

# Perception of stroke symptoms and utilization of emergency medical services

## Percepción de los síntomas del accidente cerebrovascular y utilización de los servicios de emergencias médicas

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### ABSTRACT

Lack of stroke awareness and slow activation of emergency medical services (EMS) are frequently reported reasons for delayed arrival to the hospital. We evaluated these variables in our population. **Methods:** Review of hospital records and structured telephone interviews of 100 consecutive stroke patients. Forward stepwise logistic regression was used for the statistical analysis. **Results:** Seventy patients (75%) arrived at the hospital 4.5 hours after stroke symptoms onset. The use of EMS did not improve arrival times. Most patients who recognized their symptoms did not use EMS ( $p < 0.02$ ). Nineteen patients (20%) were initially misdiagnosed. Eighteen of them were first assessed by non-neurologist physicians ( $p < 0.001$ ). **Conclusions:** Our population showed a low level of stroke awareness. The use of EMS did not improve arrival times at the hospital and the non-utilization of the EMS was associated with the recognition of stroke symptoms. There was a concerning rate of misdiagnosis, mostly by non-neurologist medical providers.

**Keywords:** stroke; emergency medical system.

### RESUMO

La falta de reconocimiento de los síntomas del accidente cerebrovascular (ACV) y la lenta activación de los servicios de emergencias médicas (SEM) son causas frecuentes de demoras en el arribo hospitalario. Nuestro objetivo fue evaluar ambas variables en nuestra población. **Métodos:** Revisión de registros hospitalarios y entrevista telefónica estructurada de 100 pacientes consecutivos internados por ACV. El análisis estadístico se realizó mediante un modelo de regresión logística multivariada por pasos. **Resultados:** Setenta pacientes (75%) arribaron al hospital luego de 4.5 horas del comienzo de los síntomas. El uso de los SEM no mejoró los tiempos de arribo al hospital ( $p < 0.02$ ). Inicialmente, 19 pacientes (20%) recibieron un diagnóstico erróneo. Dieciocho de ellos fueron evaluados por médicos no neurólogos. ( $p < 0.001$ ). **Conclusiones:** El reconocimiento de los síntomas de ACV en nuestra población fue bajo. El uso de los SEM no mejoró los tiempos de arribo hospitalario y la no utilización de los mismos se asoció con el correcto reconocimiento de los síntomas por parte de los pacientes. La proporción de diagnósticos erróneos fue preocupante, fundamentalmente entre médicos no neurólogos.

**Palavras-clave:** accidente cerebrovascular; servicios de emergencias médico.

Stroke is the second leading cause of mortality and the third cause of disability worldwide<sup>1,2</sup>. With the aging of populations, concern is growing about a potentially larger impact of the stroke burden on public health<sup>3,4</sup>. This impact can be diminished by early thrombolytic treatment as this reduces disability and improves outcomes after ischemic stroke<sup>5</sup>.

The principal reason for non-use of IV rtPA is delayed arrival time at the hospital<sup>6</sup>. Causes for this delay may be specific to particular characteristics of each population, however lack of recognition of stroke symptoms and slow activation and response of emergency medical services (EMS) are frequently reported reasons<sup>7,8,9,10,11</sup>.

Information about the recognition of stroke symptoms, the role of EMS for stroke patients' transportation and their impact on arrival times in Latin America is scant. Data from Brazil show an alarming lack of knowledge of stroke symptoms and activation of EMS in the general population<sup>12,13</sup>. However, there are no studies exploring this topic in patients with prior stroke<sup>14</sup>.

In Argentina, where thrombolytic therapy is not widely utilized, we hypothesize that low stroke awareness in the general population and in non-neurologist medical providers, as well as the lack of a rapid referral system for stroke care may negatively impact arrival times at hospital, negatively affecting the use of thrombolytic therapy.

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Our aim was to evaluate the pattern of recognition of stroke symptoms, utilization of EMS and their impact on arrival times at the hospital in our population.

## METHODS

This was a retrospective review of hospital records and prospective structured telephone interviews of 100 consecutive patients admitted to the stroke unit of our institution with a diagnosis of acute ischemic stroke from November 2012 to July 2013. As several studies suggest that the population awareness and response to transient symptoms are different<sup>15</sup>, transient ischemic attacks (TIAs) were excluded from this study. Patients or caregivers were contacted by a neurologist and questioned about their interpretation of their symptoms, and subsequent response, using a predesigned standardized questionnaire (Figure 1). Time between admission and phone contact was from one to seven months.

### Population

Patients were selected from hospital records of tertiary neurological hospital of the city of Buenos Aires. Its stroke unit admits approximately 180 patients with ischemic stroke per year.

When symptoms presented:

- 1-Did you think of stroke as a cause of your symptoms? (yes/no)
- 2-Did you or your relative call your personal physician? (yes/no)
- 3-Did you or your relative call the ambulance? (yes/no)
- 4-How did you get to hospital? (options\*)
- 5-Which was the main reason for your delay in consulting? \*\* (options\*\*\*)

\*Ambulance, own/hired vehicle or relative vehicle. \*\*Only asked those who arrived at hospital after four-and-a-half hours. \*\*\* Unawareness: unawareness of stroke symptoms and/or emergency situation; mild symptoms: non-disabling symptoms from onset; transient symptoms: rapid improvement of symptoms persisting with only a slight deficit; wake-up stroke: woke-up with symptoms and waited for remission; distance to hospital: the main determinant of the delay was the ride to hospital; misdiagnosis: misdiagnosis by the EMS or the first physician at hospital.

*Spanish version.*

Al momento de presentar los síntomas:

- 1-¿Pensó que estaba sufriendo un ACV\*? (si/no)
- 2-¿Usted o su familiar llamó a su médico de cabera? (si/no)
- 3-¿Usted o su familiar llamó a la ambulancia? (si/no)
- 4-¿Cómo se transportó hacia el hospital? (opciones)
- 5-En su opinión, cual fue el motivo de su demora a la consulta? (opciones)

\* Accidente cerebrovascular (cerebrovascular accident)

Figure 1. Close ended questionnaire.

According to a 2010 national census, the city of Buenos Aires has 2.9 million habitants. The educational level, socioeconomic status and private healthcare coverage in this population is higher than the average in Argentina<sup>16</sup>. Besides being a regional referral center, approximately 260,000 people, mostly those with private health insurance, are within the influence area and have access to acute stroke care in our hospital.

### Health care system

The health care system in Argentina is segmented and heterogeneous because of the lack of integration between the public system, social security and private sector. It is based on the public provision of health for every habitant. Additionally, people can be covered by the social security system comprising workers' organizations "health care insurance" (52%), government-funded social insurance for the retired population "PAMI" (8.3%), or by private health insurances (9%)<sup>16</sup>. The latter, in turn, subcontract to emergency medical companies.

### Definitions

Stroke was defined as an acute focal neurological deficit lasting more than 24 hours. The word used to refer to stroke in the Spanish version of the questionnaire was ACV, the acronym of "*accidente cerebrovascular*" (cerebrovascular accident). A TIA was considered to be an acute neurological deficit lasting < 24 hours with a normal physical examination beyond that time. Patients who were referred with transient symptoms but had abnormal findings on the neurological examination were considered stroke patients.

As IV rtPA efficacy decreases in a time-dependent fashion up to 4.5 hours after symptom onset and endovascular treatments can be used in selected patients within six hours, arrival time was segmented into 3, 4.5 and 6 hours between stroke onset and presentation at the emergency room, for the purpose of data analysis. To investigate the causes for which patients could not even be considered for IV rtPA treatment, patients who arrived to hospital after 4.5 hours from stroke onset were considered to have pre-hospital delay (PHD) and those who arrived to the hospital before 4.5 hours but had completed initial work-up beyond that time, were considered to have hospital diagnosis delay (HDD).

Arrival time was defined as the last time the patient was asymptomatic until arrival at hospital. If the patients were transferred from another institution, arrival time was considered to be from the onset of stroke symptoms until arrival at the first center. The term "non-specialized hospital" was used to describe centers not meeting criteria for a primary stroke center<sup>17</sup>.

We defined "educational level" as the highest level of schooling that a person has reached. It was stratified as completed elementary school, completed secondary school or university education. Patients who had an incomplete level were allocated to the immediate lower group.

## Statistical analysis

Regression analysis was performed with EMS utilization and emergency consultation as outcomes. Other variables included and/or considered potential confounders were age, gender, educational level, neighborhood, previous knowledge about stroke, history of neurological symptoms, family history of stroke, previous inpatient admission, heart disease, presence of motor or sensory symptoms, facial weakness and National Institutes of Health Stroke Scale (NIHSS) score at admission. Forward stepwise logistic regression analysis was used to determine which factors correlated with the odds of calling EMS or going to the emergency by their own means. Univariate analysis was performed for each variable and tests with  $p$  values  $< 0.25$  were ranked and kept for the next step. Age, gender, and educational level were added regardless of their  $p$  value. We then added, as a first variable, the one having the highest correlation with the dependent variable and, if it was significant, we continued with the next variable until no more were available. Partial F tests were conducted at every step, and non-significant variables were removed. Fisher's exact test was used to estimate statistical significance of the categorical data. The local ethics committee approved the study.

## RESULTS

Five patients were lost to follow up and one had died. Thus, 84 patients and 10 caregivers completed the telephone survey and were included in the final analysis.

### Demographic characteristics

Mean age was  $67 \pm 20$  years old. Sixty-four percent of patients were male. All patients had at least completed elementary school and 55% had completed college education. Thirty percent had had a stroke before the index event and 24% had relatives with stroke (Table 1). Initial symptoms and NIHSS scores on admission are presented in Table 2.

### Arrival times, pre-hospital delay and hospital diagnostic delay

Seventy patients (75%) arrived at the hospital more than 4.5 hours after onset of the stroke. Those patients were considered to have PHD. The principal causes were lack of recognition of symptoms as indicators of acute stroke and mild or transient symptoms (Table 2).

Twenty-four patients (25%) arrived at the emergency room within 4.5 hours from stroke onset, half of them ( $n = 12$ ) within 3 hours. Four of those patients had their initial work-up completed more than 4.5 hours after stroke symptoms and did not receive rtPA. They were considered to have HDD. Causes of initial HDD were misdiagnosis in three

patients and unavailability of brain imaging in one. All HDD patients were referred to our center after their first evaluation in non-specialized hospitals. The referral time was less than 24 hours in all cases. Nineteen patients (20%) were initially misdiagnosed. Eighteen of them were first assessed by a non-neurologist physician ( $p < 0.001$ ).

**Table 1.** Demographic characteristics and clinical history of patients.

Demographic Variables	n(%), n = 94
Average age (years SD)	66.5 (19.9)
Men	60
Educational level	
Primary	15 (16)
Secondary	27 (29)
University	52 (55)
Medical History	
HTA	56 (59.6)
Dyslipidemia	43 (45.7)
Prior stroke/TIA	29 (30.85)
Smoking	28 (29.7)
Atrial fibrillation	25 (26.6)
Diabetes	23 (24.5)
Familiar history of stroke	23 (24.5)
Ischemic cardiopathy	16 (17)
Oral contraceptives	6 (6.4)
Migraine with aura	4 (4.25)
Thrombophilia	1 (1.06)
Presenting symptom	
Motor	48 (51)
Language	47 (50)
Other	18 (19.15)
Visual	14 (14.9)
Headache	13 (13.83)
Sensory	10 (10.6)
Coordination/balance/walk	9 (9.6)
Loss of consciousness	4 (4.25)
NIHSS score	
$< 10$	84 (89.4)
10-20	7 (7.5)
$> 20$	3 (3.2)

HTA: hypertension ; TIA: transient ischemic attacks ; NIHSS: National Institutes of Health Stroke Scale

**Table 2.** Causes of pre-hospital and hospital diagnostic delays.

Causes of PHD	n (%), n = 70
Unawareness	30 (49)
Mild symptoms	11 (15)
Transient symptoms	10 (15)
Wake-up stroke	8 (9)
Distance to hospital	4 (6)
Misdiagnosis	7 (2)
Causes of HDD	n (%), n=4
Misdiagnosis	3 (86)
Other	1 (14)

PHD: pre-hospital delay; HDD: hospital diagnostic delay. For definitions, see Figure 1.

## Pattern of utilization of EMS

The EMS were used by 37% of patients without a significant impact on arrival time. Most patients who recognized their symptoms did not use EMS for transportation to the hospital ( $p < 0.02$ ) (Figure 2). Patients with motor symptoms were more likely to use EMS ( $p < 0.02$ ) (Figure 2). Also stroke severity, measured by the NIHSS, was associated with the use of the EMS. For each point of the NIHSS score, the chance of calling the EMS increased by 10%. Fifty-five percent of patients referred that they had received information about stroke before their event; however this did not make them more prone to call the EMS.

## IV rtPA treatment and transportation to the hospital

Ten patients (10.6%) received IV rtPA treatment. Most of them ( $n = 7$ ) arrived within three hours from stroke symptom onset. Seven out of ten treated subjects did not use the EMS and came to our emergency in their own transportation or hired vehicles.

## Interpretation of stroke symptoms

Only 21% of the patients interpreted their initial symptoms as consistent with stroke. This group was more likely to arrive within six hours (adjusted OR 2.96 95%CI 1–8.7  $p < 0.05$ ). Also a trend in the odds of consultation in the first three, and four-and-a-half hours was found among them, but this did not reach statistical significance. Motor symptoms and speech disturbances were the most frequently-recognized symptoms. There was no relationship between past history of stroke or higher educational level and the correct interpretation of symptoms.

Patients with visual symptoms tended to consult at ophthalmological medical institutions first (adjusted OR 0.11, 95%CI 0, 02–0.55,  $p < 0.01$ ) and those with prior stroke came directly to our institution (adjusted OR 5.8, 95%CI 1.81–18.6,  $p < 0.01$ )

## DISCUSSION

Compared with prior studies<sup>14</sup>, our population showed a higher educational level. All individuals had at least

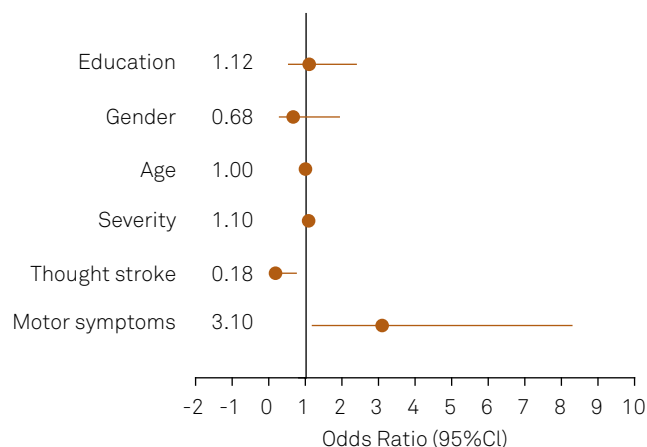


Figure 2. Factors associated with the use of EMS for transportation.

completed elementary school and 55% had a college degree. In this population, economic and educational levels may be higher than the average in Argentina<sup>16</sup> and in other Latin American populations. However, we did not find an association between educational level and correct stroke symptom interpretation or proper use of EMS.

Only 21% of patients recognized their initial symptoms as consistent with stroke. This percentage is lower than previous reports in Spanish speakers<sup>14</sup>. Recognition of stroke symptoms tripled the chances of consultation in the first six hours from symptom onset. A trend in the odds of consultation in first three and 4.5 hours was also found among those who recognized their symptoms as stroke, but without reaching statistical significance. Similar findings have been previously published in Spain<sup>14</sup>. It is remarkable that, despite most people seem not to acknowledge that they were having a stroke, they did know something was wrong enough to go to the hospital.

About 37% of subjects used the EMS, suggesting poor knowledge of its availability, lack of confidence in this system, and/or prior poor experience with its utilization. The association between motor symptoms and stroke severity and use of EMS suggests that, in this population, the reasons to call the ambulance were mainly physical difficulties in using their own transportation.

Counterintuitively, the use of the EMS was not associated with shorter arrival times. Moreover, most patients who acknowledged they were having a stroke and who were later treated with IV rtPA did not use EMS for transportation. Although this finding neither demonstrates a negative impact on EMS, nor points towards a recommendation for not using them, it does raise several areas for future analysis.

In Argentina, possibly less than 1% of patients with acute stroke receive IV thrombolysis, and this is mainly in private centers<sup>18,19</sup>. Emergency services not being focused on diagnosis, triage and rapid transportation of possible candidates for IV rtPA treatment can, at least in part, be responsible for this. Buenos Aires does not have an organized system of stroke care and predefined protocols for rapid referral of patients to stroke centers. Further studies are needed to establish if EMS are playing a detrimental role in the rates of thrombolysis compared to patients who did not use them.

In contrast to the average thrombolysis rate reported in Argentina, this group had a high rate of thrombolysis (10%). This reflects the advantage of access to specialized stroke care in this region, as well as the potential selection bias of a group of patients from a single private hospital.

Prior stroke or TIA has been associated with recognition of stroke symptoms in several studies<sup>20,21,22</sup>. Differing from them, we did not find this association. Our finding may reflect a lack of education about stroke as part of secondary prevention programs.

Frequent misdiagnosis of stroke has been described among non-neurologist medical providers<sup>23</sup>. The presence of

a neurologist in the emergency room has been proposed as a solution to improve this situation<sup>24</sup>. Overall, 20% of patients in our study were initially misdiagnosed in non-specialized hospitals or EMS, this being the principal cause of HDD and a cause of PHD. Additionally, nine subjects arrived at the emergency department in under 4.5 hours from symptoms onset despite having been initially misdiagnosed. Misdiagnosis was evident almost exclusively among non-neurologists physicians. This point is particularly concerning given that only 8.4% of patients with stroke are initially evaluated by a neurologist in Argentina<sup>18</sup>.

Our study has some limitations. Patients were contacted one to seven months after the index stroke. This may have introduced a recall bias. However, the recognition of stroke symptoms was poor even assuming that a recall bias could falsely increase the percentage of patients claiming correct stroke awareness. Additionally, excluding the questionnaire, data used for the analysis was taken from hospital records

and it was not affected by this bias. Also, we did not obtain firsthand information for 16 subjects, five were lost to follow up, one died and 10 subjects were unable to answer. In the last group, caregivers were contacted to help with the responses.

In conclusion, even in subjects with high economic and educational level, these results suggest low stroke awareness in our population. Educational programs about stroke warning symptoms as part of secondary prevention strategies for stroke patients are needed to improve early recognition in this high-risk population, given that prior stroke does not improve the recognition of new events.

The role and procedures of EMS in Argentina should be revised as their use did not improve arrival times at the hospital. Also, stroke symptom recognition was associated with the non-utilization of EMS.

Lastly, misdiagnosis by non-neurologist medical providers is concerning. Programs to address stroke knowledge among them are needed to plan future educational interventions.

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