Original Paper

Patient Recognition of and Response to Symptoms of TIA or Stroke

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Abstract
Background and Purpose: Campaigns within Australia and internationally have sought to increase awareness of the emergent nature of stroke. For these initiatives to be effective it is important to gather information about delay in seeking treatment and the reasons given for the delay by people with stroke. The purpose of this study was to examine delay in seeking treatment in people with an evolving stroke or TIA and identify clinical, behavioral and demographic factors that contributed to the delay. ***Subjects and Methods:*** During a 1-year period 150 participants were given the Response to Stroke Symptoms Questionnaire. The six domains included in the questionnaire were: (1) context in which the stroke occurred; (2) antecedents to symptoms; (3) affective response to symptoms; (4) behavioral response to symptoms; (5) cognitive response to symptoms; (6) the response of others to patient symptoms. ***Results:*** The median delay time from symptom onset to admission to hospital was 4.5 h. While 41% of participants delayed less than 3 h, more than 45% delayed greater than 6 h. Independent predictors of delay time included mode of arrival at hospital with those taking an ambulance having a median delay time of 2.7 h vs. 15.4 h for those arriving by private car (p = 0.04). Gender also predicted delay with women delaying longer (p = 0.001). The first response of others was also an independent predictor of delay time (p = 0.003) with those who called the emergency services number or took the patient to hospital resulting in the shortest patient delays. Finally, if the patient appraised their symptoms as serious they had a shorter delay time (p = 0.02). ***Conclusions:*** The message about the emergent nature of stroke may be helping to improve delay times. However, there are still many people who delay greater than 3 h after symptom onset. It is important to direct education programs to those with known risk factors for stroke and their families, who often make the decision to call an ambulance.

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Each year within Australia over 45,000 people will suffer a stroke. While the death rate from stroke has continued to fall over the last several decades, stroke continues to be a major cause of mortality representing 10% of all deaths each year. Approximately 10% will die within 1 month as a direct consequence of the stroke, and over 30% will die within a year [1]. In addition, stroke is a major cause of disability, representing 25% of chronic disability in Australia. Worldwide, the World Health Organisation estimates that 15 million people will suffer a

stroke each year, of which 5 million will die and another 5 million will be left with permanent disability [2]. Therefore, half of those who survive a stroke will be dependent in some way on others to carry out their activities of daily living. Decreases in stroke incidence and deaths due to stroke has occurred over the last 10 years but, as predicted, were offset by the increase in the proportion of the population over 75 [3].

These factors highlight the importance of stroke and implementation of measures to ensure early presentation and intervention. Unfortunately, many people are ineligible for entry into clinical trials of new treatments for stroke such as thrombolysis because they do not arrive at the emergency department early enough after their symptoms develop. This is an ongoing problem not only within Australia but internationally [4, 5].

There is little information available concerning the level of knowledge about stroke within the Australian community. The findings of a national survey in 1995 showed that 23% of those surveyed thought that a stroke was a heart attack; only 42% correctly identified the causes of stroke (e.g. a clot in the brain) while 30% were unable to give any warning signs of stroke [6]. There is still a belief among both the general and professional communities that there is little that can be done about stroke, with few recognizing that stroke is a medical emergency [7]. The 'Brain Attack' campaigns launched both internationally and within Australia attempted to increase public awareness about the emergent nature of stroke. For these initiatives to be effective it is important to gather information about delay in seeking treatment and the reasons given for the delay by people with transient ischemic attack (TIA) or stroke. The purpose of this study was to examine delay in seeking treatment among people with an evolving stroke or TIA and identify clinical, behavioral and demographic factors that contributed to the delay. The specific aims of the study were to determine the time from symptom onset to arrival at hospital and define the cognitive, affective and behavioral factors that contribute to delay in seeking treatment for symptoms of TIA/stroke.

Subjects and Methods

Study Population and Recruitment Strategy

Following approval by the Human Research Ethics Committee, all patients admitted to the study hospital (a large metropolitan tertiary facility) with a diagnosis of stroke/TIA were asked to participate in the study and consent was obtained from the patient or their next of kin. For those patients unable to participate in an interview due to speech and/or cognitive deficits information was gathered from their family or friends if they witnessed the event. Eligibility criteria included admission from home (not a nursing home), being within 72 h of admission to hospital and diagnosis of TIA or stroke. Nursing home residents were excluded, as the decision to seek treatment would be made by a professional caregiver and not the resident. Those patients who had an unwitnessed event and who were unable to be interviewed were also excluded.

Survey Instrument

All participants were given the Response to Stroke Symptoms Questionnaire (available online at www.karger.com/RSSQ). This questionnaire was modified from the Response to Symptoms Questionnaire used to assess patients with symptoms of myocardial infarction. The original questionnaire is well validated for that group. The six domains used in the original questionnaire were the same. These included (1) context in which the stroke occurred; (2) antecedents to symptoms; (3) affective response to symptoms; (4) behavioral response to symptoms; (5) cognitive response to symptoms; (6) the response of others to their symptoms [8, 9]. The questionnaire was modified so that the symptoms described in the introduction referred to symptoms of stroke rather than heart attack. The modified questionnaire was piloted in the first 10 patients admitted to the study. No changes were made after the pilot.

The time from symptom onset to arrival at the hospital (hospital arrival refers to admission to the emergency department) was determined in the interview with the patient or family member. Review of the hospital records further validated this. If the patient had difficulty identifying a time of onset because the symptoms came and went, they were carefully interviewed. The symptoms that caused them to come to hospital were used as a reference point. Patients were given the option of answering the questionnaire themselves or having the researcher read the questions and write their responses. The majority chose the latter option. Medical records were reviewed to determine sociodemographic and clinical data. Any information not available in the medical record was gathered from the attending medical, nursing and allied health staff.

Statistical Analysis

Descriptive statistics were carried out to look at patient characteristics. Analyses of data included χ^2 to test differences between patient characteristics and past clinical histories. Univariate comparisons using independent t tests or analyses of variance (ANOVA) were used to examine the impact of sociodemographic, clinical, cognitive and behavioral and social factors on time from symptom onset to arrival at the hospital. For purposes of parametric and multivariate analyses delay times were subjected to logarithmic transformation to obtain a normally distributed measure of delay time. Median delay times and interquartile ranges are reported to appropriately represent the clinical significance of the delay times, with significance levels given for comparisons between log transformed mean delay times, which were normally distributed. Forward stepwise multiple logistic regression was used to assess the independent predictors of delay time greater than 6 h in each group. Criteria for entry and removal of variables in the regression analyses were set at $p \leq 0.05$ and $p \geq 0.10$ respectively. Significant univariate factors along with age and gender were entered into the regression. Six hours was chosen because studies suggest that thrombolysis may be beneficial if given within a 6-hour time window [10].

Table 1. Clinical factors and associated times to presentation to hospital

Risk factor	n	Delay, h (mean)	Delay, h (median)	Range, h	SD	p
Hypertension						
Yes	87 (58%)	18.0	4.7	0.52–198.7	32.1	0.87
No	62 (41%)	18.0	4.6	0.33–167.3	30.3	
Hyperlipidemia						
Yes	49 (33%)	15.3	4.73	0.52–126.1	26.6	0.56
No	100 (67%)	19.4	4.34	0.33–198.7	33.4	
Cardiac (non atrial fibrillation)						
Yes	43 (29%)	20.6	3.6	0.60–167.3	36.8	0.98
No	106 (71%)	17.1	4.9	0.33–198.7	28.9	
Previous TIA/stroke						
Yes	44 (29%)	9.7	2.8	0.52–59.0	13.0	0.08
No	105 (70%)	21.6	5.8	0.33–198.7	35.8	
Smoking						
Yes	32 (22%)	14.8	4.8	0.52–126.1	24.0	0.73
No	117 (78.5%)	19.0	4.7	0.33–198.7	33.1	
Family history						
Yes	29 (20%)	15.0	4.7	0.52–150.6	28.9	0.56
No	120 (80%)	18.8	4.6	0.33–198.7	31.9	
Obesity						
Yes	24 (16.1%)	12.6	3.8	0.55–65.2	17.0	0.57
No	125 (84%)	19.1	4.7	0.33–198.7	33.3	
Atrial fibrillation						
Yes	18 (12%)	13.6	4.7	0.55–59.0	32.7	0.64
No	131 (88%)	18.7	4.5	0.33–198.7	18.4	
Diabetes						
Yes	16 (10.8%)	19.1	12.5	0.52–61.0	18.3	0.15
No	132 (89%)	18.1	4.1	0.33–198.7	32.7	

Results

Patient Characteristics

Over a 1-year period, 150 participants were entered into the study out of 410 patients admitted with stroke or TIA during the data collection period. All participants were interviewed within 72 h of admission to hospital. The study hospital is a 600-bed public, university-affiliated hospital in Sydney, Australia. All Australians have access to public hospitals within the universal health insurance scheme. As private hospitals generally do not have emergency departments, the study hospital provided the only emergency services for stroke patients within the catchment area. Logistical reasons (admissions when research staff were not available) and stroke severity prevented the researchers from approaching all stroke patients admitted. The majority (98%) of those who were asked agreed to participate. Information was gathered from family or friends of the patients who were unable to participate in an interview due to speech and/or cognitive deficits (n = 4) if they witnessed the event. Most had an ischemic stroke (n = 112, 75%), while the remaining participants had either TIAs (n = 28, 18%) or hemorrhagic stroke (n = 10, 7%). As expected, the majority of patients were older (mean age = 70, SD, 13 years). Most were male (68%), married (62%) and of Caucasian origin. The number of years of education varied from 0–18 years with a mean of 12.45 years. Seventy percent of participants were retired. Risk factors for stroke included hypertension (n = 87, 58%), hyperlipidemia (n = 49, 33%), history of cardiac problems other than atrial fibrillation (n = 43, 29%) and previous stroke or TIA (n = 41, 27%).

As shown in tables 1 and 2, there was no significant association between delay time and clinical or sociodemographic factors such as age, education level, marital status, employment status, location at time of symptom onset and whether they were alone or with others. Patients who had a previous event, either a stroke or TIA, tended to arrive earlier, 2.8 vs. 5.8 h but this did not reach significance in this sample (p = 0.08). Three-quarters of patients (73%) experienced their symptoms while at home, with the remainder in a public place (9%), at work

Table 2. Demographic factors and associated times to presentation to hospital

Risk factor	n	Delay, h (mean)	Delay, h (median)	Range, h	SD	p
Gender						
Male	102 (68%)	17.5	4.0	0.52–198.7	32.1	0.40
Female	48 (32%)	18.9	10.4	0.33–167.3	29.7	
Education						
<12	45 (32%)	21.3	4.23	0.53–167.3	38.1	0.70
>12	94 (68%)	15.4	4.42	0.33–126.1	22.3	
Age						
<65	40 (27%)	15.1	4.3	0.33–75.8	21.0	0.80
>65	110 (73%)	19.0	4.7	0.53–198.7	34.2	
Martial status						
Married	97 (68%)	15.9	4.0	0.33–167.3	26.9	0.27
Not currently married	46 (32%)	19.3	6.7	0.58–150.6	30.5	
Employment						
Employed	34 (23%)	17.0	6.4	0.33–75.8	22.8	0.93
Retired	106 (71%)	17.4	4.3	0.53–167.3	28.2	

Table 3. Mode of arrival and delay in hours

| Mode of arrival	n	Delay (mean)	Delay (median)	Range, h	SD	p
Private car	63 (44%)	31	15.4	0.33–198.7	42.9	0.000
Ambulance	74 (51%)	8.6	2.7	0.55–56.3	12.8	

(6%), visiting others' homes (6%) or in a vehicle (5%). Just over half the patients (51%) were transported to hospital by ambulance while 44% arrived by private car.

Delay Time

Median prehospital delay time was 4.5 h with a range from 20 min to 198 h and 42 min. As illustrated in figure 1, 56% of patients presented for treatment within six hours of symptom onset but more than a third delayed beyond 12 h.

Factors Associated with Longer Delay

Factors associated with delay that were significant at the univariate level included mode of transport to hospital, whether the patient experienced pain, and factors in the cognitive and behavioral domains. These included the first response of others to symptom onset and patient appraisal of symptoms as serious, whether they were anxious or felt in control. Knowledge of stroke symptoms, recognition of symptoms as stroke symptoms, not realizing the importance of their symptoms, symptoms that
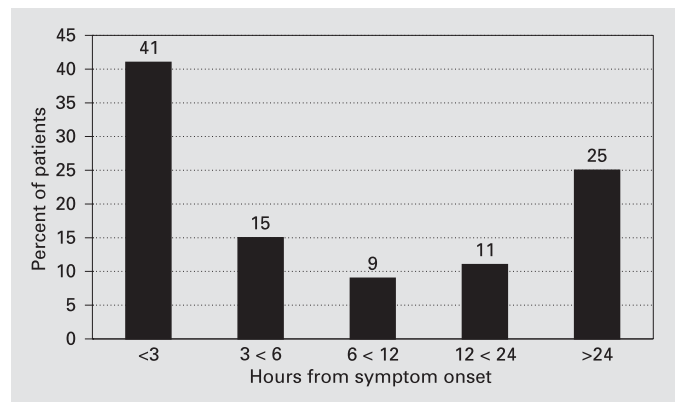
Fig. 1. Proportion of patients presenting for treatment within number of hours of symptom onset.

came and went and waiting to see if symptoms would go away were significantly related to delay.

Mode of arrival was significantly related to delay (table 3) with those who traveled by ambulance arriving ear-

Table 4. Social context of symptom recognition, first response of others and delay times

	n	Delay (mean)	Delay (median)	Range, h	SD	p
Where patient was when symptoms began						
At home	109 (73%)	18.7	4.7	0.58–198.7	33.3	0.178
Other location	40 (27%)	16.3	3.2	0.33–122.7	25.6	
Whom patient was with at symptom onset						
Alone	56 (42.1%)	14.6	7.3	0.58–75.8	18.4	0.657
With spouse	77 (57.9%)	20.8	4.2	0.33–198.7	37.1	
First response of others to symptom onset						
Called 000	43 (29.1%)	5.4	1.5	0.55–32.4	9.0	0.0005
Get medical help	40 (27%)	25.3	8.1	0.85–167.3	39.4	
Took to hospital	27 (18.2%)	6.0	1.8	0.33–60.6	12.2	
Did not tell others	17 (11.5%)	15.0	16.7	1.00–28.8	9.5	
Other	23 (15.3%)	44.9	26.3	2.5–198.7	46.0	

lier than those who took other forms of transport, mainly private car (p < 0.001). When the first response of other people with the patient was, for example, to call 000 or take the patient to hospital, they arrived faster than when they got medical help, took any other action or if the patients did not tell others (table 4). Taking the patient to hospital (e.g. being driven by a family member) was similar to calling 000. Thus, calling 000 was not significantly faster than a family member driving patients with symptoms of stroke to hospital.

Patients who first responded to their symptoms by telling family members or taking their own transport to hospital had the shortest median delay, 2.7 and 2.6 h. On the other hand, those who took no effective action (e.g. wished or prayed symptoms would go away), took medication or drove to their doctor had the longest median delay. Calling their doctor resulted in a median delay of 4.8 h. The very few (n = 4) who called 000 had the shortest delay of 1.3 h. When tested using ANOVA and post hoc two-way comparison tests, none of the differences between first responses were statistically significant in this sample (table 5).

Patient appraisal of their symptoms also influenced delay (table 6). If participants had pain (33%) they were more likely to delay longer (p = 0.03), 7.9 h with pain compared to 3.3 h without pain. If patients perceived their symptoms as serious or felt anxious about their symptoms they arrived sooner to hospital. On the other hand, if they perceived they could control their symptoms they delayed going to hospital.

Several cognitive and behavioral reasons for delaying the decision to seek treatment were significantly related to patient delay. Patients delayed if they waited to see if their symptoms went away, if their symptoms

Table 5. First response of patient to symptoms and mean and median delay in hours

Response	n	Delay (mean)	Delay (median)	p
Told someone	58 (38.6%)	12.7	2.7	
Did nothing	53 (35.3%)	26.2	11.7	0.131
Took medication	10 (6.7%)	25.7	13.8	
Called doctor	10 (6.7%)	11.1	4.8	
Took own transport to hospital	8 (5.3%)	12.9	2.6	
Drove to doctor	6 (4.0%)	14.1	12.2	
Called 000	4 (2.7%)	1.2	1.3	

Table 6. Patient appraisal of symptoms, anxiety about symptoms and perception of ability to control symptoms and mean and median delay times (h)

	n (%)	Delay mean	Delay median	p
Pain				
<2 (no pain)	101 (67)	13.6	3.3	0.03
≥3 (pain)	49 (33)	26.9	7.9	
Symptoms attributed to				
Brain	50 (33.6)	15.9	3.8	0.89
Other	99 (66.4)	19.1	4.9	
Symptoms perceived as				
Serious (4–5)	46 (30.9)	2.13	1.7	0.001
Not so serious (1–3)	103 (69.1)	2.72	9.1	
Anxious about symptoms				
Very (4–5)	47 (31.8)	2.24	1.9	0.001
Not very (1–3)	101 (68.2)	2.68	8.2	
Perception of ability to control symptoms				
High (3–5)	55 (38.2)	2.7	8.3	0.05
Low (1–2)	89 (61.8)	2.4	3.3	

Table 7. Reasons given for delay in decision to seek treatment

Variable	n	Delay (mean)	Delay (median)	Range, h	SD	p
Waited to see if symptoms would go away						
Very much	57 (38%)	25.2	11.8	0.58–198.7	38.1	0.002
Not so much	92 (61%)	13.6	3.0	0.33–167.3	25.5	
Embarrassed to get help						
Very much	12 (8%)	8.3	4.7	0.58–26.4	8.4	0.63
Not so much	137 (92%)	18.9	4.2	0.33–198.7	32.5	
Feared what might happen						
Very much	15 (10%)	11.5	11.6	0.8–30.6	10.1	0.80
Not so much	134 (90%)	18.8	4.1	0.33–198.7	32.8	
Symptoms came and went						
Very much	18 (12%)	27.1	15.3	1.0–126.13	34.6	0.048
Not so much	130 (86%)	17.0	4.0	0.33–198.7	30.9	
Did not recognize symptoms as stroke symptoms						
Very much	57 (38%)	23.5	12.0	0.58–150.6	32.6	0.004
Not so much	91 (61%)	14.4	3.2	0.33–198.73	30.3	
Did not want to trouble anyone						
Very much	38 (25%)	16.9	8.0	0.58–122.7	23.8	0.256
Not so much	110 (73%)	18.5	3.6	0.33–198.7	33.8	
Did not know symptoms of a stroke						
Very much	41 (28%)	30.7	15.4	0.8–198.7	45.3	0.002
Not so much	107 (72%)	13.2	3.2	0.33–167.3	22.6	
Did not realize importance of their symptoms						
Very much	51 (34%)	26.2	15.2	0.80–198.7	39.2	0.001
Not so much	97 (65%)	13.9	2.7	0.33–167.3	25.7	

came and went, if they did not know symptoms of a stroke or if they did not recognize their symptoms as stroke symptoms. Lastly, if they did not realize the importance of their symptoms they delayed seeking treatment (table 7).

Independent Predictors of Delay

The independent predictors of delay were determined by testing factors that were significant at the univariate level in a forward stepwise multiple logistic regression model. Gender was also added to the equation. For the purposes of the analysis, delay was defined as greater than 6 h. Independent predictors of delay greater than 6 h (table 8) were mode of arrival at hospital, the first response of others to the patient's symptoms, whether the patient appraised their symptoms as serious and being female. Arrival by ambulance reduced delay time (p = 0.040), the first response of others, either calling 000 or taking the patient to hospital, reduced delay time (p = 0.003), patient appraisal of their symptoms as serious reduced delay (p = 0.024) and females having increased delay time (p = 0.001).

Table 8. Multiple logistic regression model of independent predictors of delay of 6 h or less

Characteristic	p	Odds ratio[a]	95% CI
Gender	0.001	0.173	0.06–0.50
Mode of arrival	0.040	0.433	0.19–0.96
What others did	0.003	1.73	1.21–2.48
Appraisal as serious	0.024	5.52	1.25–24.45

[a] Odds ratios greater than 1 indicate a positive association with delay less than or equal to 6 h, odds ratios less than 1 indicate negative association.

Discussion

Median prehospital delay time in 150 patients with stroke or TIA was 4.5 h, with nearly half delaying greater than 6 h. Sixty percent delayed beyond the recommended time for administration of thrombolytic therapy. A review of studies from over 17 countries found that median stroke delay was in the range of 3–6 h. However, some studies excluded those who arrived after 6 h when calcu-

lating median delays. Therefore, interpretation of median delay data must be done cautiously [4]. As in other studies, those with severe stroke could not be included and may have had a shorter time to presentation. Therefore, these results may not apply to those patients with more severe strokes.

The importance of mode of transport to hospital as a factor that independently contributes to delay was found in several studies [11–16] and supports campaigns that encourage those with symptoms to call the emergency services number immediately. In this study the first response of others to the patient's symptoms was also important in reducing delay. It is interesting to note that there was little difference between calling the emergency services number and taking the patient to hospital themselves. This may be because patients with stroke symptoms were not given highest priority by emergency services when an ambulance was called.

Although the majority of participants had a known risk factor for stroke this was not significant in decreasing their delay time as has been reported in other studies [11, 12]. The benefits of targeting high-risk groups when introducing stroke education programs should be explored given that in this study patients with risk factors did not differ in their delay times from those without risk factors.

With the exception of gender, demographic factors (e.g. age, race, and education level) were not significant in contributing to delay. However, the demographics of the study participants were fairly homogenous. Most were Caucasian with a higher than average education level (e.g. 68% had ≥ 12 years education). The influence of demographic factors on delay varies in published reports. For example, a large US study (1,207 subjects) found no relationship between age, sex, race and educational level and delay time [16]. Other studies reported that being white [17] or older [18] decreased delay. Gender was significant in a few studies with women having a decrease in delay time in getting to hospital [19] but an increase in delay in being seen by an emergency physician [20]. Additionally, women may present with non-traditional stroke symptoms [21] which may add to delay in receiving treatment.

The influence of cognitive and behavioral factors on stroke delay has not been a focus of most studies reported previously. It is an area that requires further examination. A large Canadian study reported almost 30% of patients delayed because they waited to see if symptoms would improve [22]. Another study reported that while many patients stated they knew the symptoms of a stroke, 25% were not able to identify their own symptoms as stroke symptoms [11]. The only factor that was significant in the multivariate analysis was whether the patients considered their symptoms to be serious. Some patients correctly identify their symptoms as stroke but do not consider their symptoms as serious so delay in presenting to the emergency department [11].

Clearly, an important factor that will decrease delay time to treatment for stroke is to increase the use of the emergency medical services by those with stroke symptoms, in Australia calling '000'. This one action has the potential to decrease stroke delay time allowing more people access to treatments that have the potential of decreasing stroke mortality and disability. The greatest benefit in reducing delay may be derived from education programs that target those with known risk factors for stroke such as hypertension, previous TIAs, history of ischemic heart disease or the elderly [23]. The challenge for health professionals involved in educating these target groups will be in helping people to identify stroke symptoms given its inherent complexity. As was learned from the national heart attack campaigns, high-risk patients along with their family members need to be informed about symptoms of a stroke, the steps they should take if it happens including calling the emergency services number and the treatments available if they get to hospital early [24]. These instructions need to be supplemented with written material and reinforced frequently to ensure the emergent nature of stroke is understood along with the potential to improve the outcome if they receive early treatment.

Acknowledgments

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