

Characterization and functionality of individuals treated at a Stroke Unit in the Santa Catarina North Plateau (Brazil)

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SUMMARY

Introduction: Known as the most disabling chronic disease, stroke affects not only the individual, but also their family and society. The percentage of individuals who remain with functional disabilities varies according to access to health services, quality of care, and secondary prevention. Among the treatment approaches, the Stroke Units (U-Stroke) enable advances in prognosis, with an 18% reduction in mortality, 25% in institutionalization, and 29% in functional dependence.

Objective: To characterize post-ischemic stroke patients hospitalized in U-stroke in epidemiological, clinical, and functional profile. **Methods:** Sociodemographic data, etiology, stroke severity, and functionality were collected using the following tests, respectively: Acute Stroke Treatment (TOAST), National Institute of Health Stroke Scale (NIHSS); Functional Independence Measure (FIM); Modified Rankin Scale, in the hospital, 30 and 60 days post-stroke by telephone contact.

Results: 73 patients identified, 44 participated in the study, 79.5% were over 61 years of age; 56.8% were men, 88.6% were white, 84% had incomplete primary schooling, 77% had an income of up to one minimum wage, and 79.5% attended the health center. Clinically, 96% had modifiable risk factors. Infarctions of cardioembolic origin in addition to indeterminate infarctions were the main etiologies (68%). The proportion with mild stroke was the minority (5%), but only 9% were eligible for thrombolytic therapy. Reasons for missing the therapeutic window was failure to identify the stroke by family members (34%); delay in the transfer of municipalities to U-stroke (18%); the two added together corresponded to an increase of 12%. In the total FIM, 54% were fully dependent, 39% moderately dependent, and 7% independent. As motor FIM 70% full dependents, 23% moderate dependents and 7% independent. Regarding the evolution of functionality, at discharge, 82% were dependent with severe disability; 30 days, 57% were already walking independently, and seven individuals died; 60 days, 27% were insignificant; 29% were moderately disabled; 23% were severely disabled and one died. **Conclusion:** The presence of modifiable risk factors and significant loss of the therapeutic window were highlighted, possibly due to the delay in the identification of the stroke, and even the transfer of these to the U-stroke. Positively, an improvement in functional status was observed over time in the population under the care of the U-stroke. The findings allow us to elucidate the characteristics of post-stroke individuals and raise problems that can be implemented by public health education and regional health policies.

Keywords: Epidemiology, Stroke, Health centers, Functional status, Health education.

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INTRODUCTION

Known as the most disabling chronic disease, cerebrovascular accident (stroke) affects not only the individual, but also their family and society¹. Although the incidence and mortality rate have decreased in recent decades due to the awareness of the general population about the risk factors and primary care of acute stroke², the number of individuals with severe stroke sequelae is still alarming. This is more evident in developing countries such as Brazil, where approximately 610,000 cases of acute stroke are observed each year^{3,4}, and in the last ten years there have been almost two million hospitalizations for treatment of the disease. This is an economically catastrophic fact for the Unified Health System (SUS), which accounts for an average cost per day, considering the average length of hospital stay that is also prolonged⁵.

The significant social and family impact goes beyond the mortality rate (8.8 – 25.6 % according to age group⁵), as there is also a high risk of post-stroke depression⁶, as well as a reduced level of independence⁷. Thus, it is known that care in the acute phase must be agile and effective⁸, given that 1.9 million neurons are lost every minute when stroke is not treated⁹. In ischemic stroke, the infarcted area (irreversible damage) is surrounded by a penumbra zone, which has great potential for recovery if the patient is submitted to timely intervention^{10,11}.

Among the treatment approaches, the Stroke Units (U-Stroke) enable advances in the prognosis of affected individuals, generating an 18% reduction in mortality, 25% in institutionalization, and 29% in functional dependence¹². In this context, in addition to the U-strokes providing organized care¹³, they qualify as regional health references for

stroke care, acting as important centers in the outcome of this scenario^{14,15}. Therefore, this study aimed to characterize post-ischemic stroke individuals hospitalized in type II U-stroke of regional reference for the Northern Plateau of Santa Catarina regarding the epidemiological, clinical, and functional profile.

MATERIALS AND METHODS

This study was conducted prospectively, observationally, and longitudinally, between Nov/2019 and Dec/2020. Approved by the Research Ethics Committee via Brazil Platform (No. 3.609.943).

Population

Individuals hospitalized in U-stroke at Hospital São Vicente de Paulo (HSVP), Mafrá-SC, a reference hospital for the Northern Plateau of Santa Catarina. Inclusion criteria: adults (≥ 18 years); both sexes; post-stroke with diagnosis confirmed by computed tomography (CT) or magnetic resonance imaging (MRI). Exclusion criteria: Transient Ischemic Attack (TIA); history of previous stroke that has caused sequelae according to Modified Rankin Scale (mRS) (mRS ≥ 1) (confirmed by the patient, family member, or medical record); hemorrhagic stroke or ischemic stroke with hemorrhagic transformation (by follow-up CT scan between 24 and 36 hours after admission); or other neurological and orthopedic diseases that could lead to motor deficits or functional alterations other than those caused by stroke (Parkinson's; Amputations).

Data collection

During hospitalization, sociodemographic data were collected (age, education, presence of cardiovascular risk factors, and

previous stroke/TIA), municipality of origin, type of transportation, *Ictus*, and time of arrival at the U-stroke in the therapeutic window (considered a time of < 4.5 hours)¹⁶.

Stroke subtypes were classified into 5 categories based on etiology, using the TOAST classification: *Acute Stroke Treatment* (TOAST)¹⁷. Severity was defined at admission according to the application of the NIHSS, and stroke was classified as mild (score 1 to 4), moderate (5 to 14), moderate/severe (15 to 20) and severe (score ≥ 21)¹⁸.

The level of functional independence was assessed by FIM¹⁹, through 18 motor and cognitive tasks of daily living with a score between 1 (total dependence) and 7 points (independence) for each task, with the final score classified as complete dependence ≤ 63 points; moderate dependence between 64-107 points and independence ≥ 108 points. According to the proposed classification¹⁹, considering only motor activities, complete dependence ≤ 45 points; moderate dependence between 46-77 points and independence ≥ 78 points) are considered in the motor FIM.

The characterization of the level of initial functional disability (hospital discharge) was measured by the Modified Rankin Scale (mRS)²⁰. mRS is based on global disability (physical disability) and is then classified into six levels of disability, as follows: (0) absence of symptoms; (1) no significant disability; (2) mild disability; (3) moderate; (4) moderately severe; (5) severe; (6) death. The classification proposed by Magalhães et al. was also used in this study²¹, with scores of 1 for non-significant disability (referring to 0 and 1 in the mRS), 2 for moderate (2 and 3 MRS) and 3 for severe disability (4 and 5 MRS). MRS was also measured at 30 and 60 days after the

vascular event, using the Brazilian and validated version of the MRS interview applied via telephone contact²².

Statistical analysis

For the characterization of the sample, descriptive statistics were performed by means of absolute and relative frequency (categorical variables) and by measures of position and dispersion (numerical variables), using GraphPadPrism 9.0 demo.

The differences in the variables between the different post-stroke groups were analyzed using *the Mann-Whitney U* test for numerical variables and the Chi-square test (X^2) for categorical variables, used due to the non-parametric distribution of the data (*Kolmogorov-Smirnov*).

RESULTS

The study population consisted of 73 individuals, however, 39.7% met the exclusion criteria, and the main cause was due to the presence of associated neurological diseases (Parkinson's, brain tumor, polyneuropathy, hemorrhagic stroke, and TIA). In the *follow-up segment*, there was a loss of an individual due to the impossibility of telephone contact. The mean age group was 72 ± 13.59 years, with the following distribution: 79.5% were elderly (>61 years); 16% mature adult (46-60 years); 4.5% average adult (31-45 years); and no young adults (21-30 years)²³. Population characterized by a predominance of males; white race; with schooling with only incomplete elementary school; income of up to one minimum wage; and attendees of the public health system (Health Unit/Basic Health Unit) (Table 1).

Table 1. Population characterization

Variables	Total (n=44)
Sex	F 19 M 25
Age	72±13.59* years
Race	88.6 % white
Schooling, n (%)	
Illiterate	7%
Incomplete Elementary School	84%
Fundamental; High School and Higher Education	9%
Family income (minimum wage)	
Up to 1	77%
1 a 3	18%
6 a 9	2%
9 a 12	2%

*dp = Standard deviation; % = percentage of the total sample.

F= Female; M = Male.

Regarding the origin of the individuals studied, only 34% were from the same municipality as the U-Stroke (Mafrá/SC), demonstrating the representativeness of the unit in the region and a reference for care for the condition. Interestingly, when analyzing the type of transport

used in the transfer of individuals to the U-stroke, the municipal ambulances had the highest representativeness (65.9%), followed by the Emergency Mobile Care Service (EMCS) (25%) and the Fire Department (6.8%) (Figure 1).

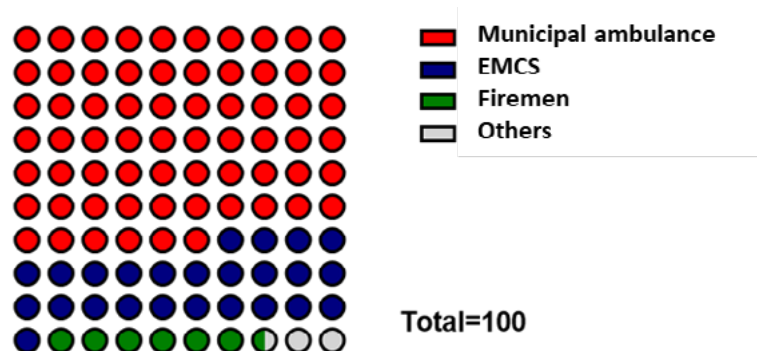


Figure 1: Projected distribution for percentage in relation to the types of transport used for the transfer of the patient to the U-stroke. Date produced in GrapPadPrism 9.0 demo.

These data interfere and reflect a lot on the therapeutic window, since it was found that only 9% of the individuals were eligible for thrombolytic therapy, a value that is significantly important if we consider that only 5% of the population had mild severity for the vascular episode (NIHSS). As for the reasons reported and computed to justify the arrival outside the therapeutic window, these were: failure to identify the stroke by family members (34%), delay during the regulation/transfer of the municipalities to the U-stroke (18%) and both reasons that corresponded to another 12%.

According to the findings, 96% of the population had at least one modifiable risk factor. Among these, there was a higher frequency of sedentary lifestyle (84%) and Sys-

temic Arterial Hypertension (SAH) (79%), followed by heart disease (41%), diabetes mellitus (32%) and dyslipidemia (25%). Considering previous events, 48% had a history of previous stroke or TIA without sequelae. Regarding the treatment of modifiable risk factors, 73% of the patients with hypertension received treatment and only 4.5% of the patients diagnosed with atrial fibrillation (AF) (22.7%) used anticoagulants.

When the etiology by TOAST was analyzed, cardioembolic infarction was the most prevalent etiology (68%). However, due to the impossibility of determining the etiology of most of the events, the prevalences could possibly be redesigned, considering that microangiopathy and atherosclerosis also had significant prevalences for the sample.

Table 2. Risk factors and etiology of stroke

Variables	Percentage
SIDE Affected, (Right)	23%
Presence of at least 1 risk factor	Total of 96%
Systemic Arterial Hypertension (SAH)	79%
Heart disease	41%
Diabetes Mellitus (DM)	32%
Dyslipidemia	25%
Alcoholism	18%
Smoking	Yes, 20%; No, 73%; Former smoker, 7%
Obesity (by BMI)	23%
Sedentary	84%
Atrial fibrillation (AF)	22,7%
Previous stroke	41%
Prior TIA	7%
Previous use of anticoagulant	9%
Etiology of ischemic Stroke (TOAST)	
Undetermined Origin	34%
Cardioembolism	34%
Occlusion of Small Arteries (lacunar)	18%
Atherosclerosis of the Great Arteries	14%
Other Etiologies	0

*Stroke = cerebrovascular accident; BMI = Body mass index; TIA = Transient Ischemic Attack.

As expected, and predicted by the literature, most of the sampled population had moderate to severe post-stroke impairment/sequelae (68%) with aphasia present in half of the total population (50%). The level of functional independence, when assessed by the FIM, was considered through the executability of 18 motor and cognitive tasks of daily living. Regarding this, when the mean score of motor function and total FIM is analyzed, the interpretation leads to the perception of complete dependence for

motor activities, as well as cognitive dependence for tasks of daily living, respectively. However, when analyzing the distribution of this analysis in the population, it is noted that regarding the total FIM: 54% were completely dependent, 39% moderately dependent and 7% independent; in relation to motor FIM, the levels of functionality were 70% for complete dependents, 23% for moderate dependents and 7% for independent dependents (Table 3).

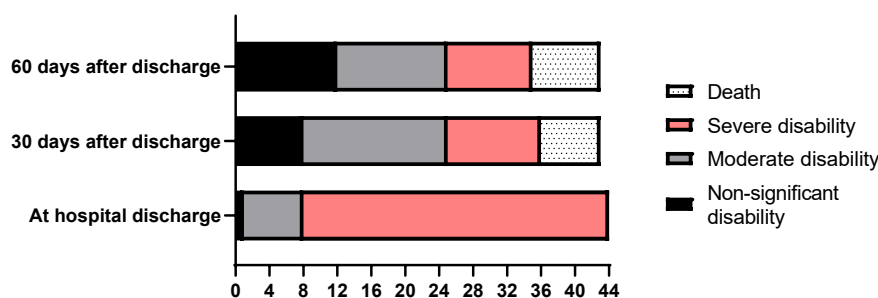
Table 3. Stroke Severity, Functionality, and Independence

NIHSS	Percentage
Mild impairment	11%
Moderate impairment	46%
Moderate/severe impairment	11%
Severe impairment	11%
Missing data	21%
Aphasia	
No aphasia	50%
Mild to moderate	27%
Grave	14%
Mutism	9%
FIM	Average, dp*
FIM motor	39.84±20.86 points
FIM total	62.42±29.7 points
- Full dependents, 54%	
- moderate dependents, 39%	
- Independent, 7%	
Average length of hospital stay	6.72±4.23 days

*dp = Standard deviation; FIM = Measure of Functional Independence.

Also evaluating the patient's level of disability as a whole and, consequently, their level of functional dependence, by the mRS score, it was found that at the time of hospital discharge, 82% of the individuals had severe functional disability, i.e., complete dependence. In the first thirty days after hospital discharge, 57% were already

walking independently and seven individuals died (15.9%). At sixty days, 29% had moderate disability, 27% had negligible disability; 23% reported severe disability and one individual died. Statistical analysis confirmed a significant increase in functionality over time (p<0.0001 value by the chi-square test) (Graph 1).



Graph 1: Graphical representation of the distribution of individuals according to mRS at hospital discharge, 30 days post-discharge and 60 days post-discharge. Data produced in GrapPadPrism 9.0 demo.

DISCUSSION

The epidemiological characterization of populations in transition, as well as their disease burden, lead to the structuring of health planning and strategies at their different levels of care²⁴. The present study allowed us to identify epidemiological, clinical, and functional characteristics of post-ischemic stroke individuals hospitalized in the U-stroke, a reference unit for high-complexity care in the Northern Plateau region of Santa Catarina. In this scenario, the presence of modifiable risk factors and loss of the therapeutic window are highlighted, as well as a significant improvement in functional status in the monitored sample.

The treatment of stroke patients in a dedicated hospital unit (U-stroke) has a high level of evidence in the literature (level 1A)²⁵, with studies demonstrating a reduction in hospitalization time and better access to rehabilitation, in addition to better functional outcomes²⁶. The U-stroke of the study in question, based on the population of the municipality of Mafra, is a reference for 13 municipalities in the region, with an estimated population of 367.521 habitants distributed in an area of approximately 10.000 km². The qualification of a unit by the Ministry of Health guarantees exclusive hospital beds to guarantee comprehen-

ve care to referred patients, in addition to health professionals trained for neurological emergency care. Specific imaging tests, clinical care, investigation of the etiological diagnosis and early rehabilitation. These structures are of paramount importance for meeting national guidelines, acting in integrated and multiprofessional care¹².

With regard to the treatment of acute stroke, there are time targets between hospital care, medical evaluation, diagnosis, and eligibility for thrombolytic, clinical, or surgical therapy²⁷ in an attempt to reduce the severity of sequelae by controlling the radius of the central ischemic zone and recruitment of cells from the penumbra zone¹¹. However, in the population studied here, 64% of the individuals had already arrived at the U-stroke outside the therapeutic window, and only 9% of those who arrived were eligible and underwent thrombolysis. In view of the results, two weaknesses in the Stroke Survival Chain²⁷ are reinforced, the first is related to the recognition of signs and symptoms and the second is due to the lack of synchronism during the regulation and transfer of the patient. In this regard, this study is in agreement with other Brazilian studies, which have already reported the same problems²⁸. Population studies reveal that a minority of Brazilians (10-15%)

refer to thrombolytic treatment when asked about the possibilities of stroke treatment, demonstrating a lack of information on the part of the population²⁹.

As for the epidemiological characteristics, the findings here agree with population data from the international literature, such as the overwhelming representativeness of individuals with low schooling. Evidence shows that low levels of formal schooling contribute to the increase in stroke frequency, as well as negatively influence the recovery of functionality^{30,31}. In relation to social aspects, the economic profile between the middle and lower classes was also the most representative and is also considered a risk factor for cardiovascular diseases³².

Still on risk factors, 90% of strokes could be avoided by controlling modifiable factors for cerebrovascular diseases³³. Among these, hypertension is the main and most significant³⁴, not differing from what was found in the present study, considering that even though 73% reported being under treatment, stroke still occurred. Here, we highlight that probably the treatment goals needed to be better evaluated or the patient's adherence to treatment itself. Within the same observation, a sedentary lifestyle was significantly prevalent in these individuals, which leads to the perception of the immediate importance of primary health care actions for the control of related morbidity and mortality^{35,36}.

Thus, the existence of U-stroke in health regions has a central representation in the strategy, prevention, and care of stroke, because it channels patient care and is an important database on the epidemiological scenario. In this scope, because the study was carried out in patients admitted and treated in U-stroke, the main etiologies of the event can also be identified,

which corroborates other studies that show the same prevalence^{37,38}.

In general, the initial severity is inversely proportional to the prognosis of motor and functional recovery. In the population studied here, stroke caused moderate to severe impairment (NIHSS), so with significant neurological deficits, a fact that probably influenced the level of independence during the hospitalization phase (FIM). As well as, at the time of discharge, when they presented severe initial disability, then, unable to walk and meet their own needs without assistance, or even restricted to bed (MRS). Unlike patients with mild or moderate initial disability, who usually reach the peaks of functional recovery up to three months post-stroke, it is expected that patients with severe initial disability may take a long time to show gains in functional recovery, leaving them to the late subacute phase, then, six months post-stroke. However, in the first thirty days after stroke, significant gains in independence were computed with good functional recovery over time. In this context, the findings are in agreement with the *Stroke Unit Trialists' Collaboration*, which demonstrates in randomized studies that patients maintained in U-stroke have better chances of survival, are able to return to their homes and achieve higher levels of independence in activities of daily living, compared to those treated in regular wards^{12,39}. It is worth noting that no information regarding the functional rehabilitation of these patients was taken.

CONCLUSION

The present study, in a pioneering way, allowed the identification of epidemiological, clinical, and functional characteristics of post-ischemic stroke individuals hospitalized in a regional reference U-stroke

for the Northern Plateau of Santa Catarina, Brazil. For this population, the presence of modifiable risk factors and significant loss of the therapeutic window by these patients was highlighted, possibly due to the delay in the identification of stroke by family members, and even the transfer of stroke to the reference U-stroke in the health region. Positively, it was observed in the population under the care of the U-stroke that over the months there was a statistically significant improvement in functional status. Thus, the findings presented here allow us to elucidate the characteristics of post-stroke individuals, as well as raising problems that can be implemented in public health education and regional health policies.

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