Hong Kong Physiotherapy Journal (2013) 31, 41–44

Available online at www.sciencedirect.com

SciVerse ScienceDirect

journal homepage: www.hkpj-online.com

RESEARCH REPORT

Reliability and validity of the Modified Functional Ambulation Classification in patients with hip fracture

Mei Wa Rosanna Chau, DHSc [a,*], Suk Ping Chan, MPhil [a], Yee Wah Wong, MSc [a], Mo Yee Polly Lau, DHSc [b]

[a] *Physiotherapy Department, Kowloon Hospital, Kowloon, Hong Kong*
[b] *Physiotherapy Department, Kowloon Central Cluster, Kowloon, Hong Kong*

KEYWORDS
elderly mobility scale;
hip fracture;
modified functional ambulation classification;
reliability;
validity

Abstract A psychometrically sound and easily applicable mobility outcome measure is crucial for evaluating patient performance and efficacy of rehabilitative treatment. The Modified Functional Ambulation Classification (MFAC) is an assessment tool designed to categorize functional ambulation ability. This study aimed to evaluate the reliability and concurrent validity of the MFAC in patients with hip fracture in a rehabilitation hospital setting. A total of 122 patients with hip fracture, aged 81.3 ± 6.5 years, were evaluated using the MFAC and Elderly Mobility Scale (EMS). Inter-rater reliability was assessed by administering the MFAC to the same patients by two independent raters. Intraclass correlation (2,1) was used to calculate inter-rater reliability, and the Spearmen correlation was used to assess the correlation between MFAC and EMS scores (i.e., concurrent validity). The results revealed that the MFAC categories provided by the two raters were highly reliable (intraclass correlation coefficient (ICC) = 0.960, 95% confidence interval: 0.942-0.972, $p < 0.001$). The MFAC scores were also significantly correlated with the EMS scores ($\rho = 0.814$, $p < 0.001$). In conclusion, the MFAC demonstrated good reliability and concurrent validity in patients with hip fracture.

Introduction

Hip fracture is a prevalent condition that creates considerable medical and socioeconomic burden. Among older adults, within 3 months of a hip fracture, the risk of mortality was found to increase by up to four times [1]. Hip fractures account for about 300,000 hospitalizations every year in the United States [1]. Given the ageing population and thus the increasing number of older people worldwide, the total number of hip fracture cases and their economic consequences are likely to rise substantively. Moreover, a good proportion of survivors of hip

* Corresponding author. PT Department, 1/F, RB, Kowloon Hospital, 147A Argyle Street, Kowloon, Hong Kong.
E-mail address: chaumw@ha.org.hk (M.W. Rosanna Chau).

1013-7025/$ - see front matter
http://dx.doi.org/10.1016/j.hkpj.2013.01.041

fracture will become more functionally dependent with a need to be institutionalized. These factors may translate into an immense fiscal burden on the health care system and society that can only be projected to rise even further in the future [2].

Similar to other countries, Hong Kong is also facing similar burden caused by hip fractures. From 1966 to 1995, the total number of hip fracture cases in Hong Kong increased by 2.7 fold among people who were 50 years and older [3]. The incidence of hip fractures has shown a continual increase over the recent 5 years, as retrieved from the Clinical Data Analysis and Reporting System (CDARS) of the Hospital Authority (HA) in Hong Kong. In the 2011/12 financial year, there were 9459 hip-fracture related in-patient discharges and deaths. The total length of stay for discharged in-patients was 164,905 days [4].

The seriousness of disability related to ambulatory function has been reported consistently across different studies on patients with hip fracture [5,6]. The dependency in functional activities of daily living persisted after a fracture for over 1 to 2 years [5,6]. Regaining functional mobility is often the primary goal of the patients after hip fracture during the rehabilitation process, and it is a critical factor in discharge planning. Safe ambulation is considered essential for effective functioning. All daily tasks such as preparing meals, cleaning up, dressing, or doing household chores depend on the ability to manoeuvre safely and effectively. Physiotherapists play an important role in facilitating the recovery of ambulatory function in patients after a hip fracture. A psychometrically sound and easily applicable ambulation outcome measure is crucial for evaluating patient performance and efficacy of rehabilitative treatment.

Several ambulation classification systems for evaluating ambulation ability were described in previous studies. These systems were designed to grade the walking ability of stroke patients or other patient groups [7—12]. In Hong Kong, the Coordinating Committee in Physiotherapy of the Hospital Authority developed a modified version of the Functional Ambulation Classification (MFAC) for stroke patients [13]. The MFAC is a 7-point Likert Scale (I to VII) that is used to classify a patient's walking capacity (see Appendix 1). Gait is divided into seven categories, ranging from no ability to walk and requires manual assistance to sit or is unable to sit for 1 minute without back or hand support (MFAC I) to the ability to walk independently on level and non-level surfaces, stairs, and inclines (MFAC VII). The professional staff of Hospital Authority had used the MFAC to assess ambulation for several years. However, no published study has assessed the reliability and validity of the MFAC among patients with hip fracture. This study was thus undertaken to evaluate the reliability and validity of the MFAC in patients who had sustained a hip fracture.

Methods

Patients

One hundred and twenty-two patients with hip fracture participated in this study. They were all recruited from the Department of Rehabilitation of Kowloon Hospital, Hong Kong. For inclusion in the study, the person had to be 60 years of age or older and should have sustained a recent low impact osteoporotic fracture of the proximal femur, which was surgically repaired up to 4 weeks before recruitment. The exclusion criteria were unstable conditions, including malignancy, tuberculosis, mental incapacitation, and inability to communicate. Written, informed consent was obtained from the patients. The study was approved by the ethics committee of Kowloon Central and Kowloon East Clusters of the Hospital Authority in Hong Kong.

Inter-rater reliability

The walking capacity of each patient was assessed using the MFAC upon discharge from the hospital. The inter-rater reliability was assessed by two raters on the same day, including the case-treating physiotherapist (Rater 1) and one independent physiotherapist who was not involved in providing treatment to the patients (Rater 2).

Concurrent validity

To assess concurrent validity, the MFAC scores were correlated with the Elderly Mobility Scale (EMS) scores. High validity and inter-rater reliability of the EMS were demonstrated in frail elderly people. Concurrent validity was established previously by correlating the EMS scores with other indexes of global and functional ability, such as the Bathel Index (BI) [14]. In fact, the EMS was better than BI for detecting the mobility improvements, indicating that it is a responsive tool to assess changes in patient condition [15]. Good inter-rater reliability of the EMS was also demonstrated in a sample of people with acute medical problems [16]. The EMS is widely used to assess mobility functions in patients with acute medical pathologies [17] and with hip fracture [18,19]. In this study, the EMS was administered to each patient on the same day as the MFAC and it was done by the same independent physiotherapist.

Data analysis

Data analyses were conducted using PASW Version 18.0 for Windows (SPSS Inc., Chicago, USA). Intraclass correlation (2,1) was used to assess the degree of inter-rater reliability, and the Spearman correlation test was used to assess concurrent validity.

Results

Inter-rater reliability

One hundred and twenty-two participants (42 men and 80 women) aged 66—98 years (mean age = 81.3, SD ± 6.5) participated in the study. The characteristics of the patients are displayed in Table 1.

The MFAC categories allocated by the case-treating physiotherapist (median: V or 5) and the independent

Table 1 Patient characteristics

Variable	Value
Sex, *n* (%)	
Men	42 (34.4%)
Women	80 (65.6%)
Age, mean (SD)	81.3 (6.5)
Pre-surgery mobility status, *n* (%)	
Unaided	55 (45.1%)
Cane	57 (46.7%)
Quadripod	5 (4.1%)
Walking frame	3 (2.5%)
Manual assistance	2 (1.6%)
Pre-surgery residence, *n* (%)	
Own home	119 (97.5%)
Old age home	3 (2.5%)

physiotherapist (median: VI or 6) ranged from II (or 2) to VII (or 7) upon discharge (Table 2). Upon discharge, about half of the patients could transfer, turn, and walk independently on level ground (Table 2). The results revealed that the MFAC was a reliable tool for assessing the participants with hip fracture (intraclass correlation coefficient (ICC) = 0.960, 95% confidence interval = 0.942–0.972 , $p < 0.001$).

Concurrent validity

The EMS scores ranged from 3 to 20 (mean = 12.6, SD ± 4.9). The results revealed a significant correlation between the MFAC and EMS scores ($\rho = 0.814$, $p < 0.001$), thus demonstrating concurrent validity.

Discussion

This is the first study to evaluate the inter-rater reliability and concurrent validity of MFAC, and the results showed that the MFAC had good inter-rater reliability and validity. The reliability and validity of different ambulation classification systems were demonstrated in previous studies. The Functional Ambulation Classification (FAC) had a good inter-rater reliability (k = 0.74) [10] and so did the Modified Emory Functional Ambulation Profile (ICC = 0.999) [9].

Table 2 MFAC scores

MFAC categories	Rater 1	Rater 2
I, *n*	0	0
II, *n*	5	5
III, *n*	6	6
IV, *n*	24	20
V, *n*	27	20
VI, *n*	57	68
VII, *n*	3	3

MFAC = Modified Functional Ambulation Classification.

The FAC was developed at Massachusetts General Hospital in Boston as an instrument for categorizing functional ambulation ability [7]. Gait was divided into six categories, ranging from no ability to walk or the ability to walk with the help of two or more people (FAC 0) to the ability to walk independently (FAC 5). Among the several ambulation classification systems, the FAC showed excellent reliability (test-retest reliability, Cohen k = 0.950; and inter-rater reliability, k = 0.905), good concurrent and predictive validity, and good responsiveness in patients with hemiparesis after stroke [12]. Since FAC has been shown to be an appropriate assessment tool in the measurement of walking ability, we adapted it for local use. The original category of "non-functional ambulation" in FAC was expanded to two categories in MFAC to differentiate those patients who was able to sit unsupported from those who were unable. This discrimination of people with different sitting balance abilities was considered to have significant clinical implications for patient care. It was thus suggested by a group of local experts to expand the "non-functional ambulation" category into two categories [13]. In the present study, high inter-rater reliability and concurrent validity was demonstrated in MFAC, just as in FAC.

The MFAC, being an easy-to-use and inexpensive outcome measure, can be readily incorporated into routine clinical practice in the management of patients with hip fracture. It provides a standardized and simple way to communicate an individual's mobility status (e.g., category I to VII) to other professional staff.

The evidence from this study supports the use of the MFAC scale to measure the mobility of patients with hip fracture in the rehabilitation hospital setting. Further investigations may develop applications of the MFAC for patients in different disease groups. Future study is also required to identify clinically meaningful changes in MFAC scores and explore the use of MFAC scores to predict the timing of hospital discharge.

This study had its limitations. First, the participants were recruited from one local hospital only, which may result in sampling bias. The patients with hip fracture in this study may have very different characteristics from their counterparts in other clinical units. Therefore, the results can only be generalized to people with similar characteristics in a similar clinical setting. Second, intra-rater reliability was not assessed and will require further examination.

Conclusion

This study showed that MFAC is a psychometrically sound assessment tool to measure ambulatory function in patients with hip fracture in a rehabilitation hospital setting. The MFAC is neither expensive nor difficult to apply and can be easily incorporated in daily clinical practice.

Acknowledgements

The authors gratefully acknowledge their colleagues who participated in the study for their cordial support and valuable contributions.

Appendix 1 Modified Functional Ambulation Classification (MFAC)

Categories	Stage	Definition
I	Lyer	Patient cannot ambulate and requires manual assistance to sit, or is unable to sit for 1 minute without back or hand support, with the bed or plinth height allowing hips, knees, and ankles positioned at 90° and both feet flat on the floor.
II	Sitter	Patient is able to sit for 1 minute without back or hand support and is unable to ambulate with the help of only one person.
III	Dependent walker	Patient requires manual contacts of no more than one person during ambulation on level surfaces to prevent falling. Manual contacts are continuous and necessary to support body weight as well as to maintain balance and/or assist coordination.
IV	Assisted walker	Patient requires manual contacts of no more than one person during ambulation on level surfaces to prevent falling. Manual contacts are continuous or intermittent light touch is required to assist balance and/or coordination.
V	Supervised walker	Patient can ambulate on level surfaces without manual contact of another person, but for safety reasons, he/she requires standby guarding or verbal cuing of no more than one person.
VI	Indoor walker	Patient can transfer, turn and walk independently on level ground, but requires supervision or physical assistance to negotiate any of the following: stairs, inclines, or uneven surfaces.
VII	Outdoor walker	Patient can ambulate independently on level and non-level surfaces, stairs, and inclines.

Note: This classification does not take account of any aid used.

References

[1] US Department of Health and Human Services. The Surgeon General's Report on Bone Health and Osteoporosis: What it means to you. U.S. Department and Health and Human Services, Office of the Surgeon General, 2012.

[2] Handoll HHG, Sherrington C, Mak JCS. Interventions for improving mobility after hip fracture surgery in adults. Cochrane Database Syst Rev 2011:CD001704. http://dx.doi.org/10.1002/14651858.CD001704.pub4.

[3] Lau EMC, Cooper C, Fung H, Lam D, Tsang KK. Hip fracture in Hong Kong over the last decade — a comparison with the UK. J Pub Health Med 1999;21:249—50.

[4] Hospital Authority. Clinical Data Analysis and Reporting System [Electronic database], 2012.

[5] Magaziner J, Hawkes W, Hebel JR, Zimmerman SI, Fox KM, Dolan M, et al. Recovery from hip fracture in eight areas of function. J Gerontol Med Sci 2000;55:M498—507.

[6] Magaziner J, Fredman L, Hawkes W, Hebel JR, Zimmerman S, Orwig DL, et al. Changes in functional status attributable to hip fracture: a comparison of hip fracture patients to community-dwelling aged. Am J Epidemiol 2003;157:1023—31.

[7] Holden MK, Gill KM, Magliozzi MR, Nathan J, Piehl-Baker L. Clinical gait assessment in the neurologically impaired. Reliability and meaningfulness. Phys Ther 1984;64:35—40.

[8] Perry J, Garrett M, Gronley JK, Mulroy SJ. Classification of walking handicap in the stroke population. Stroke 1995;26:982—9.

[9] Baer HR, Wolf SL. Modified emory functional ambulation profile: an outcome measure for the rehabilitation of post stroke gait dysfunction. Stroke 2001;32:973—9.

[10] Viosca E, Martinez JL, Almagro PL, Gracia A, González C. Proposal and validation of a new functional ambulation classification scale for clinical use. Arch Phys Med Rehabil 2005;86:1234—8.

[11] Vidán M, Serra JA, Moreno C, Riquelme G, Ortiz J. Efficacy of a comprehensive geriatric intervention in older patients hospitalized for hip fracture: a randomized, controlled trial. JAGS 2005;53:1476—82.

[12] Mehrholz J, Wagner K, Rutte K, Meiβner D, Pohl M. Predictive validity and responsiveness of the functional ambulation category in hemiparetic patients after stroke. Arch Phys Med Rehabil 2007;88:1314—9.

[13] Coordinating Committee in Physiotherapy Hospital Authority. Validation study of Modified Rivermead Mobility Index and Modified Functional Ambulation Classification for stroke patients. Unpublished data, Hospital Authority 2007.

[14] Smith R. Validation and reliability of the elderly mobility scale. Physiotherapy 1994;80:744—7.

[15] Spilg EG, Martin BJ, Mitchell SL, Aitchison TC. A comparison of mobility assessments in a geriatric day hospital. Clinic Rehabil 2001;15:296—300.

[16] Prosser L, Candy A. Further validation of the elderly mobility scale for measurement of mobility of hospitalized elderly people. Clinic Rehabil 1997;11:338—43.

[17] de Mortan NA, Berlowitz DJ, Keating JL. A systematic review of mobility instruments and their measurement properties for older acute medical patients. Health Qual Life Outcome 2008; 6:1—15.

[18] Mitchell SL, Stott DJ, Martin BJ, Grant SJ. Randomized controlled trial of quadriceps training after proximal femoral fracture. Clinic Rehabil 2001;15:282—90.

[19] Chiu KC. Predictors of old-age-home placement in Hong Kong Chinese elderly persons after hip fracture. Asian J Gerontol Geriatr 2007;2:69—77.