A Study of Psychometric Properties Of Modified Rivermead Mobility Index

Dr.Suvarna Ganvir

Professor,. PDVVPF's College of Physiotherapy, Ahmednagar Maharashtra, 414111, India.

Abstracts: Background : To evaluate the effect treatment on mobility various studies have used. But responsiveness of Rivermaid mobility Index has found to be poor as items are scored on a dichotomous (yes/no) basis. MRMI is a modified version of RMI to increase the responsiveness of the measure which is not studied in depth by many studies. Objective: The objective of this study was to investigate in detail interrater reliability ,validity & responsivenss of Modified Rivermaid Mobility Index. Methodology : Patients fulfilling the inclusion criteria were assessed with the help of RMI , MRMI & STREAM at three different occasions i.e. on15th,30th& 90thday to study validity & responsiveness. For studying interrater reliability three measures were assessed by two physical therapists blinded to the results of each other. Results: The 3 mobility measures were highly responsive in detecting changes before 90 days after stroke onset (14 to 30 days, SRM≥ BORDER="0">1.14; 30 to 90 days, SRM≥0.83;) The medians of the weighted κstatistic for each item of RMI, MRMI, and STREAM were 0.81 (range, 0.37 to 0.94), 0.83(range, 0.47 to 0.9), and 0.89 (range, 0.55 to 0.89), respectively, indicating generally acceptable interrater agreement on the item level. Conclusion: It is concluded that MRMI is a valid ,reliable & sensitive measure as compared to RMI. [Suvarna Ganvir NJIRM 2011; 2(3) : 56-60]

Key Words: modified Rivermaid mobility index, responsiveness, interrater reliability , Validity

Author for correspondence: Dr. Suvarna Ganvir, Prof. PDVVPF's College of Physiotherapy, Ahmednagar 414111,Maharashtra India.Email : suvarna.ganvir@rediffmail.com

Introduction: To develop independent lifestyle after stroke mobility plays the most important role.hence one of the important aims of stroke rehabilitation is improving mobility.[1] Clinicians & researchers are always in search of a measure of mobility which is simple to administer & has sound psychometric properties[2].

To evaluate the effect treatment on mobility various studies have used RMI[3].But responsiveness of RMI has found to be poor as items are scored on a dichotomous (yes/no) basis[4]. Therefore, to increase the responsiveness of the measure the modified RMI (MRMI) was developed by extending the scoring level to 6 points[1] However, the psychometric properties of the MRMI are not as yet evaluated scientifically. Comparatively the Mobility Subscale of the Stroke Rehabilitation Assessment of Movement Measure (STREAM) that assesses mobility after stroke is simple to administer and is reliable and valid in stroke patients[5,6].

It is necessary to compare the psychometric properties of clinical mobility measures so that it can provide useful guidelines for both clinicians and researchers to determine an objective and scientific measure[7].Hence the purpose of this study was to compare the interrater reliability & validity, of RMI, MRMI, and STREAM in stroke patients.

Material and Methods: The study design was correlational study. Ethical committee clearance was obtained prior Ethical beginning the study. Subjects were recruited from dept of medicine & referred to dept of physiotherapy between May 1 and December 31, 2008.

Patients were included in the study if they met the following criteria: (1) confirmed diagnosis of stroke (2) first onset of stroke without other major disease and the absence of a preexisting disability, (3) stroke onset within 14 days before admission, (4) ability to follow instructions, (5) willingness to participate in this study. The clinical diagnosis of stroke was confirmed by neuroimaging examination. Patients who suffered another stroke or had another major disease during the follow-up period were excluded.

The study protocol consisted of 2 parts. The first part was a comparing the validity. The 2 scales were administered to patients at 15, 30,& 90 days after stroke onset. Initial stroke severity was

ascertained with the National Institute of health Sciences Scale. Degrees of responsiveness of the mobility measures were calculated from the changes occurring between 15 to 30, 30 to 90, 15 to 90 days after stroke onset. When necessary, patients were allowed to rest during the testing protocol, which lasted for 40-45minutes.

The second part of the protocol was an interrater reliability study. The 2 mobility measures were administered separately by 2 physical therapists. To minimize the effects of possible recovery, assessments were administered within a 24-hour period according to a counterbalanced sequence. The therapists were blinded to the results of each other's assessments during the study period.

Instruments: The primary instrument used in the study was RMI, which covers a range of hierarchical activities from turning over in bed to running, & is comprised of 14 questions and 1 direct observation.[8] Each patient's mobility performance is rated primarily by interviewing the patients and/or their primary caregiver. The highest score, 15, indicates the highest mobility status. Although previous studies [2-8] found that RMI had good psychometric properties in stroke patients, sample sizes in 2 of these studies were modest (≤23),[8,9] limiting generalization of their results.

Whereas that modified version of RMI that is MRMI has 8 test items: turning over, changing from lying to sitting, maintaining sitting balance, going from sitting to standing, standing, transferring, walking indoors, and climbing stairs. Scores of the MRMI range from 0 to 40. One main characteristic of the MRMI is that patients are scored by direct observation of their performance on the items.

STREAM contains 10 four-point items: rolling, bridging, going from supine to sitting, changing from sitting to standing, standing, placing affected foot onto first step, stepping backward, stepping to affected side, walking 10 m, and walking down stairs. Scores of STREAM range from 0 to 30. Although the reliability and validity of STREAM are high in stroke patients, its responsiveness has not been reported.[10]

Stroke severity at admission was determined by the NIHSS[11] the score ranges from 0 to 42. This instrument has been shown to be valid and reliable in assessing stroke severity.

Result: Any mobility measure is said to be effective when it is able to reflect the whole range of mobility disability after stroke. Hence the floor and ceiling effects were calculated, representing the percentage of subjects achieving the lowest and highest scores possible, respectively. Floor and ceiling effects exceeding 20% of sample size are considered to be significant,[12] indicating that the measure can represent only a limited range of mobility disability. Concurrent validity is usually established by demonstrating a high correlation or agreement between the measure and a gold standard.[13] but because both scales had a different scoring system & the highest score were different , the scores from each measure were converted to a range of 0 to 100. The relationship and agreement between the 2 mobility measures at 2 time points were examined by use of the Spearman correlation coefficient (ρ) and the intraclass correlation coefficient (ICC), respectively.

The convergent validity of the mobility measures was assessed by examining the relationships between the total scores of the mobility measures and those of the BI at all 3 time points after stroke using Spearman's ρ. The predictive validity of the mobility measures was assessed by examining the associations between results of the mobility measures at 2 time points (15, 30 days after stroke onset) and those of the Barthel Index at 90 days after stroke onset using the Spearman ρ. Standard response mean was used to examine responsiveness over a period of time . SRM was calculated by dividing the mean change scores by the SD of the change score in the same subjects. An effect size >0.8 is usually considered large; 0.5 to 0.8, moderate; and 0.2 to 0.5, small.[14]

Wilcoxon matched-pairs signed-rank tests were performed to determine the statistical significance of the change scores. The interrater agreement on individual items of the mobility measures was analyzed with the quadratic weighted κstatistic. The interrater agreement of the total score of the mobility measures was analyzed with the ICC

statistic. The fixed effect of ICC model 3[15] was used to compute the ICC value for interrater reliability. Both weighted κ and ICC values $\geq$0.80 indicate very good agreement; 0.60 to 0.79, good agreement; 0.40 to 0.59, moderate agreement; 0.20 to 0.39, fair agreement; and 0 to 0.2, poor agreement.[16]

To begin with 59 patients were screened for inclusion in the study . but 5 patients had to be excluded because of stroke onset that was more than 14 days before admission, the occurrence of recurrent stroke, and/or communication difficulties. Of the remaining 54 patients, 50 completed the follow-up at 180 days after stroke. The National Institute of Health stroke scale scores showed that patients had a broad range of severity (from mild to severe stroke) at admission.

The medians of the weighted statistic for each item of RMI, MRMI, and STREAM were 0.81 (range, 0.37 to 0.94), 0.83(range, 0.47 to 0.9), and 0.89 (range, 0.55 to 0.89), respectively, indicating generally acceptable interrater agreement on the item level. 3 RMI items, 1 MRMI item and 1 STREAM items had fair to moderate agreement ($0.37 \leq \kappa \leq 0.6$). The ICCs for the total scores of RMI, MRMI, and STREAM were 0.93 (95% confidence interval [CI], 0.84 to 0.96), 0.96 (95% CI, 0.90 to 0.97), and 0.98 (95% CI, 0.95 to 0.99), respectively, indicating excellent total score agreement.

Discussion: To identify, monitor & manage mobility disability after stroke ,it is important for both clinicians & researchers to have a simple and psychometrically sound mobility measure.[3,9]In the present study comparison of psychometric properties of the RMI, MRMI, and STREAM mobility measures in stroke patients concurrently and systematically is done. In addition, patients in the study were monitored at 3 specific time points after stroke for an extended period (up to 90 days after stroke onset) to evaluate how appropriate these measures were for use at different recovery stages after stroke. Results of this study can provide information useful for the selection of mobility measures for both clinicians and researchers.

In the present study it was found that all 3 mobility measures demonstrated acceptable distributions from the acute stage up to 90 days after stroke onset, except for RMI, which at 14 days after stroke onset showed a limited score range and a notable floor effect. Thus it can be inferred that the RMI might not adequately characterize patients' mobility functions in the early stages of stroke, especially for patients with severe disabilities.

Responsiveness is designed to measure change over time.[16] The 3 mobility measures were highly responsive in detecting changes before 90 days after stroke onset. All changes in the 3 measures at each stage were significant. According to the present results, STREAM was slightly more responsive than the other 2 measures. This may be because STTERAM covers more number of items & are graded more systematically. But, MRMI was no more responsive than RMI, despite the fact that MRMI, with more scoring levels, was revised from RMI to make it more responsive.[2] This suggests that further refinement of MRMI needs to be done so that it can detect changes overtime more effectively. Interrater agreement on individual items of mobility measures has rarely been examined. The interrater agreement of STREAM was high for individual items and the total scores. Although the total score interrater agreement of the RMI and MRMI was high, at least 2 items of both measures demonstrated only fair to moderate agreement between raters. These findings indicate that the interrater reliability of STREAM is slightly higher than that of RMI and MRMI.

There are various scales used for assessing the mobility of the patients after stroke specially the walk tests. For example, the gait speed test (eg, 10-m walking speed test and 6-minute walking distance) is commonly used to measure mobility after stroke in both clinical and research settings. However, the gait speed test is not relevant for all patients with stroke. Mobility, by nature, is complex and multifactorial, whereas the gait speed test simply reflects 1 unique and specific dimension of mobility. Furthermore, the speed test cannot be used for the patients without the ability to walk. Hence the use of the mobility scales RMI, MRMI is justified. So also it measure patients' performance on some tasks that reflect the multifactorial nature of mobility. Furthermore, the 3 mobility measures examined in this study are feasible for assessing

most stroke patients, including those with very poor mobility.

Limitations of this study can be a small sample size because of which results can not be generalised. We have extended this study for another year & will be presenting the results soon. Also we will try to analyse the effect of type & severity of stroke on the psychometric properties of these mobility measures. Another limitation of the present study is that the intrarater reliability of the measures was not examined. We found a high interrater reliability of the measures. Therefore, the intrarater reliability of the 3 measures might not be an issue of great concern. Furthermore, the psychometric properties of STREAM appeared to be slightly better than those of the other 2 measures (eg, RMI showed a notable floor effect in the early stages of stroke; the score changes of RMI and MRMI at 90 days after stroke onset were not significant). However, the psychometric differences among the 3 measures may not be statistically significant.

Conclusion: It can be concluded that MRMI had lesser floor & ceiling effect than RMI but both equally responsive in detecting changes after stroke. Hence MRMI can be used in clinical & research settings, but with a caution.

References:

1. Lennon S, Johnson L. The modified Rivermead Mobility Index: validity and reliability. Disabil Rehabil. 2000; 22: 833–839.
2. Hsieh CL, Hsueh IP, Mao HF. Validity and responsiveness of the Rivermead Mobility Index in stroke patients. Scand J Rehabil Med. 2000; 32: 140–142.
3. Forlander DA, Bohannon RW. Rivermead Mobility Index: a brief review of research to date. Clin Rehabil. 1999; 13: 97–100.
4. Lennon S, Hastings M. Key physiotherapy indicators for quality of stroke care. Physiotherapy. 1996; 82: 655–664.
5. Daley K, Mayo N, Danys I, Cabot R, Wood-Dauphinee S. The Stroke Rehabilitation Assessment of Movement (STREAM): refining and validating the content. Physiother Can. 1997; 49: 269–278.
6. Wang CH, Hsieh CL, Dai MH, Chen CH, Lai YF. Inter-rater reliability and validity of the Stroke Rehabilitation Assessment of Movement (STREAM) instrument. J Rehabil Med. 2002; 34: 20–24.
7. Spilg EG, Martin BJ, Mitchell SL, Aitchison TC. A comparison of mobility assessments in a geriatric day hospital. Clin Rehabil. 2001; 15: 296–300.
8. Collen FM, Wade DT, Robb GF, Bradshaw CM. The Rivermead Mobility Index: a further development of the Rivermead motor assessment. Int Disabil Stud. 1991; 13: 50–54.
9. Green J, Forster A, Young J. A test-retest reliability study of the Barthel Index, the Rivermead Mobility Index, the Nottingham Extended Activities of Daily Living Scale and the Frenchay Activities Index in Stroke Patients. Disabil Rehabil. 2001; 23: 670–676
10. 10, Wang CH, Hsieh CL, Dai MH, Chen CH, Lai YF. Inter-rater reliability and validity of the Stroke Rehabilitation Assessment of Movement (STREAM) instrument. J Rehabil Med. 2002; 34: 20–24
11. Goldstein LB, Chilukuri V. Retrospective assessment of initial stroke severity with the Canadian Neurological Scale. Stroke. 1997; 28: 1181–1184.
12. Holmes WC, Shea JA. Performance of a new, HIV/AIDS-targeted quality of life (HAT-QoL) instrument in asymptomatic seropositive individuals. Qual Life Res. 1997; 6: 561–571.
13. Hsueh IP, Lin JH, Jeng JS, Hsieh CL. Comparison of the psychometric characteristics of the Functional Independence Measure, 5 item Barthel Index, and 10 item Barthel Index in patients with stroke. J Neurol Neurosurg Psychiatry. 2002; 73: 188–190.
14. Cohen J. Statistical Power Analysis for the Behavioral Sciences. Hillsdale, NJ: Lawrence Erlbaum Associates; 1988.
15. Shrout P, Fleiss J. Intraclass correlations: uses in assessing rater reliability. Psychol Bull. 1979; 86: 420–428.
16. Bushnell CD, Johnston DC, Goldstein LB. Retrospective assessment of initial stroke severity: comparison of the NIH Stroke Scale and the Canadian Neurological Scale. Stroke. 2001; 32: 656–660
17. Dorman PJ, Waddell F, Slattery J, Dennis M, Sandercock P. Are proxy assessments of health status after stroke with the EuroQol

questionnaire feasible, accurate, and unbiased? Stroke. 1997; 28: 1883–1887.
18. Guyatt G, Walter S, Norman G. Measuring change over time: assessing the usefulness of evaluative instruments. J Chronic Dis. 1987; 40: 171–178.
19. Mao HF, Hsueh IP, Tang PF, Sheu CF, Hsieh CL. Analysis and comparison of the psychometric properties of three balance measures for stroke patients. Stroke. 2002; 33: 1022–1027.
20. Jorgensen HS, Nakayama H, Raaschou HO, Vive-Larsen J, Stoier M, Olsen TS. Outcome and time course of recovery in stroke, II: time course of recovery: the Copenhagen Stroke Study. Arch Phys Med Rehabil. 1995; 76: 406–412.
21. Rossier P, Wade DT. Validity and reliability comparison of 4 mobility measures in patients presenting with neurologic impairment. Arch Phys Med Rehabil. 2001; 82: 9–13.
22. Hobart JC, Thompson AJ. The five item Barthel Index. J Neurol Neurosurg Psychiatry. 2001; 71: 225–230.
23. Wallace D, Duncan PW, Lai SM. Comparison of the responsiveness of the Barthel Index and the Motor Component of the Functional Independence Measure in stroke: the impact of using different methods for measuring responsiveness. J Clin Epidemiol. 2002; 55: 922–928.