

Reliability and concurrent validity of the Hospital Mobility Scale in acute stroke patients

Confiabilidade e validade concorrente da Escala de Mobilidade Hospitalar em pacientes após acidente vascular cerebral

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ABSTRACT | INTRODUCTION: The Hospital Mobility Scale (HMS) evaluates the mobility of stroke patients in the hospital environment and in a previous study showed its inter-examiner agreement, predictive validity and responsiveness to changes in the acute phase. **OBJECTIVE:** To evaluate the concurrent validity of HMS and its reliability when applied by interview. **METHODS:** This is a validation study, that was developed with patients admitted in a stroke unit, in the city of Salvador, Bahia, Brazil. In order to assess the concurrent validity of the HMS, we compared its score with the modified Rankin Scale (mRS) score by using the spearman test. The same researcher applied both scales on the fifth day after stroke. To assess the reliability of HMS when applied by interview, two examiners applied the scale in different shifts, on the same day. The first evaluation was face-to-face and the second was performed by interview. For this analysis, we used the intraclass correlation coefficient (ICC). **RESULTS:** The HMS showed a very strong positive correlation with the mRS ($r = 0.90$) and a significant correlation was also found between the sub-items of the HMS and the mRS. We found excellent inter-examiner agreement between face-to-face and interview assessment ($ICC > 0.90$). **CONCLUSION:** The hospital mobility scale, that was developed specifically for stroke patients, showed a high degree of concurrent validity and was reliable when applied by interview.

KEYWORDS: Stroke. Early mobilization. Reliability. Validation studies.

RESUMO | INTRODUÇÃO: A Escala de Mobilidade Hospitalar (EMH) avalia de forma específica a mobilidade de pacientes após AVC no ambiente hospitalar e em estudo prévio foi demonstrada a sua concordância interexaminadores, validade preditiva e a responsividade a mudanças na fase aguda. **OBJETIVO:** Avaliar a validade concorrente da EMH e a sua confiabilidade ao ser aplicada através de entrevista. **MATERIAIS E MÉTODOS:** Trata-se de um estudo de validação, desenvolvido com pacientes internados em uma Unidade de AVC na cidade de Salvador-Bahia. Para avaliar a validade concorrente da EMH comparamos o seu escore com a pontuação da Escala de Rankin modificada (ERm) utilizando o teste de Spearman. Ambas escalas foram aplicadas no quinto dia após o AVC pelo mesmo pesquisador, previamente treinado. Para avaliação da confiabilidade da EMH quando aplicada através de entrevista, a escala foi aplicada por dois examinadores em turnos diferentes, no mesmo dia. O primeiro examinador aplicou a escala através da observação do desempenho e o segundo examinador através de entrevista. Utilizamos para esta análise o Coeficiente de Correlação Intraclasse (CCI). **RESULTADOS:** A pontuação total da EMH apresentou uma correlação positiva muito forte com a ERm ($r=0,90$) e também foi encontrada uma correlação significativa entre os subitens da EMH e a ERm. Ao comparar a aplicação da EMH através da observação do desempenho e aplicação por entrevista, observamos uma excelente concordância interexaminadores ($CCI > 0,90$). **CONCLUSÃO:** A Escala de Mobilidade Hospitalar, projetada especificamente para pacientes após AVC, mostrou um alto grau de validade concorrente e se mostrou confiável quando aplicada através de entrevista.

PALAVRAS-CHAVE: Acidente vascular cerebral. Mobilização precoce. Confiabilidade. Estudos de validação.

Introduction

Assessment of mobility in hospitalized patients is essential for the establishment of physiotherapeutic treatment and for the monitoring of the patients' progress, especially among stroke patients, who can present some limitations on mobility during the acute phase¹. In this scenario, we find some mobility scales that have been validated for stroke patients^{2,3}. However, these instruments need to be applied within a standardized environment and with equipment²; although this may seem simple and accessible, this may not be available within the routine of hospitals, especially in low-resource services.

Over the last few years, we have seen the appearance of some mobility scales developed for the evaluation of hospitalized patients in intensive care units (ICUs)^{4,5}. These scales tend to be one-dimensional, and evaluate mobility as being one single task, ranging from being totally bedridden (zero points) to independent gait (maximum points)^{4,5}. This grading of mobility level adapts well to an ICU environment, but is insufficient to evaluate stroke patients, as postural control in each of the postures is highly variable in this patients.

The Hospital Mobility Scale (HMS) is a new scale developed to assess the mobility of stroke patients within the hospital environment¹. This is an instrument that is quick and easy to apply, that assesses mobility based on three core tasks (sitting, standing and gait), that does not require specific training, equipment or a standardized environment. This means that it could easily be included in clinical practice for the daily evaluation of the mobility level, enabling the physiotherapist to aim treatment at the higher levels of mobility. In addition, different from the other mobility scales as here mentioned, the HMS includes the possibility of having the assistance of one or two other people during the phases of evaluation of sitting, standing and gait, which is frequently the reality of stroke patients, and makes it easier to plan physiotherapeutic attention at hospital units¹.

The study by Maso and collaborators¹ (2019) showed that the HMS is able to predict the functional outcome after 3 months, also showing agreement between examiners and response to changes in the acute phase. The purpose of the present study is to enhance the evaluation of the psychometric properties of the HMS by investigating: 1. The concurrent validity, through a comparison of the HMS score with the modified Rankin Scale (mRS); 2. The reliability of the HMS when applied by interview.

Methods

This is a validation study with patients admitted in a stroke unit at Hospital Geral Roberto Santos, in the city of Salvador, Bahia, Brazil. This unit offers multidisciplinary care that includes early rehabilitation for stroke patients in the acute phase. We include in this study patients with diagnosis of ischemic or hemorrhagic stroke, confirmed by computed tomography or nuclear magnetic resonance, and older than 18 years. Patients were excluded for the following reasons: previous blindness, amputated patients, pre-stroke modified Barthel Index < 95, and patients with dementia or other neurological pathology that affect mobility. We used a questionnaire with clinical and sociodemographic variables to collect data from medical records.

For the evaluation of the concurrent validity, we use the database of a study previously published¹ while for the evaluation of reliability we use a convenience sample of the patient seen to at the stroke unit in the same period as the study here mentioned.

Assessment of concurrent validity

For the evaluation of the concurrent validity, we compare the HMS score with the mRS. Both scales were applied on the fifth day after stroke, by the same researcher, previously trained for this purpose.

Assessment of reliability of the HMS on being applied by interview

For the assessment of reliability, the HMS was applied by two examiners at different times, on the same day. The first examiner was a physiotherapist who performed the patient mobilization and applied the scale, face-to-face, observing the performance of the patient for each task. The second examiner applied the HMS at the end of his shift, by means of an interview with the physiotherapist who mobilized the patient.

Assessment instruments

The Hospital Mobility Scale (Figure 1) evaluate three mobility tasks: sitting, standing and gait. This scale is based on the amount of assistance in performing this mobility tasks (performs independently, needs help from 1 person, needs help from 2 people, or fails to perform the task). The total score ranges from 0 to 12, and the higher the score, the greater the degree of dependence.

Figure 1. Hospital Mobility Scale

Tasks	Score
Sitting on edge of bed, feet off ground	
Can proceed with a transfer and remain seated independently without help	0
Needs help from one person to remain seated and/or during transfers	2
Needs help from two people to remain seated and/or during transfers	4
Fails to perform the task	6
Standing	
Is able to remain standing against the bed without help	0
Needs help from one person to remain standing against the bed and/or during transfers	1
Needs help from two people to remain standing against the bed and/or during transfers	2
Fails to perform the task	3
Gait	
Independent gait	0
Walking with the assistance or supervision of one person	1
Walking with the assistance of two people	2
Fails to perform the task	3

Source: Neurorehabil Neural Repair. 2019. doi: [10.1177/1545968319856894](https://doi.org/10.1177/1545968319856894).

The modified Rankin Scale is a disability scale that includes gait, basic activities and usual activities assessment. The mRS score ranges from 0 to 6, with 0 - Asymptomatic and 6 - Death¹⁰.

Statistical Analysis

The SPSS version 20.0 was utilized for statistical analysis. A descriptive analysis of the clinical and demographic variables was carried out in order to identify the characteristics of the studied population. Numerical variables were presented as mean and standard deviation or median and interquartile range after verification of normality using the Kolmogorov-Smirnov test. We used the Spearman test to assess the correlation between HMS and mRS scores. The following classification was used: $r = 0$, null; $r \leq 0,30$, weak; $0.30 < r \leq 0.60$, regular; $0.60 < r \leq 0.90$, strong; $0.90 \leq r < 1$, very strong; and $r = 1$, full or perfect¹¹. We used the Intraclass Correlation Coefficient (ICC) to compare the HMS score when applied by interview versus face-to-face. The ICC ranges from 0 to 1, and the higher the coefficient, the better the agreement. We consider a poor agreement $ICC < 0.4$; satisfactory agreement, $0.4 \leq ICC < 0.75$; excellent agreement, $0.75 \leq ICC < 1$; and perfect agreement, $ICC = 1$ ¹². The significance level was established as 5%.

Ethical Aspects

This study received approval from the local institutional review board (Approval number CAEE: 27383014.9.0000.54), and all patients or legally authorized representatives provided written informed consent.

Results

In order to assess the concurrent validity, we evaluated 283 patients, the average age of the patients was 62.3 years (+/-0.8) and 51.2% were male (Table 1).

Table 1. Demographic and clinical characteristics of 283 stroke patients admitted in a Stroke Unit, in the city of Salvador, Bahia

Variables	n = 283
Age, mean (SD)	62.3 (± 0.8)
Male, n (%)	145 (51.2)
Schooling in years, median (IR)	6 (4-12)
Family income*, median (IR)	2 (1-2)
Previous stroke, n (%)	70 (24.7)
Type of stroke	
Ischemic, n (%)	237 (83.7)
Ischemic with hemorrhagic transformation, n (%)	46 (16.3)
Thrombolytic treatment, n (%)	83 (29.3)
Localization of stroke	
Anterior circulation, n (%)	210 (74.2)
Posterior circulation, n (%)	43 (15.2)
Anterior circulation, n (%)	3 (1.1)
No lesion on CT after thrombolysis, n (%)	26 (9.2)
Stroke severity (NIHSS)	
Mild (0-7), n (%)	105 (37.1)
Moderate (8-16), n (%)	112 (39.6)
Severe (>16), n (%)	66 (23.3)

Abbreviations: SD, standard deviation; IR, interquartile range; CT, computed tomography; NIHSS, National Institutes of Health Stroke Scale.

* Family income was described by the number of minimum wages received per month.

The correlation between the HMS and mRS was very strong ($r=0.90$), therefore, the greater the mobility impairment, the greater the functional disability. We also found a significative correlation between the subitem of HMS and the mRS score (Table 2).

Table 2. Correlation between the Hospital Mobility Scale (HMS) scores and modified Rankin Scale (mRS)

	Spearman correlation coefficient (r)	P-value
HMS Sitting score and mRS	0.79	<0.001
HMS Standing score and mRS	0.92	<0.001
HMS Gait score and mRS	0.97	<0.001
Total HMS score and mRS	0.90	<0.001

To assess the reliability of HMS when applied by interview, we evaluated a sample of 39 patients, the average age of the patients was 62.1 years (± 2.1), 56.4% were male, 81.6% were ischemic stroke and 18.4% hemorrhagic stroke.

We found an excellent inter-examiner agreement between the HMS applied by interview and face-to-face ($ICC > 0.90$). This correlation was found in the following scores: HMS total score, sitting and gait. In the standing subitem we found a perfect agreement ($ICC = 1$), which indicates that the two examiners selected the same answers for all patients (Table 4).

Table 3. Hospital Mobility Scale reliability when applied by interview and face-to-face

	ICC*	Confidence interval	P-value
Sitting	0.96	(0.92-0.98)	<0.001
Standing	1.00	-	-
Gait	0.99	(0.98-0.99)	<0.001
Total score	0.99	(0.98-0.99)	<0.001

*ICC: Intraclass Correlation Coefficient

Discussion

The present study expanded the assessment of the psychometric properties in the HMS, establishing a strong correlation with the mRS and a high degree of reliability when applied by interview. This instrument, developed for the specific assessment of mobility, showed itself to be valid and reliable for the evaluation of stroke patients, in the acute phase.

The concurrent validity of the HMS was shown by the strong positive correlation with the mRS, thereby showing that, the more mobility is compromised, the greater the extent of functional disability. The mRS is an instrument that evaluates global incapacity, being widely used in clinical practice and also in research studies^{9,10}. A research study showed that the mRS was the scale most commonly used for the assessment of the functional result in clinical trials on stroke patients¹¹, being used preferably after discharge from hospital, or as a functional status prior to the stroke⁹.

It is known that the data acquisition method is of great importance, especially in the case of scientific research, as it directly affects costs and the logistics of data collection. The interviews, even though they are frequently less trustworthy, are quicker, do not require any instruments, and make research logistics easier. In some cases, the interviews can even be conducted by telephone¹². The present study showed that the results of HMS when applied by interview are very similar to those found with the observation of performance, probably because its items are simple and objective. The evaluation of mobility by interview would not restrict data collection to those professionals who have the skills and the authorization to remove the patients from their beds, meaning that the test can be applied by other health professionals, students, or other researchers who are not part of the health care team at the unit where the patient is hospitalized. One example found in clinical practice and research is the Barthel Index, which is widely used and can be applied by means of an interview with the patient or with an informant, meaning that it is not essential to witness the patient carrying out the tasks¹³. We have not found any records that mention the possibility that the other mobility scales that have been validated for use with stroke patients could be applied by means of interviews^{2,3,14,15}.

Among the other mobility scales that have been validated for population after stroke, we highlight the Mobility Scale for Acute Stroke (MSAS) and the Elderly Mobility Scale (EMS)^{2,3}. These instruments have had their validity, reliability, and construct validity proven in different studies^{2,3,16}. Even though these are simple scales, with tasks very similar to those of the HMS, the application of the Mobility Scale for Acute Stroke requires a standardized environment, including a chair which is 43 cm tall, an adjustable bed, and a footrest, which could make it difficult to include this scale within a daily routine of care². The Elderly Mobility Scale includes the functional reach test within its tasks³, which makes it more complicated to apply, particularly in the case of patients with comprehension difficulties. On the other hand, The Functional Status Score for the ICU, developed for patients hospitalized in intensive care units, does not need any equipment or even a standardized environment¹⁷, but in this scale the classification of each level is more detailed than in the case of the HMS, meaning that more time is needed for its application.

For this study, we have decided to compare the HMS with the mRS, even being aware of the limitations on the use of the mRS in the acute phase, due to the difficulty of assessing the activities of daily life and the habitual activities within the hospital environment. At the moment of the development of the HMS, we did not identify other mobility scales that have been translated and validated for the Brazilian population. Future studies comparing the HMS with other mobility scales could contribute to the evaluation of its psychometric properties.

Conclusion

The Hospital Mobility Scale, developed specifically for acute stroke patients, showed a high degree of concurrent validity and was reliable when applied by interview.

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Author contributions

Maso I participated in the conceptualization and design of the study, database management, statistical analysis of the data and wrote the article. Oliveira-Filho J participated in the conceptualization and design of the study and the statistical analysis of the data. Jesus APJ participated in the study design, stroke case definitions and data interpretation. Monteiro M participated in the study design and data interpretation. Mascarenhas L, Makhoul M and Vasconcelos L participated in the acquisition and interpretation of the data. Pinto EB participated in the conceptualization and design of the study, research supervision and article writing. All authors approved the final manuscript version.

Competing interests

No financial, legal or political competing interests with third parties (government, commercial, private foundation, etc.) were disclosed for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc.).

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