Effects of Stroke Education Using an Animated Cartoon and a Manga on Elementary School Children

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Background: Stroke education for the youth is expected to reduce prehospital delay by informing the bystander of appropriate action to take and providing knowledge to prevent onset of stroke in future. Previously, we developed effective teaching materials consisting of an animated cartoon and a Manga for junior high school students. The aim of this study was to evaluate the feasibility and effectiveness of our educational materials for stroke education taught by schoolteachers to elementary school children. *Methods:* Using our teaching materials, a 30-minute lesson was given by trained general schoolteachers. Questionnaires on stroke knowledge (symptoms and risk factors) and action to take on identification of suspected stroke symptoms were filled out by school children before, immediately after, and at 3 months after completion of the lesson. *Results:* A total of 219 children (aged 10 or 11 years) received the stroke lesson. Stroke knowledge significantly increased immediately after the lesson compared with before (symptoms, $P < .001$; risk factors, $P < .001$); however, correct answer rates decreased at 3 months immediately after completion of the lesson (symptoms, $P = .002$; risk factors, $P = .045$). The proportion of the number of children calling emergency medical service on identifying stroke symptoms was higher immediately after the lesson than baseline ($P = .007$) but returned to the baseline at 3 months after the lesson. *Conclusions:* Stroke lesson by schoolteachers using our teaching materials consisting of an animated cartoon and a Manga that was previously used for junior high school students was feasible for elementary school children. However, revision of the materials is required for better retention of stroke knowledge for children. **Key Words:** Stroke education—elementary school children—Manga—animated cartoon.
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Time is critical in acute stroke management because acute thrombolytic therapies should be performed within 4.5 hours of symptom onset.[1,2] In these settings, the

symptom onset to hospital arrival time (onset-to-door time) is a key factor for increasing the number of patients with acute stroke who can undergo reperfusion therapy because only one fourth of the patients with acute ischemic stroke arrive at the hospital within 3.5 hours after the onset.[3]

Stroke education is expected to reduce the onset-to-door time by increasing the knowledge of warning signs for stroke. Moreover, stroke education for the youth is anticipated to contribute to stroke prevention. Campaigns using mass media[4-6] aimed at the population at high risk of stroke,[7] have improved the knowledge of warning signs and risk factors of stroke, and have increased the number of emergency department visits[6]

or corresponding frequencies of using emergency medical service (EMS)[8] for patients suspected with acute stroke. However, these studies were intended for adults, and there are a few studies targeted at younger individuals. Moreover, the optimum means of how to educate adolescents on stroke knowledge is not completely clear. We showed that stroke education performed by a stroke neurologist using the "FAST" mnemonic, derived from the Cincinnati Prehospital Stroke Scale (F = facial drooping, A = arm numbness or weakness, S = slurred speech or difficulty in speaking or understanding, T = time),[9] improved stroke knowledge for junior high school students and their parents.[10] We also confirmed that a schoolteacher could deliver the FAST message lesson to junior high school students with a similar outcome as a stroke neurologist using our stroke education system.[11] For wide dissemination of stroke knowledge, we developed effective teaching materials, such as an animated cartoon and a Manga for junior high school students.[12] In the present study, we aimed to determine the feasibility and utility of our stroke education program using our teaching materials delivered by a schoolteacher for elementary school children.

Methods

Study Setting and Population

Suita City is located in the urban area of Osaka prefecture in Japan and has around 350,000 residents. Almost all the residents are Asian. The research was in partnership with the Suita City Board of Education (SCBE) and included all the public elementary schools (20,000 pupils) and junior high schools (9000 students) in Suita City. The present study was a preliminary examination for investigating the utility of the stroke education program for fifth-grade children in 2 public elementary schools selected at random. The SCBE approved this study, and the study was exempted from the institutional review board approval based on our domestic guidelines because only anonymous and untraceable data sets were used.

Educational Program

We previously produced an animated cartoon and a Manga for junior high school students that provided instruction on the signs and symptoms of stroke, its risk factors, and increased awareness to immediately contact the EMS on identification of signs and symptoms of stroke.[12] Using these materials, a 30-minute tutorial was given by general schoolteachers for elementary school children. We developed the entire content of the lesson in cooperation with SCBE. The schoolteachers delivered the lesson within 2 weeks after receiving instructions from a stroke neurologist (T.A.) on educating the children on stroke knowledge. The lesson consisted of 2 parts: a didactic session on stroke knowledge including risk fac-

tors, signs and symptoms, and treatments, followed by a review session using our animated cartoon and a Manga. Educational items consisting of a magnet poster printed with the FAST message were distributed to all the students after the lesson. Schoolteachers asked the children to place the magnet poster on the kitchen refrigerator. The quality of the lesson was checked by 2 neurologists (Y.S. and F.M.) by reviewing a video recording of the class.

Assessment of Education Program

Multiple-choice and closed-type questionnaires on stroke knowledge (including a total of 6 correct answers from 12 items for the signs and symptoms of stroke and 7 correct answers from 14 items for risk factors) were filled out by school children before, immediately after, and 3 months after the lesson (Table 1). The children scored 1 point if they chose a correct answer or did not choose an incorrect answer. Therefore, the scores of questionnaires on signs and risk factors of stroke ranged from 0 to 12 and 0 to 14, respectively. How to act on recognition of suspected signs or symptoms of stroke was asked in single-choice and closed-type manner as described in Table 1.

Statistical Analyses

All data were collected without personal identifiers. Data are presented as mean ± standard deviation or frequencies (%). A general linear model repeated-measures analysis of variance was used to compare the composite score over time from baseline to 3 months after the lesson. Post hoc analyses using Bonferroni correction for multiple comparisons were performed to interpret the significant effects. The proportion of students selecting "calling EMS" on identification of the signs or symptoms of stroke was also assessed with chi-square test. All statistical analyses were performed using PASW for Windows version 17.0 software (SPSS, Inc., Chicago, IL). Results were considered significant at P less than .05.

Results

In February 2012, 249 school children of 7 classes from 2 public elementary schools received the stroke lesson. Of these, 30 students of 1 class were excluded from the analyses because the last assessment test at 3 months was not conducted because of concern about 1 student who lost his or her father because of stroke 2 weeks before the test.

Figure 1 shows the composite score of stroke symptoms (left panel, maximum score of 12) and risk factors (right panel, maximum score of 14) before, immediately after, and 3 months after the lesson. The mean composite score changed significantly over 3 months after the stroke lesson (stroke symptoms, $P < .001$; risk factors, $P < .001$). On the post hoc analysis, both the scores