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ORIGINAL RESEARCH

Assessment of degree of disability by using Barthel Index and modified Rankin Scale and determinants of disability among acute stroke patients admitted to Teaching Hospital Karapitiya – A descriptive study

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Abstract

Background: Acute stroke results in functional disability, measurable using the well-known Barthel Index (BI) and modified Rankin Scale (mRS). The objectives of the study were to describe the degree of disability following stroke using BI and mRS and to describe its changes from presentation up to 3 months post-stroke, among patients with acute first ever stroke admitted to Teaching Hospital Karapitiya.

Methods: A total of 170 in-hospital acute stroke patients were recruited during 07/2019 -11/2019 and their BI and mRS scores were measured at the time of presentation, at 1- and 3-months post-stroke. The first assessment was a face-to-face encounter, while assessments at 1 and 3 months were carried out through telephone interviews. The determinants of disability included stroke subtypes, age, sex, and time of measurement of disability.

Results: There were 170 patients in the study. The mean age was 67.34 years (standard deviation (SD) 13.43). Males 92 (54.11%) and females 78 (45.88%). 105 (61.76%) were detected to have an ischaemic stroke while 65 (38.23%) presented with a haemorrhagic stroke. The total mean BI scores at presentation, at 1 and 3 months were 22.78 (SD 30.57), 63 (SD 23.01) and 83.15 (SD 23.10) respectively. In the patients with ischaemic stroke the BI scores at presentation, at 1 and 3 months were 25.52 (SD 30.53), 61.42 (SD 28.1) and 81.72 (SD 24.04) respectively. In patients with a haemorrhagic stroke, the BI at presentation, at 1 month and at 3 months were 16.92 (SD 28.58), 65.15 (SD 30.67) and 89.64 (SD19.33) respectively. mRS scores showed similar findings.

Conclusion: Overall, the mean BI scores and mRS showed an increased trend of improvement in disability from the time of presentation up to 3 months post-discharge among acute stroke patients.

The age at presentation showed a significant correlation with disability at presentation. Sex and stroke subtype did not demonstrate a significant association with disability at presentation.

INTRODUCTION

Acute stroke results in functional disability which could be measured using the widely known Barthel Index (BI)[1] and modified Rankin scale (mRS).[2] Strokes are considered as the second commonest cause of death and the third commonest cause of disability in the world.[3] There have been many advances in stroke diagnosis, diagnostic investigations, therapeutic modalities, and primary and secondary stroke prevention strategies. But even with many advances many patients remain with disabilities following stroke,[4] Worldwide, most strokes, stroke-related deaths and disability-adjusted life years occur in low- and middle-income countries and they create a huge burden on the health sector.[3]

The mRS is the most widely used clinical disability measurement in the majority of stroke clinical trials [2] and it could be reliably used to assess the degree of disability in the post stroke period.[5] Similarly, the BI is a widely used clinical outcome measure of disability following stroke and it is very commonly used in rehabilitation centres worldwide.[1,6] Research data and evidence on stroke, stroke management and disability and health burden following stroke in Sri Lanka is very minimal compared to other countries of the world.[3]

OBJECTIVES

The objectives of the study were to describe the degree of disability following acute stroke using the above scales and describe their changes from presentation up to 3 months post-stroke, among patients with acute first ever stroke admitted to Teaching Hospital Karapitiya.

Furthermore, we aimed to describe the correlations of selected determinants of disability which included age at presentation, sex, and sub-type of stroke.

METHODS

A descriptive cross-sectional study was performed among acute stroke patients admitted to Teaching Hospital Karapitiya in 2019. A total of 170 hospitalised patients with first ever acute stroke were recruited between 07/2019 -10/2019. The hospital includes four medical units with equal turnover of random admissions.

We recruited patients admitted with a first ever stroke to Teaching Hospital Karapitiya in accordance with inclusion and exclusion criteria. All the patients presenting with a stroke at age >18 years were included, and acute stroke subtype was limited to either ischaemic stroke (infarction of the brain) or haemorrhagic stroke (spontaneous non-traumatic intra-cerebral haemorrhage). Patients with a preceding history of head trauma or patients with preceding disability prior to the current event and patients with a documented history of previous stroke were excluded from the study.

A pre-tested interviewer administered questionnaire was used. The questionnaire consisted of demographic data, clinical details and stroke disability scales and was administered after obtaining informed consent. Data was obtained by interviewing patients and evaluating their clinical notes. The participants were followed up to 3 months from the date of recruitment for the study.

Their BI scores, and mRS scores were measured at the time of presentation and at 1 month and 3 months post-stroke. These were scored at presentation by face-to-face encounter, while the subsequent were telephone interviews. The determinants of disability included in the study were age, sex, subtype of stroke and time of measurement.

Statistical analysis was performed using Microsoft Excel and SPSS version 21.

Barthel Index

The Barthel Index (BI) is a scale that indicates the ability to perform a selection of activities of daily living.[7] It comprises 10 items (tasks), with total scores ranging from 0 (worst mobility in activities of daily living) to 100 (full mobility in activities of daily living). It comprises of adequate quality clinical measurements and properties in stroke rehabilitation, and it is widely acclaimed as a useful tool.[8]

The BI comprises of 10 items which have these scoring combinations: a) 0 and 5, b) 0, 5 and 10, or c) 0, 5, 10 and 15. The above items in the BI address a patient's ability in feeding, bathing, grooming, dressing, bowel and bladder control, toileting, chair transfer, ambulation and stair climbing.[7,9]

Like other studies, we also treated the BI scale as a numerical scale rather than categorising it because of the lack of consistency in selecting appropriate cut-off points of the items measured in the process of calculation of the BI.

In describing the determinants of disability, we categorised the BI score at presentation into four categories.[1]

0-20 = Total dependency

21-60=severe dependency

61-90=Moderate dependency

91-99=Slight dependency

Modified Rankin Scale (mRS)

The Modified Rankin Scale (mRS) is a 6-point disability scale with possible scores ranging from 0-6. Category 0 indicates the absence of any disability including absence of symptoms and category of 6 indicates patients who expire. Scores 1-5 are used to describe different severities of disability in ascending order. The mRS is the most widely used outcome measure in stroke clinical trials and similarly to other studies we also treated the mRS scores as a numerical scale.[2]

This study received ethical approval from the Ethical Review Committee of the Faculty of Medicine, University of Ruhuna.

RESULTS

There were 170 patients in the study during the period from 07/2019 -10/2019. The mean age was 67.34 years (standard deviation (SD) 13.43), with 92 (54.11%) males and 78 (45.88%) females. 105 (61.76%) were detected to have an ischaemic stroke while 65 (38.23%) presented with a haemorrhagic stroke.

We recruited 170 patients during the study period according to inclusion and exclusion criteria. The study sample at 1-month follow up was reduced to 115 due to deaths and non-contactable study participants and further to 109 at 3-months of follow up due to the same reasons (Figure 1).

The disability of stroke measured by BI and its evolution is shown in Table 2.

The lowest mean BI score at presentation was in patients with haemorrhagic stroke and the lowest mean BI score at 1 and 3 months was in ischaemic stroke patients. The mean BI scores improved with time indicating improvement in disability.

The Pearson correlation co-efficient between age and total BI score at presentation was -0.313 ($p<0.01$). There was a significant negative correlation indicating that when age at presentation increased, the BI score decreased. However, the stroke subtype and sex did not show a significant correlation with the total BI score at presentation.

The disability of stroke measured by mRS and its evolution is shown in Table 3.

TABLE 1 Characteristics of study participants

Characteristic	Value
Age (years) (Mean (standard deviation (SD))	67.34 (13.43)
Sex (number (% male)	92 (54.11%)
Stroke subtype	
-Ischaemic stroke (Number (%))	105 (61.76%)
-Haemorrhagic stroke (Number (%))	65 (38.23%)

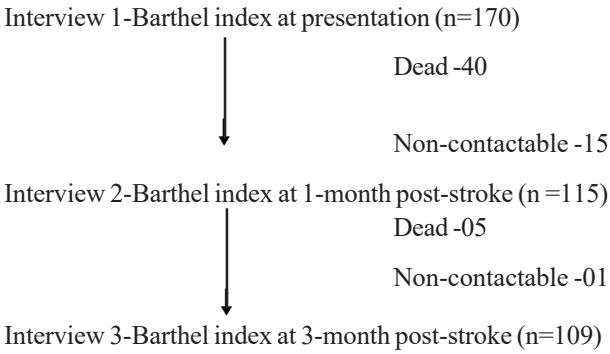

FIGURE 1 Description of the study sample.

TABLE 2 Disability of stroke measured by the Barthel index

Characteristic	Number of patients	At presentation (Mean(SD))	Number of patients	At 1 month (Mean (SD))	Number of patients	At 3 months (Mean (SD))
Total population	170	22.78 (30.57)	115	63 (23.01)	109	83.15 (23.10)
Ischaemic stroke	105	25.52 (30.53)	83	61.42 (28.1)	81	81.72 (24.04)
Haemorrhagic stroke	65	16.92 (28.58)	32	65.15 (30.67)	28	89.64 (19.33)

TABLE 3 Disability of stroke measured by mRS (modified Rankin Scale)

Characteristic	At presentation (Mean (SD))	At 1 month (Mean (SD))	At 3 months (Mean (SD))
Total	4.18 (0.94)	3.10 (1.25)	2.00 (1.30)
Ischaemic stroke	4.07 (0.97)	3.18 (1.24)	2.12 (1.32)
Haemorrhagic stroke	4.43 (0.88)	2.9 (1.27)	1.67 (1.18)

The highest mean mRS at presentation was seen in haemorrhagic stroke patients and the highest mean mRS at 1 and 3 months was seen in ischaemic stroke patients. The Pearson's correlation co-efficient between age at presentation and mRS score was 0.317 ($p<0.01$) and indicated a significant positive correlation.

In describing the determinants of disability, we conducted cross tabulation to see whether there is an association with disability category according to BI at presentation with sex and type of stroke. The Fisher's exact test result was 1.155 ($p=0.76$) for sex, and for type of stroke it was 4.03 ($p=0.26$). Therefore, we could not demonstrate a significant association between the category of disability at presentation and the sex of the patient or the type of stroke.

DISCUSSION

Stroke is one of the main causes of disability and death in the world. Acute stroke leads to many disabilities including neurological, functional and cognitive and these disabilities are measured using several methods. The BI and the mRS are widely used methods.[1,2]

There is minimal documented data on disability following stroke in Sri Lanka, but there is data from similar studies done in other parts of the world. This is a study done among stroke patients admitted to Teaching Hospital Karapitiya before the establishment of a stroke unit.

According to the literature, most recoveries took place between the baseline and 1 month after stroke.[9] We also observed improvement in disability over time. In our study, the overall mean BI score increased by about 176.55% (from 22.78 to 63) and 264.83% (22.78 to 83.15), from the time of stroke to 1 month and from the time of stroke to 3 months respectively. The mRS scores also improved similarly. The overall mRS score decreased by about 25.83% (from 4.18 to 3.10) and 52.15% (from 4.18 to 2.00) from the time of stroke to 1 month and from the time of stroke to 3 months respectively, indicating improvement of disability. However, these observed changes of mean scores should be interpreted cautiously because there was lost to follow up of patients and the reduction in the study population may have affected the mean scores.

The results suggested that substantial recovery from acute strokes had taken place during these periods, especially between the time of stroke and 1 month. Similar studies in the literature have found similar patterns of improvement in post-stroke disability and this early recovery has been attributed to the spontaneous neurological processes of recovery, which occur within 3 months after stroke.[9] Between 6 months and 2 years post-acute stroke, the BI score still improves but not considerably, according to similar studies. Measurements of time, age and stroke subtype were prognostic factors for change in the BI scores.[9]

Initial disability due to haemorrhagic stroke is more severe due to more extensive brain injury.[9] In our study we also found similar findings. The mean BI score in patients with haemorrhagic stroke at presentation was 16.92 (SD 28.58) compared to the mean BI score in infarction at presentation 25.52 (SD 30.53). This observation is explained in similar studies by the following reasons.

The initial severe disability is suggested to be due to a) the accumulation of blood and b) brain ischaemia following the haemorrhage. It has also been found that haemorrhagic stroke patients suffered more complications during in-hospital rehabilitation, had a higher prevalence of mental disorders and experienced poorer cognitive status, which rendered them more vulnerable to delayed recovery.[9]

The strengths of our study include the fact that our follow-up was up to 3 months after the stroke, which is an appropriate period for showing clinical changes in functional status. Similar studies have shown that most motor recovery in stroke is often completed within 10 weeks of stroke.[9] One limitation of our study is that we took only 3 measurements over the 3-month period. To better quantify the changes in the BI score after stroke, more measurements are recommended during the follow-up period because improvements may be extended until 12 months post-stroke, according to some studies. Further prolonged follow up

would be recommended for future studies in order to observe the overall outcome of stroke disability. Secondly, the sample size should be larger as deaths and non-contactable participants will reduce the original sample size as the study progresses. Furthermore, we did not evaluate the impact of thrombolysis or post-stroke rehabilitation in this observed data, and we only assessed a selected number of determinants.

We used telephone interviews which tended to provide incomplete information, a higher level of missing data, considerable difficulty in achieving rapport and a lack of visual cues, perhaps due to aphasia or cognitive decline. The consequences of telephone interviews were minimised by interviewing the carers. However, it is a much more practical and effective method of acquiring information according to similar studies and video consultations may have also been more effective in these clinical settings and can be utilised in future studies.[6]

Lastly, our study also did not include other indices such as Motricity Index (to measure strength of extremities after stroke), Katz Index, Functional Ambulation Classification (FAC), Walking Handicap Scale (WHS), which could provide a more comprehensive representation of the functional and outcome assessments.[9] The BI and mRS are recognised as crude assessments of overall disability and further studies using the above specific assessments are likely to reveal more specific details on post-stroke disability.

CONCLUSION

Overall, the mean BI and mRS scores showed a trend of improvement in disability from the time of presentation up to 3 months post-discharge, among acute stroke patients.

The age at presentation showed a significant correlation with disability at presentation. Sex and stroke sub type did not demonstrate a significant association with disability at presentation.

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Conflicts of interest

There are no known conflicts of interest associated with this publication and the author(s) received no financial support for the research, authorship and/or publication of this article.

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