

Stroke Code: analysis of Emergency Department care times in Galicia

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OBJECTIVE. To analyze the impact of emergency department care times on quality of life in patients with stroke.

METHOD. Longitudinal retrospective observational study in patients with stroke in the province of Ourense, Galicia. We analyzed demographic variables (age and sex), hospital variables, care times in each of the steps after code activation, patient quality of life, and 30-day mortality.

RESULTS. We studied 153 patients with a mean (SD) age of 76 (12) years; 83 (54%) were women. Mean time to arrival at the hospital was 100.72 (142.90) minutes. The only difference associated with patient sex was in door-to-doctor time ($P < .05$). No differences in care times were found to be associated with patient quality of life. Care in the hospital in Verín was significantly associated with door-to-doctor times ($P = .032$), time to computed tomography scan ($P = .024$), and management of fibrinolysis treatment.

CONCLUSIONS. Care times related to hospital location and patient sex should be improved.

Key words: Emergency care times. Code stroke. Mortality. Quality of life.

Código ictus: análisis de los tiempos asistenciales en Servicios de Urgencias Hospitalarias de Galicia

OBJETIVO. Analizar en pacientes con ictus, el impacto en calidad de vida de los tiempos de atención en urgencias hospitalarias (SUH).

MÉTODOS. Estudio longitudinal, retrospectivo y observacional de pacientes con código ictus en la provincia de Ourense, Galicia. Se analizaron variables demográficas (edad y sexo), hospital de asistencia, calidad de vida del paciente, mortalidad a los 30 días y tiempos asistenciales en cada paso de la activación del código ictus.

RESULTADOS. Se recogieron 153 casos [edad media 76 (SD12) años, y 54% mujeres]. El tiempo de llegada al hospital fue de 100,72 (SD 142,90) minutos. No hubo diferencias entre el sexo de los pacientes y los tiempos del SUH a excepción del tiempo transcurrido entre la llegada al hospital y la atención médica recibida ($p < 0,05$). Hubo relación significativa entre los tiempos asistenciales y las variables sexo, hospital de referencia y mortalidad a los 30 días. Para el sexo, se encontraron diferencias en el tiempo puerta-atención médica ($p < 0,05$). No se encontraron diferencias entre los tiempos y la calidad de vida de los pacientes. Entre hospitales, hubo diferencias entre los tiempos de atención médica ($p = 0,032$), la realización de la tomografía computarizada ($p = 0,024$) y el tratamiento de fibrinólisis.

CONCLUSIONES. Los factores a mejorar en cuanto a tiempos asistenciales se relacionan con el sexo de los pacientes y con la localización del hospital.

Palabras clave: Tiempos en urgencias. Código ictus. Mortalidad. Calidad de vida.

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Article Information: Received: 30-4-2022. Accepted: 3-5-2022. Online: 13-5-2022.

Editor in Charge: Guillermo Burillo Putze.

Introduction

It is estimated that around 15 million people worldwide suffer a stroke each year, with a global average incidence of 200 new cases per 100,000 inhabitants according to the World Health Organization (WHO).¹ Of these 15 million individuals, one third die and another third are left with permanent disability.² Numerous studies have highlighted the importance of early activation of the stroke code,³ as well as the importance of early transport to the reference center by emergency medical services, as this is associated with faster evaluation and treatment.⁴ Acute therapies applied in the context of ischemic stroke have emphasized the need for evaluations and treatments within the emergency department (ED) as quickly as possible.

The objective of this study is to analyze the impact of ED times in stroke patients in the hospitals of the province of Ourense who were admitted for fibrinolysis/thrombectomy to determine whether there is a relationship between delays in medical care and complications arising from the cerebrovascular accident, age, sex, and patient mortality. Another aim is to analyze the relationship between arrival times to the hospital from the moment the event occurred, to determine whether geographic factors influence stroke progression.

Method

We conducted a longitudinal, observational, and descriptive study of patients from the Ourense Healthcare Area who met the criteria for activation of the stroke code (Table 1) and were included in the Galician regional stroke code registry from October 1st, 2018 through October 1st, 2020. From these, those patients who underwent fibrinolytic treatment or thrombectomy were selected.

The variables analyzed were grouped as dependent and independent. The dependent variables recorded were: sex (female/male), age (stratified as < 80 years and ≥ 80 years), hospital to which the patient initially presented (Ourense, Verín, O Barco de Valdeorras) (Figure 1), 30-day mortality after the event, and Rankin score (patient quality of life in the first 3 categories: 0, 1, and 2) (Table 2). The independent variables were time at which the event occurred, time of arrival to the emergency department, time of evaluation by the emergency physician, time of brain computed tomography (CT), time of initiation of



Figure 1. a) Map of the Autonomous Community of Galicia. b) Hospitals where patients were recruited and fibrinolysis was performed. c) Hospitals to which patients were transferred for thrombectomy.

fibrinolysis, and time of thrombectomy. Using these, the time delta for each of the eight phases analyzed from the moment the stroke code was activated was calculated (Table 3).

For analysis of the independent (time) variables, the standard deviation, mean, and median were calculated by sex, age, and hospital. Normality tests were performed using the Kolmogorov–Smirnov test, and correlations between quantitative variables were assessed using Spearman’s coefficient due to the nonparametric nature of the data. To determine the level of association between time variables and qualitative variables (sex, age, and hospital), the nonparametric Kruskal–Wallis (K-W) and Mann–Whitney (M-W) tests were applied.

If any of the analyzed times showed differences among hospitals, a pairwise comparison test was performed to determine whether the difference corresponded to a single hospital or to all 3 equally (Ourense, Verín, O Barco de Valdeorras).

Table 1. Inclusion criteria for activation of the stroke code

– Age: between 18 and 85 years, inclusive.
– Symptom onset to hospital door: < 4.5 hours.
– Baseline patient status: Rankin score ≤ 2.
– Current neurological focality at diagnosis: presence of any stroke-suspected symptoms.
1. Sudden numbness, weakness, or paralysis of the face, arm, or leg on one side of the body.
2. Sudden confusion.
3. Difficulty speaking or understanding.
4. Sudden loss of vision in one or both eyes.
5. Severe, sudden headache without apparent cause, associated with nausea and vomiting (not attributable to other causes).
6. Difficulty walking, loss of balance, or coordination.

Table 2. Modified Rankin Scale. Degree of patient quality of life (Grades 3 to 6 are explained without stroke code inclusion criteria)

0 – Asymptomatic	
1 – Very mild:	Performs usual tasks and activities without limitations.
2 – Mild:	Unable to perform some previous activities but does not require assistance.
3 – Moderate:	Requires some help; walks independently.
4 – Moderately severe:	Dependent for basic activities of daily living but does not require continuous supervision (can manage personal needs without help).
5 – Severe:	Completely dependent; requires continuous care.
6 – Death	

Table 3. Times of the different care phases of the stroke code

Description	Mean (min)	SD (min)	Percentile		
			25%	50%	75%
Time between stroke onset and hospital arrival	100.72	142.901	47	77	115
Time between medical evaluation and hospital arrival	13.19	54.454	2	5	10
Time between medical evaluation and stroke onset	92.06	57.479	55	79.5	129.75
Time between CT and medical evaluation	18.92	18.797	7	13.5	25
Time between CT and hospital arrival	49.19	168.99	12	18	37.5
Time between CT and stroke onset	117.43	126.51	66	99	144
Time between medical evaluation and fibrinolysis	99.4	123.83	34	54	140.5
Time between CT and fibrinolysis	111.65	105.63	48	75	164

SD: standard deviation; CT: computed tomography.

A 95% confidence interval was used, so P values $< .05$ were considered significant. Statistical analysis was performed using IBM SPSS v22 for Windows and R version 3.5.2.

Ethical considerations

This study was conducted in full compliance with principles of respect for the patient outlined in the Declaration of Helsinki and was approved by the Research Ethics Committee of Pontevedra-Vigo-Ourense, reference 2019/635.

In addition, compliance with European Regulation EU 2016/679 along with Organic Law 3/2018 of December 5 on the protection of personal data and digital rights was ensured, including the acquisition, processing, storage, communication, and transfer of data.

Results

A total of 153 patients were included, with a mean age of 76 years (SD, 12), of whom 54.2% (83) were women. Overall, 47.7% were older than 80 years. Fibrinolytic treatment was administered to 55.3% of patients, 19.1% underwent thrombectomy, and the remaining 25.7% received both therapies (fibrinolysis + thrombectomy).

Regarding patient quality of life, 66.4% (99 patients) corresponded to Rankin 0. Thirty-day mortality was 13.1%. Most patients (86.3%) were treated in the emergency department of Ourense Hospital (132 patients), 11 in Verín Hospital, and 10 in Hospital "O Barco de Valdeorras" (Ourense, Spain).

The mean time elapsed between the event and arrival at the ED was 100 minutes (SD, 142). The delay until the first medical evaluation was 13.19 minutes. The minutes elapsed between stroke onset and hospital arrival, and between arrival and head CT, were 117.43 (SD, 126.51) and

49.19 minutes (SD, 168.99), respectively. The 75th percentile of the times to first medical evaluation, CT, and fibrinolysis initiation exceeded 120 minutes (Table 3).

No statistically significant association was found between patient sex and ED times, except for the interval between hospital arrival and first medical evaluation ($P < .05$) (Table 4).

Regarding differences between ED times and the hospital at which the patient was treated, no statistically significant differences were found except for the interval between CT and fibrinolysis ($P < .05$). A similar association was found between the interval from CT to first medical evaluation in the ED ($P = .032$) (Table 3).

To determine which hospital showed the gap in care times, 2 pairwise comparisons were performed: one evaluating the CT-to-fibrinolysis interval, and the other one evaluating the CT-to-first-medical-evaluation interval. For the first case, a statistically significant association was found ($P = .021$) among patients treated in Verín. A similar result ($P = .026$) was found for the same hospital in the second comparison.

When analyzing the 2 age groups into which the patients were categorized, no statistically significant association was found between patient age and ED care times.

A statistically significant association was identified between the event-to-hospital arrival, event-to-first medical evaluation, and event-to-CT intervals and 30-day mortality ($P < .05$). No differences were found for the remaining time intervals ($P > .05$).

Similarly, a weak but positive association was found for the event-to-hospital arrival interval ($r_s = 0.208$) and the event-to-first medical evaluation interval ($r_s = 0.259$), both with $P < .05$.

Tabla 4. Hypothesis testing and correlation coefficients for hospital emergency department wait times

Variable	P value				rs
	Sex	Hospital	Coded age	Mortality at 30 days	Rankin
Time between stroke onset and hospital arrival	.656	.872	.263	*.029	.208
Time between medical evaluation and hospital arrival	*.006	.901	.353	.564	.062
Time between medical evaluation and stroke onset	.433	.766	.662	*.027	.259
Time between CT and medical evaluation	.394	.582	.905	.789	.090
Time between CT and hospital arrival	.22	.777	.216	.138	*.050
Time between CT and stroke onset	.643	.987	.269	*.030	.180
Time between medical evaluation and fibrinolysis	.688	*.024	.436	.297	-.097
Time between CT and fibrinolysis	.164	.032	.507	.251	-.123

CT: computed tomography.

Discussion

In this study, we found differences between ED times and the hospital to which the patient presented. Reasons related to accessibility and geographical location of the health care center could explain this.⁵ This association was specifically found in the CT-to-fibrinolysis and evaluation-to-fibrinolysis intervals in Hospital de Verín (Ourense, Spain). These associations may be influenced by geographical factors and staff availability at this center, resulting in delays in performing CT or subsequent fibrinolysis. Such an association was not found in Hospital "O Barco de Valdeorras" (Ourense, Spain), which is located farther from thrombectomy referral centers.

Regarding demographic aspects, no relationship was found between patient age and hospital arrival times (event-to-door). However, studies such as that by León *et al.*⁶ found that one of the factors associated with arriving at the hospital within the first 3 hours was belonging to the 40–69-year age group, a finding also highlighted by Bayona *et al.*⁷ Additionally, we believe it is important to note the high variability between stroke onset and hospital arrival, suggesting that factors other than age may influence arrival time, such as health history, family history, or education level.⁶⁻⁹

Regarding 30-day mortality, a statistically significant association was found with the event-to-door, event-to-first medical evaluation, and event-to-CT intervals, demonstrating the importance of rapid hospital arrival and prompt care for patient survival. Indeed, it has been shown that arrival within 3 hours reduces hospital complications and mortality at 3 months.^{6,10,11}

Additionally, no significant linear association was found between patient quality of life (Rankin ≤ 3) and ED times. However, these results are not entirely conclusive. The association between ED times, hospital arrival, and the development of post-stroke symptoms had already been reported in 2011 by Bruno¹² and by Bouckaert,¹³ who independently identified a relationship between ED care times and reduction in patient complications.

Future studies could analyze in greater detail the relationship between ED care times and stroke severity (Rankin > 3), considering social factors such as education level, socioeconomic status, ethnicity, and stroke awareness, as well as clinical factors: stroke type, health history, family history, hypertension, dyslipidemia, etc. This would help verify whether reductions in care times are influenced by these variables.

Naturally, this study has limitations, primarily its retrospective design, its specific geographical setting, and the relatively small sample size. Additionally, only cases in which intervention for ischemic stroke (fibrinolysis or thrombectomy) was performed were included, potentially introducing selection bias affecting overall and hospital-specific care times. Nonetheless, we believe this does not invalidate the results, which allow for the generation of new hypotheses aimed at improving care quality and health outcomes.

In conclusion, the main factors associated with care times are hospital location and patient sex, with women experiencing longer delays. Likewise, the time elapsed between symptom onset and initial ED care is critical to maintaining patient quality of life.

ARTICLE INFORMATION

Conflict of Interest Disclosures: None reported.

Funding: The authors declare the non-existence of funding in relation to this article.

Ethical Responsibilities: The authors have confirmed the maintenance of confidentiality and respect for the patient rights, agreement of publication, and transfer of rights to Revista Española de Urgencias y Emergencias.

Article not commissioned by the Editorial Board and with external peer review.

Note of the editors: This is a BOWMAN-generated English translation of the officially indexed Spanish-language article, which should be cited as *Rev Esp Urg Emerg.* 2022;1:20-24. In this translated version, the editors have supervised the process; however, it cannot be ruled out that some errors resulting from the artificial intelligence translation process may have gone unnoticed.

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