Evaluating the Effect of Novel Ways of Teaching Symptoms and Treatment of Acute Stroke on Thrombolytic Therapy

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Abstract: *Background and Objective*: Given that a small percentage of people with ischemic stroke are treated with recombinant tissue plasminogen activator (rtPA) in Iran, it is necessary to use appropriate educational methods that, in addition to raising the awareness of patients about stroke, lead them to refer health centres early. The purpose of this study was to evaluate the effect of new methods of training warning signs of acute stroke on thrombolytic therapy.

Method: This was a community-based empirical intervention study in Ahvaz, Iran, in 2018. Initially, educational content was provided, including warning signs of a stroke, its risk factors, and the need for prompt referral to a well-equipped treatment centre for thrombolytic therapy. This content was used to prepare brochures, pamphlets, posters, and training sessions for health care personnel. Before starting, immediately, and three months after the training course, a questionnaire was used to assess staff knowledge of stroke symptoms and the need for rapid patient referral for FAST-based thrombolytic therapy. Also, the timely referral of patients with suspected stroke to hospital, as well as their thrombolytic therapy during the six months after the intervention and the similar six months in the previous year were compared.

Results: The level of knowledge was significantly increased at the end of training ($P<0.0001$). Although this average was reduced three months after completion of training, the difference was not significant ($P = 0.42$). Based on the results, the number of stroke patients referred to hospital in golden time (less than 4.5 hours) from the beginning of training to 6 months after the end of the course ($n = 54$) was increased compared to the same period last year ($n=38$). The number of thrombolytic patients from the beginning of the training course to 6 months after the course ($n=38$) increased compared to the same period of the previous year ($n=21$).

Conclusion: Based on the results, the implementation of educational programs was reported to be effective in raising public awareness of stroke symptoms and the need for prompt hospital referral for appropriate and timely treatment.

Keywords: Ischemic stroke, Thrombolytic therapy, Educational programs.

INTRODUCTION

Stroke is the rapid progression of clinical signs of focal or diffuse cerebral dysfunction with symptoms that last 24 hours or more or lead to patient death if there is no apparent cause other than the vascular origin [1]. Stroke is the leading cause of disability [4-5], and its prevalence varies across geographic regions and social classes [5-8]. Many people with stroke suffer from functional disorders, disability, and loss of quality of life and incur high costs [9-11]. Age, high blood pressure, dyslipidemia, diabetes mellitus, asymptomatic carotid artery stenosis, and oral anticoagulant medications are major risk factors for stroke [13-15]. The results of a cohort study showed that the incidence of stroke in Iran is higher than in developed countries and occurs almost a decade earlier [12]. Early intravenous administration of recombinant tissue plasminogen activator (rtPA) in ischemic stroke has been shown to reduce mortality, improve neurologic outcomes, and limit lesion growth [16, 17]. The sooner treatment begins, the more effective it is and the better the prognosis of the patient [18]. rtPA is a costly treatment for acute ischemic stroke in developed countries [19]. Despite the high rate of stroke in Iran, factors such as side effects, high cost, inappropriate drug distribution, and inadequate hospital service structure have prevented early initiation of rtPA treatment in Iran [12, 20]. Although strokes often occur suddenly, awareness of the causes, risk factors, and warning signs can prevent the occurrence of a stroke or, if it happens, can lead to quicker referrals to appropriate treatment centres. Therefore, educating the public about the causes, risk factors, and warning signs of stroke can reduce the incidence of stroke, increase the success rate of treatment, and reduce health care costs at the level of individuals and families, as well as at the community and country level. These educations can include the use of mass media, especially radio, television and newspapers, the printing of posters and pamphlets, the establishment of training classes in health centres, and face-to-face training [21-25]. Although some studies have shown that public awareness of the warning signs and risk factors of stroke is favourable in Iran [26, 27], however, in some other studies, the level of awareness has not been reported as desirable [30]. Therefore, it is necessary to use appropriate educational methods that can increase the knowledge and awareness of stroke

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patients and lead them to refer to health centres early for faster treatment [31-33]. Given that a small percentage of people with ischemic stroke are treated with rtPA in Iran [34], the present study was designed to investigate the impact of novel methods of teaching the warning signs of acute stroke on thrombolytic therapy.

MATERIALS AND METHODS

This study was approved by the Ethics Committee of Jundishapur University of Ahvaz (Code of Ethics: IR.AJUMS.REC.1397.565) as a community-based empirical intervention study in 2018. Initially, educational content was provided, including warning signs of a stroke, its risk factors, and the need for prompt referral to a well-equipped treatment centre for thrombolytic therapy. This content was used to prepare brochures, pamphlets, posters, and training sessions for health care personnel. After coordination with health centres where patients could be referred to the Golestan Hospital of Ahvaz in the golden time of thrombolytic therapy (less than 4.5 hours), the centre was visited, and a training course was held for the personnel of the centres. Before starting education, using a pre-test questionnaire including 18 questions, awareness of urban and rural health care personnel about the warning signs of a stroke, its risk factors, and the need for prompt referral to a well-equipped thrombolytic therapy centre based on FAST was examined. Then, the personnel was informed about the warning signs of a stroke, its risk factors, and how to deal with the patient and their referral. The effectiveness of this training class was assessed immediately after the course using a post-test questionnaire. The training was conducted for three months. In order to evaluate the effect of education and its sustainability on individuals' minds, the subjects were re-evaluated and interviewed three months after the training. Posters were also posted on the wall of health centres, and their staffs were asked to share brochures and pamphlets with attendees while holding training sessions.

At the same time, training was conducted through the media such as television, radio, social networks, and mass media such as newspapers, as well as training for related occupations such as holding retraining classes for general practitioners. Using a checklist, the timely referral rate of suspected stroke patients to the hospital in the golden time (less than 4.5 hours) from the beginning of the course to 6 months after the course was compared with the same rate in the similar six months period of the previous year. Also, the number of patients undergoing thrombolytic stroke from the beginning of training to 6 months later was compared with that of the same period of the previous year. Finally, all data were collected, and the impact of training programs on changes in timely referral and thrombolytic therapy was assessed. Quantitative data were reported as mean, and standard deviation and qualitative data were reported as frequency and percentage.

RESULTS

The training measures performed over a period of 3 months are given in Table **1**.

Based on the mean number of correctly answered questions (out of 18 questions), the level of knowledge of the subjects at the end of the training was significantly increased ($P < 0.0001$). Although this mean was reduced three months after completion of training, the difference was not significant ($P = 0.42$) and the effectiveness of the training was assessed as acceptable (Table **2**).

Based on the results, the number of stroke patients referred to hospital in golden time (less than 4.5 hours) from the beginning of training to 6 months after the end

Table 1: Training Measures Performed Over 3 Months

Place	Training measures
Urban and rural health care centres	Training of health care staff (11 sessions)
Golestan Hospital	Workshop for nursing and triage staff (5 sessions)
Television, radio and mass media	Frequent presence in popular medical programs on television and radio
Social networks	The animated associated with FAST
Public and crowded places such as airports	Installation educational posters based on FAST
University and several health care centres	Stroke celebration with media coverage of World Stroke Day
Ahvaz University of Medical Sciences	Workshop for general practitioners on the topic of acute stroke

Table 2: Knowledge of Urban and Rural Health Care Personnel Based on FAST

Evaluation steps	Mean numbers of correct answers
Before starting the course	6.42±2.77
After completing the course	16.64±4.52
3 months after completing the course	14.24±3.19

Table 3: Comparison of the Number of Patients with Acute Stroke Treated with Thrombolytic Stroke before and after Training

Patients	Evaluation steps	Numbers of patients
With acute stroke	From the beginning of the course until 6 months later	54
	6 months similar to last year	37
Treated with thrombolytic	From the beginning of the course until 6 months later	38
	6 months similar to last year	21

of the course (n = 54) was increased compared to the same period last year (n = 38). Of the patients with stroke referred to the hospital in the golden time, due to the contra-indication for the administration of tPA, some patients did not receive the drug. Comparing the number of people receiving thrombolytic therapy at the start of training up to 6 months after the course (n = 38) with the same period of the previous year (n = 21), it was observed that more patients had received thrombolytic therapy after training. This may also be related to the higher number of people referred to in the golden time following educational measures (Table **3**).

At the beginning of the course up to 6 months thereafter, patients (or their companions) with stroke referred to the hospital in the golden time, with and without indications of thrombolytic therapy, were asked about the extent and how they were aware of the symptoms of stroke and thrombolytic therapy. Among those who were previously familiar with the symptoms of stroke, the number of people who became aware of these symptoms through health centres and relatives, and those who were aware of television programs, were greater. Fewer people reported using the internet and cyberspace for information and awareness of related training programs. In addition, a high percentage of people (35.18%) had no previous knowledge of the symptoms of a stroke (Table **4**).

DISCUSSION

In this study, educational activities performed during three months consisted of training of health care personnel, holding training workshop for nursing and triage staff, continuous presence in medical television programs, making FAST-related animations, posting FAST-based educational brochures, holding Stroke Celebration with media coverage on the occasion of World Stroke Day, and holding retraining workshops for general practitioners on the topic of acute stroke. Immediately after completing the course, the level of awareness of the subjects based on the mean number of correctly answered questions (out of 18 questions) increased significantly ($P < 0.001$).

Three months after the training course, although the mean number of correctly answered questions decreased, there was no significant difference (P =

Table 4: The Extent and the way Patients or their Companions become Aware of Stroke Symptoms and Thrombolytic Therapy

How to know patients with stroke symptoms	Numbers of patients (n=54)
Television and radio programs	12 (22.22%)
Internet and social network	9 (16.67%)
Health care centres and their staffs	14 (25.93%)
Had no prior knowledge	19 (35.18%)

0.42), and the effectiveness of the training was assessed as acceptable. However, due to the decrease in the level of knowledge of staff, it seems necessary to repeat the training courses held in retraining workshops.

In the study of Beker *et al*. (2001), the effect of community-based education on awareness of stroke in Washington was investigated. The results of their research showed increased awareness of the symptoms of stroke following educational campaigns using television and newspaper programs. Finally, after evaluations, it was stated that the public's knowledge of stroke is weak and should be enhanced by educational programs [36].

In the study of Hodgson *et al*. (2007) in Canada, the impact of television educational programs on the number of stroke visits in a 3-year emergency department was investigated. The results of their study showed a general increase in awareness of the warning signs of stroke during the implementation of educational programs. Still, after the discontinuation of programs, the level of awareness was again reduced; therefore, suggested the continuation of educational programs for a longer-lasting effect on the community [38].

In a study by Fogle *et al*. (2010), a 20-week general campaign in a store showed a significant increase in awareness of stroke symptoms in both men and women. They recommended holding such public education campaigns to raise public awareness of the warning signs of stroke and the need for emergency contact [39].

The number of stroke patients referred to the hospital in the golden time (less than 4.5 hours), during the start of training course up to 6 months after it, was increased compared to the same period last year. There were also more patients undergoing thrombolytic therapy after training, which may also be related to the greater number of patients referred to a hospital in the golden time after training.

Wolters *et al*. (2015) examined the effect of public education campaigns through FAST-based television on the delayed treatment of stroke patients in the United Kingdom. The mean number of people with stroke symptoms who arrived in the hospital in less than 3 hours, as well as the use of emergency services, increased significantly after the start of the campaign and reported results were independent of age, sex, race, education level, social class, previous history of stroke, and stroke severity [42]. In the study Advani *et al*. (2016) in Norway, the impact of one month of mass media training programs on the number of admissions of suspected stroke patients in the emergency department was investigated. In this study, mass media training programs increased the number of patients with suspected stroke referred to the emergency department and significantly increased thrombolytic therapy [44]. In a review study, Lecouturier *et al*. (2010) examined the impact of educational interventions through the media on improving the diagnosis of stroke symptoms and faster treatment. In this study, a community-based campaign increased awareness of the symptoms of a stroke. In another campaign conducted in the community of specialists, there was no increase in hospital admission in the first two hours, but an increase in thrombolysis occurred [40]. In the study of Trobbiani *et al*. (2012), awareness and practice of individuals after general education campaigns on symptoms of stroke in Australia, England, and Canada were investigated. The results of their study showed that the awareness of the symptoms of stroke and how it can be dealt with through emergency contact could be increased by public campaigns. However, such campaigns need to focus on key and functional points for behaviour change [41].

In a study by Nishijima *et al*. (2016) in Japan, the implementation of television educational programs reduced the time from symptom onset to hospitalization in people with symptoms of stroke, but there was no significant difference in the rate of rtPA administration before and after training courses [43].

In the present study, among those who had previous knowledge of the symptoms of stroke, the number of those who were familiar with these symptoms through health centres and relatives working in the treatment personnel, and those who were aware through television programs were higher. Fewer people reported using the internet and cyberspace for information and awareness of related training programs, which could be due to two reasons, including the lack of use of the internet by older people who make up a large part of the statistical population, or inadequate design and implementation of educational measures in this area. Given the high potential of internet networks, further investigations are suggested to address the shortcomings and reasons for less feedback. Also, a high percentage of people (35.18%) had no previous knowledge of the symptoms of stroke, which necessitates continuing educational

activities at the community level. Silver *et al*. (2003) used various educational methods such as television programs and publishing educational material in newspapers to raise awareness of stroke warning signs. The results of their study showed that education through television programs had a significant effect on raising the awareness of both men and women and those with less education, but no significant change was achieved in the communities using the newspaper [37].

CONCLUSION

Based on the results of the present study, the implementation of educational programs was reported to be effective in raising public awareness of stroke symptoms and the need for prompt hospital referral for appropriate and timely treatment. In the present study, fewer people reported using the internet for getting information and awareness of related training programs, which could be due to two reasons, including the lack of use of the internet by older people who make up a large part of the statistical population, or inadequate design and implementation of educational measures in this area. Given the different effectiveness of the educational methods observed in this study, further studies focusing on designing the most effective and cost-effective methods to achieve the best educational outcome with high durability of the materials presented in the community are recommended.

DECLARATION

Ethics Approval and Consent to Participate

The study was approved by the Ethics Committee of Ahvaz Jundishapur University of Medical Sciences (Ethic code: IR.AJUMS.REC.1397.565), and all patients provided written informed consent before enrollment.

Consent for Publication

This manuscript has not been published and is not under consideration for publication elsewhere in whole or in part. No conflicts of interest exist in the submission of this manuscript, and the manuscript has been approved for publication by all listed authors.

Availability of Data and Material

The data used to support the findings of this study are available from the corresponding author upon request.

Competing Interests

None of the authors has any financial and personal relationships with other people or organizations that could potentially and inappropriately influence this work and its conclusions. Authors declared no competing interest in publishing this paper.

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