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Original Article

Characterization of patients treated by rehabilitation service after establishing of an acute stroke unit in a Brazilian hospital

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Abstract. [Purpose] The study aimed to characterize patients treated by rehabilitation section after establishment of an acute stroke unit. [Subjects and Methods] Medical consultation records of individuals with ischemic stroke were studied retrospectively, excluding individuals with hemorrhagic stroke, thrombolysis, previous Modified Rankin Scale ≥ 1, prior stroke, structural bone deformities, associated neurological disease, and prior cognitive deficit. The data evaluated were age, gender, etiology, localization, treatment received, ictus onset, hospitalization time, discharge date, and date of first evaluation at the rehabilitation center. The Modified Rankin Scale in 90 days after ictus was utilized to measure functional incapacity with the individuals divided into two groups, before and after acute stroke unit implementation (2010). Functional incapacity was compared between before and after acute stroke unit implementation by the Mann-Whitney test, χ^2 test and Fisher's exact test. [Results] The medical records of 170 patients were evaluated. In the group evaluated after 2010, the patients were significantly older and presented a shorter time between hospitalization and discharge, shorter time until the first evaluation in rehabilitation, and increased percentage of mild incapacity (Modified Rankin Scale = 0 to 2). [Conclusion] After acute stroke unit implementation, the patients treated in the rehabilitation section presented a shorter hospitalization time and rehabilitation delay and less functional incapacity.
Key words: Stroke, Acute stroke unit, Rehabilitation outcome

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INTRODUCTION

There are approximately 610,000 acute stroke patients in Brazil per year, accounting for up to 10% of hospital admissions, which makes acute stroke not only the principle cause of chronic incapacity in adults but also the cause of high morbidity and mortality indices and a significant impact on the health system[1–4)]. With the advent of treatment units organized around and specialized in stroke, there was a significant diminution in the mortality and dependence of affected individuals after hospital discharge[5, 6)]. Stroke is the principle cause of mortality and incapacity in Brazil, and there remains a scarcity of stroke units and rehabilitation services.

A stroke unit (Stroke-U) is defined as an organized service and space with a focus on care of patients with stroke during hospitalization by a multidisciplinary team specialized in stroke management[5)]. In Brazil, the report of implementation of a Stroke-U was in 2003 in the city of Joinville, and it described an observable effect in absolute numbers on lethality and the survival curve in the first 30 days after stroke[7)].

Stroke patients commence the rehabilitation process in the hospitalization phase, and the time at which patients initiate rehabilitation after discharge has become important in recent years due to high rates of patients presenting with incapacity after stroke[8)]. Diverse studies affirm that a delay in initiation of the rehabilitation process is associated with a worse functional outcome[9, 10)], principally as a result of a reduction in exposure of the patient to therapeutic interventions during the period of greatest cerebral plasticity[11–13)].

Implementation of a stroke-U currently produces shorter hospitalization periods, reduces morbidity and mortality, and facilitates of patient access to rehabilitation centers after hospital discharge[14, 15)]. The present study aimed to characterize patients attended in a rehabilitation service before and after stroke-U implementation in a Brazilian population in relation to hospitalization time and permanence in the hospital (LOS), time between discharge and rehabilitation initiation (DR), and functional incapacity. The hypothesis of

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the study was that implementation of a stroke-U would result in a shorter LOS for patients in addition to a shorter DR and increased functional capacity.

SUBJECTS AND METHODS

This was a cohort study with retrospective analysis the medical records of 170 patients with a clinical diagnosis of ischemic stroke supported by imaging studies who were being treated in an integrated rehabilitation service in the Clinical Hospital at University Estadual Paulista (HC-UNESP). The exclusion criteria were hemorrhagic stroke, thrombolysis in acute phase (first 4.5 hours), previous Modified Rankin Scale (mRS) ≥ 1, prior stroke, structural bone deformities, associated neurological disease, or prior cognitive deficit.

HC-UNESP attends to a population of 275 thousand inhabitants and diagnoses an average of 352 patients with stroke per year. In 2010, an acute stroke-U with 5 beds and a multidisciplinary team (neurologist, speech language pathologist, physiotherapist, and nurses) was implemented in the hospital's emergency department, serving as a direct reference for 13 cities.

After analysis of the medical records, the patients were distributed into two groups: a pre-stroke-U group comprised of patients admitted to the rehabilitation service between January 2002 and December 2009 and a post-stroke-U group comprised of patients admitted to the rehabilitation service between January 2010 and December 2012. All the patients admitted to the rehabilitation service participated in an integrated regime of physiotherapy and occupational therapy; each session lasted 45 minutes, and sessions were performed 3 times per week for 90 days. The procedures during the rehabilitation regime were the same before and after implantation of the stroke-U.

The data obtained were age; gender; etiology, that is, large vessels, cardioembolic, small vessels, other causes and indeterminate causes, according to the TOAST classification[16]; Bamford classification[17], that is, lacunar infarct (LACS), partial anterior circulation stroke (PACS), total anterior circulation stroke (TACS), and posterior circulation stroke (POCS); length of stay (LOS); delay until rehabilitation (DR) and functional outcome (mRS). The variables utilized as potential confounding factors for functional outcome were age, gender, TOAST classification, Bamford classification, and type of treatment received. The outcomes observed were LOS (in days), DR (months), and functional incapacity 90 days after ictus measured by mRS as prioritized in the principle clinical trials that utilized this scale[18, 19]. All the variables were obtained from the Botucatu Stroke Databank and recorded in accordance with our research protocol, which was approved by the Research Ethics Committee of the Botucatu School of Medicine. The subjects analyzed composed an intentional-type, non probabilistic sample from a target population of patients with a stroke diagnosis from the region attended by HC-UNESP between 2002 and 2012. The effect of stroke-U implementation on the outcomes was estimated by comparing patients who underwent rehabilitation after 2010 (year of stroke-U implementation) with those who underwent rehabilitation prior to 2010.

Comparison of the patients attended before and after stroke-U implementation was performed by Mann-Whitney test, χ^2 test, and Fisher's exact test, and multinomial regression model adjusted to explain current incapacity as a function of time between discharge and rehabilitation initiation by period. Differences and associations were considered significant when $p < 0.05$. Analysis was performed with SPSS v15.0.

RESULTS

In the period from January 2002 to December 2012, the medical records of 300 patients referred to the rehabilitation service with a stroke diagnosis were analyzed. Of these individuals, 130 were excluded (base on the exclusion criteria), thereby leaving 170 medical records to be analyzed for the study. Of these 170 individuals, 51.2% were male, and the average age was 63 years (10–90). Regarding the etiologies, 20% presented stroke originating in large vessels, 17.6% presented stroke resulting from cardioembolism, 22.4% presented stroke originating in small vessels, 32.4% presented stroke resulting from indeterminate causes, and 7.6% presented stroke resulting from others causes. The strokes were classified as LACS, PACS, TACS and POCS in 39.4%, 35.9%, 12.9% and 11.8%, respectively (Table 1).

In the period of 2010 to 2012, the patients were significantly older, whereas the LOS and DR were significantly shorter; furthermore, the distribution of individuals in the mRS range of 0 to 2 was greater, augmenting the percentage of patients classified as having mild incapacity when compared with the period prior to stroke unit implementation. There was no difference between etiology (TOAST classification) and localization (Bamford classification) in the two periods (Table 1).

The relationship between period in which rehabilitation was initiated and the resultant functional incapacity is shown in Table 2. According to the adjust regression model, each day of additional delay in the period of 2002 to 2009 resulted in an estimated risk of a patient presenting an mRS of 4 (moderately severe incapacity) of 0.13% (OR = 1.0013; p=0.039) relative to an mRS 0 to 2 (mild incapacity), while in 2010 to 2012, the risk increased to 2.48% (OR = 1.0248; p=0.001). Considering the last 10 years, the relative risk of the patient being classified as having an mRS of 4 increased by 0.21% (OR = 1.0021) for each day of delay in commencing rehabilitation after hospital discharge.

DISCUSSION

Our study demonstrated that after the implementation of the stroke-U, shorter hospitalization and rehabilitation delay times, as well as better functional outcomes, were observed. A diverse variety of benefits were observed in the individuals that underwent rehabilitation organized by means of a multidisciplinary team, such as reduction of mortality, recuperation of functional independence, and faster return to domicile, in comparison with those that did not undergo the same rehabilitation[5].

There were more elderly subjects after stroke-U implementation in the present study. It is important to emphasize that this may have been due to a longer life expectancy of the

Table 1. Comparison of patients attended before and after stroke-U implementation

Variable	Total Sample	2002–2009 (n = 84)	2010–2012 (n = 86)	p
Age on admission (y)	63 (10–90)	57 (10–90)	65 (32–90)	0.002(1)
Gender (male)	51.2%	49.4%	53.2%	0.634(2)
LOS (days)	8.6 (0–60)	10.5 (0–60)	7 (0–60)	0.036(1)
DR (months)	1.1 (0–99)	1.3 (0–99)	1.0 (0–12)	0.04(1)
TOAST classification				
Large vessels	34 (20%)	16 (19%)	18 (20.9%)	
Cardioembolic	30 (17.6%)	14 (16.7%)	16 (18.6%)	0.920(3)
Small vessels	38 (22.4%)	18 (21.4%)	20 (23.3%)	
Indeterminate	55 (32.4%)	30 (35.7%)	25 (29.1%)	
Others	13 (7.6%)	6 (7.1%)	7 (8.1%)	
Bamford classification				
LACS	67 (39.4%)	32 (38.1%)	35 (40.7%)	
PACS	61 (35.9%)	31 (36.9%)	30 (34.9%)	0.947(2)
TACS	22 (12.9%)	10 (11.9%)	12 (13.9%)	
POCS	20 (11.8%)	11 (13.1%)	9 (10.5%)	
mRS				
0–2	60.6%	48.1%	72.2%	
3	25.9%	36.7%	15.2%	0.004 (3)
4	11.8%	13.9%	10.1%	
5	1.7%	1.3%	2.5%	

LOS: length of stay; DR: delay until rehabilitation; mRS: Modified Rankin Scale; (1) Mann-Whitney test, (2) χ^2 test, (3) Fisher's exact test

Table 2. Multinomial regression model adjusted to explain current incapacity as a function of time between discharge and rehabilitation initiation

Period	mRS	OR	CI (OR; 95%)	p
2002–2009	0 to 2 (n=41)			
	3 (n = 31)	1.0	(0.9–1.0)	0.073
	4 (n = 11)	1.0	(1.0–1.0)	0.039
	5 (n = 1)	1.0	(0.9–1.0)	0.082
2010–2012	0 to 2 (n=62)			
	3 (n = 13)	1.0	(1.0–1.0)	0.026
	4 (n = 9)	1.0	(1.0–1.0)	0.001
	5 (n = 2)	1.0	(0.9–1.0)	0.399
General (2002–2012)	0 to 2 (n=103)			
	3 (n = 44)	1.0	(1.0–1.0)	0.013
	4 (n = 20)	1.0	(1.0–1.0)	0.008
	5 (n = 3)	1.0	(1.0–1.0)	0.046

mRS: Modified Rankin Scale; OR: odds ratio; CI: confidence interval

population and increased prevalence of non-transmissible chronic diseases in this age group[20], in addition to an etiological investigation more accurate for detecting lacunar and small-vessel strokes, common in this age range after stroke-U installation[21, 22].

In relation to hospitalization time, we can affirm that the integrated regime of rehabilitation organized by means of a multidisciplinary team shortened the stay[5] by reducing diverse complications related to immobility and prolonged hospitalization[23–25]. With the diminution of diverse complications related to prolonged hospitalization time, we may infer that patients after stroke-U implementation would have fewer complications and greater recovery of independence in daily activities.

The medical literature has discussed the ideal time for initiating the process of rehabilitation after stroke. The principle guidelines indicate that rehabilitation must be started as soon as possible or in an early manner and that the ability to rise from bed is a predictor of functional independence, and they also indicate that the shorter the time to initiate the rehabilitation process, the higher the level of functional independence and discharge to domicile[26–29]. In a study by Murie-Fernández and colleagues, the authors observed that for each day of delay in commencing rehabilitation, the Functional Independence Measure score decreased by 0.3 points[9]. In our study, the time until arrival at the rehabilitation service was shorter after stroke-U implementation because of the team structure and therapeutic planning by means of protocols integrated between the hospital and rehabilitation center.

There was improvement in the level of functional independence after 90 days of monitoring at the rehabilitation service among patients hospitalized in the stroke-U, highlighting that for this outcome there was no impact of risk factors or etiologies associated with stroke. Individuals who commence the rehabilitation process without delays are associated with a lower index of complications and higher scores for functional independence[30]. The decrease in mRS in our study probably originated from the decrease in delay

of rehabilitation and to the integral assistance provides to patients through organized protocols during the hospital period, in addition to the shorter hospitalization time and frequent visits with the patients made by the multidisciplinary team until hospital discharge.

The present study is limited in that it is a retrospective review of data from medical records of the patients. The effects of acute medical complications were not included in our analyses due to a lack of sufficient data on these variables. Furthermore, the time of inclusion in the group of patients after implementation of the stroke-U was lower, although the numbers of patients were similar in both groups; this was due to the increase in admissions to HC-UNESP for stroke after the implementation of the stroke-U. Another factor to consider is that the mRS was the only variable used to measure the functional outcome. Although, other scales could supply a detailed picture of the functional state of a patient, the mRS was reported to be an efficacious instrument for examination of functional incapacity in the principle randomized clinical studies on the subject[31–33].

The results of the present study showed that after implementation of stroke-U, the patients attended by the rehabilitation service presented shorter hospitalization times and rehabilitation delays as well as lower functional incapacity.

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