Stroke Awareness and Factors Influencing Hospital Arrival Time: A Prospective Observational Study

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Background: *Data concerning stroke awareness and factors associated with time of hospital arrival for acute stroke patients in Thailand are still lacking.*
Objective: *To assess stroke awareness and to identify factors influencing hospital arrival time after an acute stroke.*
Material and Method: *This is a prospective study comprising consecutive acute stroke patients admitted in Siriraj Hospital, Bangkok, Thailand between August 2010 and December 2011. Demographic data, stroke severity using the NIHSS, diagnosis and stroke awareness questionnaire were collected.*
Results: *Of 217 acute stroke patients, mean age was 66±13.7 years. Mean stroke severity was 10±7.6. Patients arrived at the Emergency Department within 4.5 hours (early hospital arrival: EHA) in 38.2% of the cases, 16.6% by ambulance. Only 34.6% of patients recognized that they were having stroke. Factors associated with EHA were 1) stroke awareness (OR 1.96, 95% CI 1.07-3.60, p = 0.030), 2) arrival by ambulance (OR 2.23, 95% CI 1.03-4.81, p = 0.042), and 3) NIHSS >15 (OR 2.26, 95% CI 1.17-4.35, p = 0.015).*
Conclusion: *Only one-third of patients were aware of stroke symptoms. Only one in six patients used emergency transportation. Public educational campaign is needed to increase the community awareness of stroke warning symptoms and the urgent emergency medical services.*

Keywords: *Stroke awareness, Acute stroke, Hospital arrival time*

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Acute stroke has been recognized as an emergency medical condition. Intravenous thrombolysis with recombinant tissue plasminogen activator (rt-PA) has been proven effective when given within 4.5 hours after onset in an acute ischemic stroke[1]. An acute "stroke fast track" protocol is widely established in stroke centers to reduce time delay and increase the use of rt-PA[2]. Some studies report that only 50-60% of stroke patients arrived at an emergency room within 4 hours after onset[4-6]. However, in Thailand, 27.1% of ischemic stroke patients arrived within 3 hours, and only 3.8% received rt-PA[2,3].

Delay in hospital arrival after an acute stroke is a main reason for an exclusion from receiving tPA, associated with a lower probability of achieving a favorable outcome. Previous studies have identified awareness of stroke symptoms and emergency calls "911" are the two most relevant factors associated with early hospital arrival (EHA)[4,7,8,10]. In addition, delayed arrival could be due to lack of stroke awareness. The purposes of the present study were to assess stroke awareness and to identify factors influencing EHA after an acute stroke.

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Material and Method

This is a prospective study conducted between August 2010 and December 2011 at Siriraj Hospital, Bangkok, Thailand. Consecutive acute stroke (according to World Health Organization definition)[10], and transient ischemic attack (TIA) patients 18 years and older were eligible for this study. Perioperative stroke and stroke occurred while being admitted in the hospital (in-hospital stroke) were excluded. Participants were recruited from Siriraj Acute Stroke Unit, general medicine wards and neurosurgical unit. A structured interview was performed within 48 hours after admission by a neurologist (SW). Stroke awareness questionaire was applied to all patients (Appendix 1). Family members or caregivers were asked if the patient was not able to

answer the survey questions. The time last seen well was recorded as the start of the event for those presented with unknown onset.

The authors included the following information: mode of transportation, demographics, vascular risk factors, stroke subtype and stroke severity. Initial stroke severity was measured by Thai version of National Institutes of Health Stroke Scale (NIHSS-T)[16]. EHA was defined as an arrival time of within 4.5 hours from stroke onset. The study was approved by Siriraj Institutional Review Board (SIRB).

Statistical analysis

SPSS software version 13.0 for Windows (SPSS Inc) was applied. Frequencies, means, and standard deviations were used for descriptive data on clinical and demographic variables. Logistic regression was performed to identify variables associated with EHA. Multivariate analyses were reported as odds ratios (ORs), 95% confidence interval (95% CI). All tests were 2-tailed and considered $p<0.05$ levels as statistically significant.

Results

Overall, 217 acute stroke patients were enrolled with a mean (± SD) age of 66±13.7 years. Men comprised of 56.7%, 79.3% of patients experienced stroke at home (Table 1). Cerebrovascular disease subtypes were classified as follows: acute ischemic stroke (82.9%), transient ischemic attack (TIA) (6.5%), and hemorrhagic stroke (10.6%). The mean ± SD initial National Institutes of Health Stroke Scale (NIHSS) score was 10±7.6. Acute stroke unit admission rate was 88.5%. Patients arrived at the emergency room within 4.5 hours after onset in 38.2%.

Unilateral weakness was the most recognized stroke symptom (66.3%) that urged patients to seek medical attention. Of the participants, 75 (34.6%) thought they might be having a stroke at the onset, although 61% expressed prior knowledge of stroke. Most of those patients came to hospital by their own car or taxi (83.4%); only 16.6% used emergency medical service.

Outcome measures

In the univariate analysis, stroke awareness [OR, 1.87; 95% CI, 1.05-3.30], mode of transportation by ambulance [OR, 2.69; 95% CI, 1.30-5.58], and stroke severity (NIHSS >15) [OR, 2.49; 95% CI, 1.35-4.58] were associated with higher odds of EHA (Table 2). Demographic factors, presence of stroke risk factors, and stroke subtype were not associated with EHA.

Multivariate analyses

Multivariate analyses revealed that awareness of strokes (p = 0.030; adjusted OR, 1.96; 95% CI, 1.07-3.60), mode of transportation by ambulance (p = 0.042; adjusted OR, 2.23; 95% CI, 1.03-4.81), and stroke severity (NIHSS >15) (p = 0.015; adjusted OR, 2.26; 95% CI, 1.17-4.35) were associated with EHA (Table 3).

Factors associated with stroke awareness among patients with EHA included not being alone at the symptom onset (p = 0.049; OR, 2.33; 95% CI, 0.18-1.01), and prior knowledge of stroke (p<0.001; OR, 8.94; 95% CI, 4.13-19.32).

Table 1. Patients' characteristic

Characteristics	n = 217
Age (years), mean (min-max)	66 (29-92)
Gender: male, n (%)	123 (56.7)
Vascular risk factors, n (%)	168 (77.4)
Presenting symptom(s), n (%)	
Unilateral weakness	145 (66.3)
Speech difficulties	19 (8.8)
Dizziness, vertigo	11 (5.1)
Alteration of consciousness	8 (3.7)
Facial drooping	4 (1.8)
Others	20 (9.2)
Patients' view of what was happening at the onset, n (%)	
Stroke	75 (34.6)
Fainting	25 (11.5)
Severe hypertension	19 (8.8)
Vertigo	9 (4.1)
Fatigue	7 (3.2)
I don't know and others	82 (37.8)
Early hospital arrival (≤4.5 hours), n (%)	83 (38.2)
Ambulance transportation, n (%)	36 (16.6)
Diagnosis, n (%)	
Acute ischemic stroke	180 (82.9)
Transient ischemic attack	14 (6.5)
Intracerebral hemorrhage	23 (10.6)
Initial NIHSS, mean (min-max)	10 (0-29)
Mild (NIHSS 0-4), n (%)	64 (29.5)
Moderate (NIHSS 5-15), n (%)	94 (43.3)
Severe (NIHSS >15), n (%)	59 (27.2)
Stroke unit admission, n (%)	192 (88.5)

NIHSS = National Institutes of Health Stroke Scale

Table 2. Univariate analysis of factors associated with early hospital arrival (EHA)

Variables	*p*-value	OR (95% CI)
Gender, male	0.254	0.73 (0.42-1.26)
Age ≤55 (years)	0.538	1.23 (0.63-2.4)
Onset symptom at home	0.192	0.64 (0.33-1.25)
Living alone	0.300	0.65 (0.29-1.47)
Hemiparesis (any side)	0.246	1.41 (0.79-2.56)
Symptom recognized by bystander	0.067	1.67 (0.34-1.04)
Prior knowledge of stroke	0.516	1.20 (0.69-2.11)
Awareness of stroke	0.032	1.87 (1.05-3.30)
Mode of transportation by ambulance	0.007	2.69 (1.30-5.58)
Initial NIHSS >15	0.003	2.49 (1.35-4.58)
Underlying stroke risk factors*	0.674	0.87 (0.45-1.67)
Classification of stroke Acute ischemic stroke Transient ischemic attack Intracerebral hemorrhage	0.321	
Territory of stroke, anterior circulation	0.189	1.63 (0.78-3.42)

NIHSS = National Institutes of Health Stroke Scale
* Including; hypertension, diabetes mellitus, hyperlipidemia, coronary heart disease, peripheral arterial disease, atrial fibrillation, valvular heart disease

Table 3. Multivariate analyses showing factors associated with early hospital arrival (EHA)

Variables	Adjusted *p*-value	Adjusted OR (95% CI)
Awareness of stroke	0.030	1.96 (1.07-3.60)
Mode of transportation by ambulance	0.042	2.23 (1.03-4.81)
Initial NIHSS >15	0.015	2.26 (1.17-4.35)

NIHSS = National Institutes of Health Stroke Scale

Table 4. Factors influence to stroke awareness

	p-value	OR (95% CI)
Gender, male	0.473	1.23 (0.70-2.17)
Living alone	0.049	0.429 (0.18-1.01)
Hemiparesis (any side)	0.201	1.486 (0.80-2.73)
Prior knowledge of stroke	<0.001	8.94 (4.13-19.32)
Initial NIHSS >15	0.845	1.06 (0.57-1.99)
Underlying stroke risk factors*	0.316	1.43 (0.71-2.86)

NIHSS = National Institutes of Health Stroke Scale
* Including; hypertension, diabetes mellitus, hyperlipidemia, coronary heart disease, peripheral arterial disease, atrial fibrillation, valvular heart disease

Discussion

This study demonstrated that only 34.6% of patients were able to recognize stroke symptoms and arrived at the hospital within 4.5 hours. EHA was significantly associated with stroke awareness, the use of emergency medical service (EMS) and severe stroke.

Our study results are similar to those from other countries reporting stroke awareness in 25-36%[6,9,14]. Factor associated with delay hospital arrival was the lack of stroke awareness which has been identified by previous studies[11]. In addition, relevant factors found to improve the number of EHA patients were 1) patients' awareness of stroke symptoms[9,12,14], 2) calling for an ambulance[9,12-14], 3) an immediate decision to seek emergency medical attention[13] and 4) severe stroke[14,15]. Interestingly, data from our cohort did not showed any significant association between high risk patients with underlying vascular risk factors (including hypertension, diabetes mellitus, dyslipidemia, coronary heart disease, atrial fibrillation) and EHA thus emphasizing an urgent need for stroke education campaign primarily focus on those with vascular risk factors and general population.

The substantially low rate of the use of ambulance (16.6%) in our study may partly explain a small proportion of patients (38.2%) arriving at an emergency room within 4.5 hours. Most patients who were not transported by an ambulance claimed that they did not know how to reach the EMS system. Previous study performed in the northern suburban part of Bangkok reported similar results that less than 10% (10/181) of patients with acute ischemic stroke came to the hospitals by ambulance[18]. Therefore, an initiative aiming to improve the accessibility of EMS as well as to increase public awareness on the role of EMS in acute stroke in Thailand is crucial.

Our study has limitations that deserve comment. Firstly, 88.5% of the participants were treated in acute stroke unit. A significant number of acute stroke patients treated in general medical wards were not included. The patients admitted outside stroke unit usually arrive late and were excluded from intravenous thrombolysis or endovascular intervention. This selection bias may interfere with the study results. Secondly, this study was performed in a single tertiary care center which located in Bangkok,

a capital city of Thailand. Therefore, the results may not represent rural areas of the country.

Despite limitations, our study constitutes a representative estimate of stroke awareness and patients' response during acute stroke in capital city of Thailand. These findings have drawn attention of stakeholders and policy makers to initiate national strategies aiming at improving stroke awareness and EMS system.

Conclusion

Stroke awareness was significantly low among acute stroke victims in Thailand. Only 1 in 3 patients can recognize stroke symptoms and 1 in 6 uses emergency medical service for patients' transportation. Factors associated with EHA are stroke awareness, the use of ambulance and severe stroke. A national stroke awareness campaign and an initiative aiming to increase the use of EMS system are urgently needed.

What is already known on this topic?

Awareness of stroke symptoms is associated with early hospital arrival and vary between countries.

What this study adds?

Stroke awareness, as well as, the use of EMS is significantly low among acute stroke victims in Thailand.

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Potential conflicts of interest

None.

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Appendix 1. Questions for evaluation stroke awareness

1. What was the symptom that urged you to come to the hospital?
2. What was your thought about what happened to you while you were having the symptom?
3. Have you known about stroke?
4. Were you aware of having a stroke at that moment?
5. What did you do first after the symptom occurred?
6. How did you get to the hospital?
7. How long did you wait and observe the symptom before you decided to come to the hospital?

ความตระหนักรู้เรื่องโรคหลอดเลือดสมองและปัจจัยที่ส่งผลต่อระยะเวลาของการมารับการรักษาที่โรงพยาบาล การศึกษาแบบไปข้างหน้า

ศรัทธาวุธ วงษ์เวียงจันทร์, จุฬาลักษณ์ โกมลตรี, นิพนธ์ พวงวรินทร์, ยงชัย นิละนนท์

ภูมิหลัง: *การตระหนักรู้ถึงโรคหลอดเลือดสมองและข้อมูลของปัจจัยที่มีความสัมพันธ์ต่อระยะเวลาในการเดินทางมาถึงโรงพยาบาลของผู้ป่วยโรคหลอดเลือดสมองเฉียบพลันในประเทศไทย ณ ปัจจุบันนั้น ยังไม่มีข้อมูลชัดเจน*

วัตถุประสงค์: *เพื่อประเมินถึงการตระหนักรู้และค้นหาปัจจัยที่ส่งผลต่อระยะเวลาในการเดินทางมาถึงโรงพยาบาลของผู้ป่วยโรคหลอดเลือดสมองเฉียบพลัน*

วัสดุและวิธีการ: *การศึกษานี้เป็นการศึกษาโดยการสังเกตการณ์ไปข้างหน้า ในผู้ป่วยโรคหลอดเลือดสมองเฉียบพลันที่ได้รับการรักษาในโรงพยาบาลศิริราช ตั้งแต่ เดือนสิงหาคม พ.ศ. 2553 ถึง ธันวาคม พ.ศ. 2554 เพื่อเก็บข้อมูลพื้นฐาน การวินิจฉัย และการตอบแบบสอบถามเพื่อประเมินการตระหนักรู้ถึงโรคหลอดเลือดสมองของผู้ป่วย*

ผลการศึกษา: *จากผู้ป่วยโรคหลอดเลือดสมองเฉียบพลันทั้งหมด 217 ราย มีอายุเฉลี่ย 66 ± 13.7 ปี ร้อยละ 38.2 มาถึงโรงพยาบาลภายใน 4.5 ชั่วโมง ร้อยละ 34.6 ของผู้ป่วย ตระหนักรู้ว่าตนเองเกิดโรคหลอดเลือดสมองขึ้น และมีผู้ป่วยร้อยละ 16.6 ที่เดินทางมาโรงพยาบาลด้วยรถพยาบาล ปัจจัยที่มีความสัมพันธ์ต่อระยะเวลาในการเดินทางมาถึงโรงพยาบาลภายใน 4.5 ชั่วโมง ได้แก่ 1) การตระหนักรู้ถึงโรคหลอดเลือดสมอง (OR 1.96, 95% CI 1.07-3.60, p = 0.030) 2) การเดินทางมาโรงพยาบาลด้วยรถพยาบาล (OR 2.23, 95% CI 1.03-4.81, p = 0.042) 3) NIHSS มากกว่า 15 คะแนน (OR 2.26, 95% CI 1.17-4.35, p = 0.015)*

สรุป: *ผู้ป่วยเพียง 1 ใน 3 ที่ตระหนักรู้ว่าตนเองเป็นโรคหลอดเลือดสมองเฉียบพลัน โดย 1 ใน 6 ของผู้ป่วยเท่านั้น ที่ใช้บริการรถพยาบาลฉุกเฉินในการเดินทางมาโรงพยาบาล ดังนั้นจึงควรดำเนินการรณรงค์ให้ความรู้แก่สาธารณชนให้ตระหนักถึงอาการของโรค และวิธีการติดต่อการบริการทางการแพทย์ฉุกเฉิน*