survival," starting from the recognition of stroke signs, to dispatching to specialized stroke centers, to attaining early recanalization therapies. Training programs for EMTs decreased the prehospital on-scene time of thrombolysis candidates by 10%.[1] Accurate diagnoses of potential strokes by EMTs also shortened the arrival times to stroke centers.[2,3] In contrast, patient-dependent delays dominated prehospital bottleneck problems[4,5]; thus, we believe that public awareness of stroke signs is indispensable for cutting the prehospital delay. We and others demonstrated that school-based education pertaining to stroke was effective not only for the children but also,

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indirectly, for their families through communication among family members.[6-8] We also showed that stroke education by EMTs in the Akashi project was effective in increasing stroke awareness in elementary school children and their parents.[9] We think that the school-based education by EMTs may improve the recognition of stroke signs by EMTs and facilitate early arrival at stroke units. The aim of the present study was to examine the effect of stroke education of school children by EMTs in the Akashi project on the stroke onset-to-door time (ODT), the time from the awareness of stroke symptoms to the arrival at the hospital door.

Methods

The Akashi project was approved by our institutional review board. No informed consent was required because of acquired departmental approval. The study setting was as follows: Ohnishi Neurological Center, the only comprehensive stroke center in Akashi city, an urban area of Hyogo Prefecture, manages all neurologic emergencies 24 hours a day, covering approximately 290,000 residents within an area of 49.42 km^2. The proportion of the under 15-year-old population is 13.5%, and that of the 65 or over year-old population is 25.3% in Akashi city.

In the Akashi project, EMTs of the Akashi Fire Department ambulances provided lessons on stroke to children (9-10 years old) at 11 public elementary schools using our educational materials comprising the FAST mnemonic (F, face numbness or weakness; A, arm numbness or weakness; S, speech slurred or difficulty speaking or understanding; T, time to call ambulance)[10] between September 2014 and October 2015 as described previously.[9] In brief, 50 of a total of 70 EMTs, who received a lesson on stroke by a specialized stroke neurologist, created a stroke lesson program and instructed a total of 887 of 2668 9-10-year-old children in Akashi city (33.2%).

EMTs identified patients with possible acute strokes when they recognized at least 1 of the following 6 symptoms: consciousness disturbance, facial drooping, arm numbness or weakness, speech slurred or difficulty speaking or understanding, dizziness, and severe headache.

Demographics data, including age, gender, and consciousness level based on the Japan coma scale,[11] of consecutive patients with stroke were analyzed. ODT data of patients with stroke, who were transported to Ohnishi Neurological Center, were collected by reviewing prehospital medical records of EMTs over periods of 6 months before intervention (period 1; January-June 2014) and 6 months after intervention (period 2; January-June 2016). The onset time was defined as the time of symptom onset or the time when the patient last appeared to be healthy. Cases with neither of these 2 pieces of information were excluded from the analyses concerning onset time.

We divided the ODT into 2 parts: the onset-to-call time (OCT), the time from the recognition of stroke symptoms to the calling of an ambulance, and the call-to-door time (CDT), the time from the calling of an ambulance to arrival at the stroke center. The hospital administrative database for the 2 periods was queried for identifying the final diagnoses at discharge for all patients with stroke carried to the hospital by EMTs.

Statistical analyses were performed using JMP 8 software (SAS Institute Inc., Cary, NC). The statistical significances of intergroup differences between period 1 and period 2 were assessed by the Pearson chi-square, unpaired t test, and Mann–Whitney U test, as appropriate. Ages are given as mean and standard deviation (±SD). All other continuous variables are given as median and interquartile range (IQR). P values < .05 indicated statistically significant differences.

Results

A total of 6392 patients were transported by Akashi Fire Department ambulances in period 1 and 5957 in period 2. Of these, 225 patients in period 1 and 206 in period 2 were suspected of having acute strokes by the EMTs. Six hundred eighty patients in period 1 and 784 in period 2 were transported to Ohnishi Neurological Center (Fig 1). Of these, 111 patients in period 1 and 125 patients in period 2 were excluded because prehospital records and the final diagnoses at discharge could not be collected. Complete prehospital medical records were collected by EMTs for 569 patients (84%) in period 1 and 659 (84%) patients in period 2. Among these, 144 patients in period 1 and 143 in period 2 were considered by the EMTs to potentially have acute strokes. Among these, 119 patients (77 ischemic, 36 hemorrhagic, 6 transient ischemic attack [TIA]) in period 1 (83%) and 114 (69 ischemic, 37 hemorrhagic, 8 TIA) in period 2 (80%) received final diagnosis of acute stroke or TIA. In patients who were not identified as potentially having acute strokes by EMTs, 417 in period 1 and 501 in period 2 did not have a final diagnosis of stroke or TIA. Therefore, identification by EMTs agreed with the final diagnosis of stroke or TIA or not in 536 of 569 patients in period 1 (94.2%) and 615 of 659 patients in period 2 (93.3%). The mean age in period 2 was older than that in period 1 (75 years old versus 72 years old); however, there were no significant differences in gender and consciousness level between the 2 periods. Forty-two patients in period 1 and 40 in period 2, who did not have information on onset time, were excluded from the analyses of the number of patients with ODT within 4.5 hours, median ODT, and OCT. Median CDT (IQR) in period 2 (28 [18-28] minutes) was significantly shorter than that in period 1 (32 [27-38] minutes; $P = .0057$). There were no significant differences in the median ODTs and OCTs between the 2 periods (Table 1).