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Research Article

Inpatient Rehabilitation after Hip Fracture: Predicting Success in Rehabilitation based on Preliminary FIM

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Abstract

Background: Predicting success of inpatient rehabilitation after hip fracture is an unmet challenge

Objective: To assess whether a first impression Functional Independence Measure (FIM) before comprehensive evaluation may be useful to predict success in rehabilitation

Setting: Geriatric rehabilitation center.

Design: Retrospective observational study

Subjects: 42 consecutive elderly patients with proximal hip fracture

Methods: The Functional Independence Measure (FIM) was assessed on the day of admission by a nurse (PreFIM), on day 3-5 by a multidisciplinary team (FimAdm) and on the day before discharge by the same multidisciplinary team (FIMDis). The potential of motor PreFIM to predict rehabilitation success, corresponding to motor FIMDis >58, was assessed, along with the length of stay in rehabilitation (LOS).

Results: The mean motor PreFIM was 43.3 (SD 11.4), motor FIMAdm 48.9 (SD 13.7), motor FIMDis 63.8 (SD 16.7), LOS 22.5 days (SD 9.7). Motor PreFIM predicted motor FIM discharge >58, the surrogate measure for success of rehabilitation, with 76.7% sensitivity and 83.3% specificity. Motor PreFIM relation to LOS was statistically insignificant.

Conclusions: In a population of disabled elderlies, the motor PreFIM on admission-day was helpful to predict success in rehabilitation after hip fracture, but not the necessary duration of rehabilitation. Large prospective studies are needed to validate this data.

Keywords: hip fracture, rehabilitation, functional independence measure, FIM

Introduction

Numerous factors affect the outcomes of rehabilitation in patients with hip fractures, including age, sex, pre-fracture functional ability and frailty, cognitive status, affective status, patient motivation and preferences, comorbidity, the number of treatments, as well as family and social support [1-5]. It would be important for clinicians to predict success of rehabilitation better than clinical judgment alone. The aim of the present study was to find an instrument, which is generally available, quick and easy to use, and might enhance the clinician's judgment in defining situations when rehabilitation is futile. The candidate was the Functional Independence Measure (FIM) assessed on the admission-day by a nurse (PreFIM) before rehabilitation is started.

Methods

The Institutional Review Board approved this retrospective observational study and waived the need for obtaining informed consent. The study was performed in a 40 bed rehabilitation department that admits mainly orthopedic patients. Included were consecutive patients aged 65 years or older transferred from orthopedic surgery to the geriatric rehabilitation ward. Excluded were non-cooperative subjects, as well as patients having an infected operation site, and those temporarily prohibited to tread. The following variables were appraised: demographic data, mini mental state examination of Folstein [6], social support [7], and functional independence measure [8].

The Functional Independence Measure (FIM) is a tool used explore an individual's physical, psychological, and social functions and to monitor the progress under rehabilitation. The FIM has two subscales: the motor subscale, consisting of 13 items related to self-care, transfers, and locomotion, and the cognitive subscale, consisting of 5 items related to comprehension, expression, and memory. Each item is assigned a rating of 1–7, where 1 denotes the necessity for assistance and 7 denotes complete independence [8]. The preliminary FIM (PreFIM) was administered on the day of admission by a specifically initiated and experienced nurse before rehabilitation was begun. Admission FIM (FIMAdm) was provided by corroboration of a multidisciplinary teem 3-5 days after admission, having already qualified the patient's abilities over a few days of rehabilitation. FIM on the wake of discharge from rehabilitation (FIMDis) was provided by the same multidisciplinary team including physicians, occupational therapists, physical therapists, social workers, speech and language therapists, dietitians, and nurses. The following variables were calculated: motor PreFIM, motor FIMAdm, motor FIMDis, motor FIMDis >58 indicating that usually a person may be discharged to the community [9], the absolute motor functional gain (i.e. motor FIMDis minus motor FIMAdm), the length of stay (LOS), and the motor PreFIM sensitivity and specificity in predicting motor FIMDis >58.

Rehabilitation involved the diagnosis of a person's problems and needs, defining rehabilitation goals, and therapeutic interventions. Rehabilitation was provided by the multidisciplinary team consisting of physicians, occupational therapists, physical therapists, social workers, speech and language therapists, dietitians, and nurses. The patients received 5 days per week standard physical therapy (i.e., walking, climbing stairs, balance, muscle strength, and range of motion) and occupational therapy (i.e., basic ADL, instrumental ADL, and environment advice).

Statistical analysis used descriptive statistics, Student's t test, Pearson's correlation, Receiver Operating Characteristic curve, as appropriate. $P < 0.05$ was considered significant.

Results

The data of 47 consecutive patients who met the inclusion criteria were reviewed. Five patients could not complete the rehabilitation because of intercurrent illness needing hospitalization and were excluded from the analysis. Patient demographics, FIM scores at different times, the LOS and ΔFIM/LOS are shown in Table 1.

| Variables	Mean	SD	Range
Age	80	9	
Female: male	32:10		
MMSE	22	7	8 - 30
Social support (out of 15)	10.7	3.3	4 -15
Motor PreFIM	43.3	11.4	18 − 71
Cognitive PreFIM	23.7	4.4	10 -32
Motor FIM Admission	48.9	13.7	18 - 76
Cognitive FIM Admission	26.3	3.9	18 − 32
Motor FIM Discharge	63.8	16.7	18 - 32
Cognitive FIM Discharge	27.2	4.5	17 - 34
LOS (days)	22.5	9.7	9 - 60

Table 1. *Patient characteristics and outcomes of rehabilitation. MMSE: mini-mental state examination; FIM: functional independence measure; PreFIM assessed on the day of admission, FIM Admission assessed by the multidisciplinary team 3- 5 days later, FIM Discharge assessed by the multidisciplinary team the day before discharge, LOS: length of stay.*

Motor FIM changes from admission to discharge are shown in Figure 1.
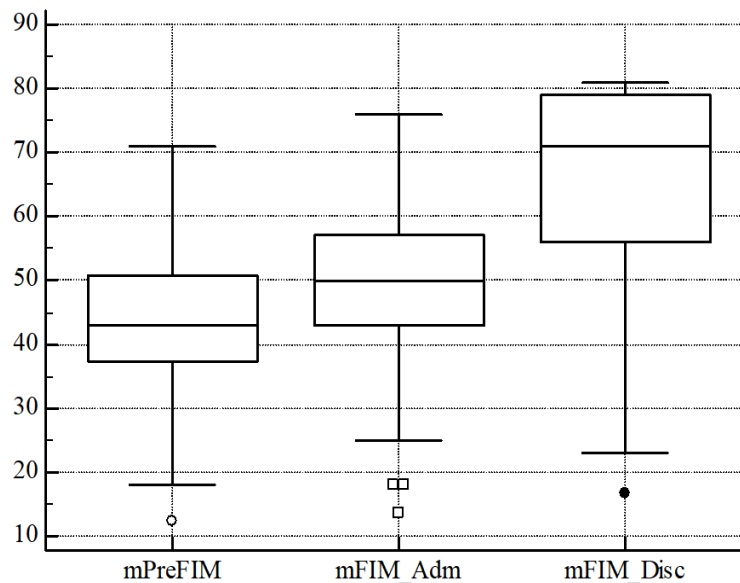
Figure 1. *Motor FIM at different instances. The mean difference between motor PreFIM and motor FIM admission was by 5 .5 points (95% CI 3.9 – 7.2), p <0.001. The mean difference between motor FIM admission and motor FIM discharge was by 14.9 points (95% CI 11.8 – 18), p <0.0001.*

Motor FIM Discharge >58 was found in 28 patients. The total FIM (motor and cognitive) improvement from admission to discharge was by 16.6 points (SD 9.9). The mean functional gain per day, i.e. total FIM at the time of discharge – total FIM on admission was of 0.8 points (SD 0.6). Prediction of rehabilitation outcome by motor Pre FIM, the sensitivity and specificity in relative to motor FIM Discharge >58, are shown in Figure 2.
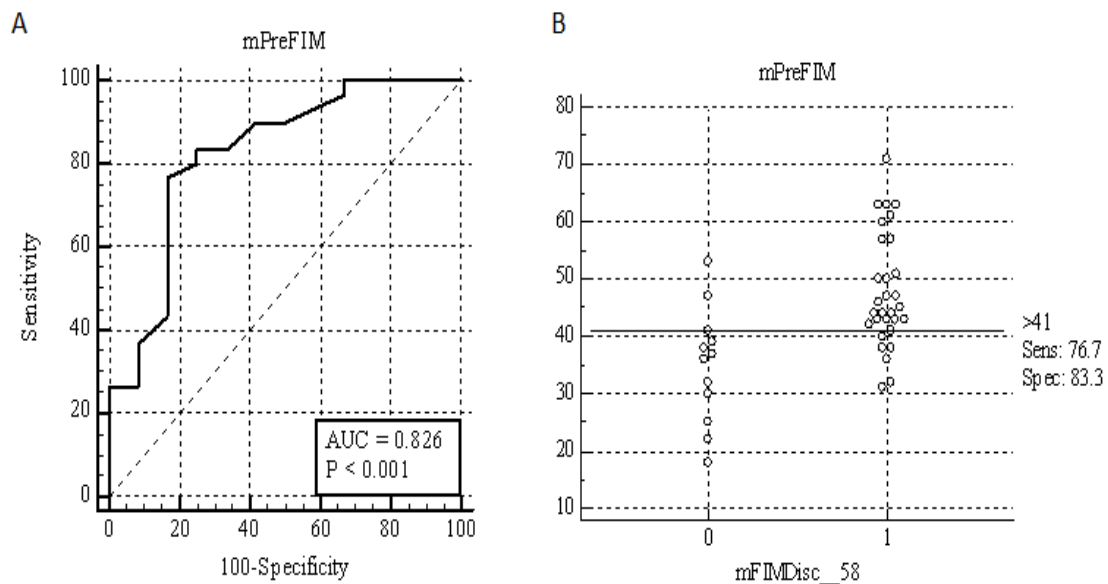

Figure 2. A. *ROC curve analysis showing sensitivity and specificity motor PreFIM in predicting motor FIM Discharge >58. **B.** Motor PreFIM >41 was the best cutoff between success (motor FIM Discharge >58) and failure of rehabilitation, with 76.7% sensitivity and 83.3% specificity.*

According to cutoff motor PreFIM >41, 24 cases were true positive, 9 true negative, 3 false positive and 6 false negative, accuracy 77%.

The correlation between motor PreFIM and the daily functional gain, i.e. progress in rehabilitation (Figure 3), was calculated according to the equation:

Daily motor functional gain = (motor FIM Discharge – motor FIM Admission)/LOS.
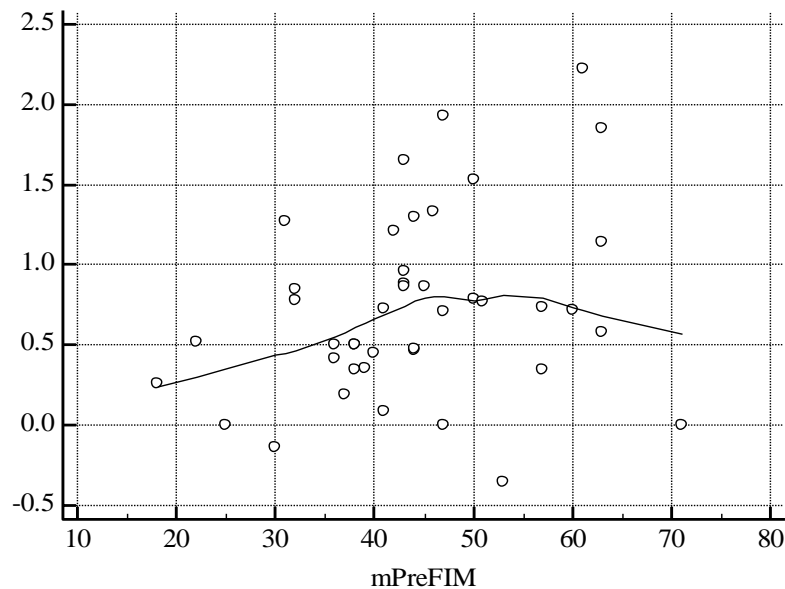
Figure 3. *Correlation between motor PreFIM and daily motor functional gain. R 0.277, p 0.07 (NS)*

ROC curve analysis confronting LOS with FIM Discharge >41 was also insignificant statistically.

Discussion

In this cohort of elderly patients assigned for inpatient rehabilitation after hip fracture, the motor PreFIM assessed by a nurse on admission day, proved to have 77% accuracy in predicting rehabilitation success, the latter corresponding to motor FIM discharge >58.

The validity of FIM instrument for determining outcomes of rehabilitation has been in a study of 117.168 Medicare beneficiaries receiving inpatient rehabilitation for hip fracture in 2007-2009. A discharge motor FIM score of 58 yielded the best balance in sensitivity and specificity for classifying patients by discharge setting. FIM motor was equally effective as FIM total and more effective than FIM cognition in discriminating patients discharged to the community from those discharged to an institution. Moreover, FIM motor ratings alone were as effective as a multivariable model in discriminating patients discharged to the community from those discharged to an institution [9]. Indeed, from a clinical perspective, a diagnostic tool based on a single standard measure and a defined threshold of success is more practical and meaningful than values obtained from a composite model [9, 10]. This understanding was echoed in a survey of consultant members of the British Society of Rehabilitation Medicine [11].

Beyond commonsense used for the first triage, the preliminary FIM assessed by a nurse on admission-day was a valuable instrument to predict success in rehabilitation but not the pace of recovery. As shown in Figure 2, the motor PreFIM did not correlate with the daily motor functional gain. For the disadvantaged, a longer stay in rehabilitation compensated for slow improvement (Figure 3), also indicated by the lack of correlation between LOS and motor FIM discharge >41. Indeed, predicting success of inpatient rehabilitation after hip fracture is challenging because the outcome is affected by numerous factors in addition to treatment, including demographics, family and social support, patient motivation and preferences, which are beyond the control of rehabilitation facilities [12]. In practice, the use of one representative predictor of outcome, e.g. motor FIM discharge, is a necessary compromise.

Whether as simple a tool as the motor PreFIM can be an aid to predict when rehabilitation is futile remains to be answered by larger studies, combining the experience of different institutions in different populations. Data of the present study suggest that this might be possible.

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