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Research Article

Combined Frailty - Functional Independence Measure Instrument

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Abstract

Introduction: Frailty indicates a state of reduced homeostatic reserves and increased vulnerability to adverse outcomes. Based on these attributes, frailty instruments are used as aids in clinical decision making, yet with variable success. As a model to assess frailty indices' accuracy in predicting clinical outcomes we compared frailty tools and the Clinical Frailty Scale (FIM) in predicting success of rehabilitation after hip fracture.

Methods: We conducted a retrospective observational study in consecutive patients admitted for rehabilitation after hip fracture. The study variables were pre-fracture frailty by FI-MDS and Clinical Frailty Scale (CFS), FIM on admission day (Pre-FIM) and FIM before discharge (FIM-Dis), the combined parameters Pre-FIM/FI-MDS and Pre-FIM/CFS. Each variable was related to the outcome measure FIM-Dis >89 which signifies rehabilitation success.

Results: There were 34 women and 11 men, median age 80 years. The median pre-fracture frailty scores were FI-MDS 9.45 (95% CI 6.9-10.3) and CFS 4 (94% CI 3-5) consistent with mild frailty. The median Pre-FIM was 51 (95% CI 48-54). The median FIM-Dis was 97.5 (95%CI 85.1-103). The mean length of stay in rehabilitation was 22.5 days (SD 9.7). Sensitivities and specificities of the variables vs. FIM-Dis >89 were: FI-MDS 80.7% sensitivity, 50% specificity; CFS 92.3% sensitivity, 33% specificity; Pre-FIM 88.46% sensitivity, 66.67% specificity; Pre-FIM/FI-MDS 92.3% sensitivity, 50% specificity; Pre-FIM/CFS 80.7% sensitivity, 61.1% specificity.

Discussion/Conclusions: Frailty tools and FIM are sensitive predictors of rehabilitation success after hip fracture, but their low specificity limits potential uses. A combined frailty-FIM tool was not superior to either variable alone.

Keywords: frailty; functional independence measure; decision making; hip fracture; rehabilitation

Introduction

Frailty, a term used by and large by geriatricians, indicates a state of reduced homeostatic reserves and increased vulnerability to adverse outcomes. Frailty scores are informed by cognitive, motor and social functioning, disability and morbidities, psychological factors and social support [1]. In rehabilitation the Functional Independence Measure (FIM) is used to explore an individual's cognitive and physical functions and monitor the progress under rehabilitation [2]. By different means, frailty and FIM provide multidimensional estimates of a person's health status.

Frailty as a predictor of short-term functional recovery after a pathological event has been investigated in conditions such as trauma, surgery, chemotherapy, transplantation, cardiac interventions, and intensive care medicine [3-6]. A comprehensive literature survey investigated the association of frailty (by means of the Clinical Frailty Scale) with an outcome, mostly in hospitalized patients. Frailty was predictive in 74% of the cases, highlighting its utility for the care of older patients [7]. Quantification of frailty might aid the clinical judgment now employed [8]. Recently, the National Institute for Health and Care Excellence (NICE) endorsed the use of Clinical Frailty Scale (CFS) to help with decision-making []. However, a systematic review of the literature on frailty tools showed that they have very low specificity, limiting their clinical use [10].

We used inpatient rehabilitation after hip fracture as a model for assessing the accuracy of frailty tools. In addition to the classical frailty tools, we proposed a combination of two indices, one or the other frailty tool with FIM, assuming that jointly they might provide a meaningful advantage.

Materials and 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 ward that admits mainly orthopedic patients. Included were consecutive patients aged 65 years or older

transferred from orthopedic surgery to the geriatric rehabilitation wards. Excluded were non-cooperative subjects, as well as patients having an infected operation site, and those temporarily prohibited to tread. The Functional Independence Measure (FIM) and two frailty tools, the FI-MDS calculated from the Minimum Data Set document and the CFS, both appropriate for use in subjects with physical impairment and cognitive decline.

The Functional Independence Measure (FIM) is a tool used to 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 [2]. The preliminary FIM (Pre-FIM) was administered on the day of admission by a purposely initiated and experienced nurse before rehabilitation was begun. Admission FIM (FIM-Adm) 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 day before discharge from rehabilitation (FIM-Dis) was provided by the same multidisciplinary team including physicians, occupational therapists, physical therapists, social workers, speech and language therapists, dietitians, and nurses. According to common knowledge, FIM-Dis >89 signifies that a person has the potential to be discharged home [11].

Pre-fracture frailty was assessed by physicians who were directly involved in the patients' care. Two frailty tools were used, FI-MDS calculated from the Minimum Data Set document [12] and the FI-Rockwood [13]. From the MDS document a list of 58 deficits was derived representing multiple functional domains. Each deficit was assigned either 0 (absence of the condition or attribute) or 1 (presence of the condition or attribute). The body mass index was assigned score 0 unless it was < 18.5 kg/m2 or ≥ 30 kg/m2, in which case a score of 1 was assigned. Medication usage was scored according to the number of medications used: 6-9 score 1; 10-14 score 2; 15-19 score 3; > 20 score 4. The mean of the deficits was expressed as a proportion of the total 58 points, ranging from 0 (no deficits) to 100% (58 deficits) [12]. For the CFS the examiner's intuitive perception of a patient's disability and cognitive impairment was represented by a score ranging from 1 (robust health) to 9 (complete functional dependence) [13]. The Mini–Mental State Examination (MMSE) of Folstein [14] was used assess the patients' cognitive state at the time of admission.

The following variables were calculated: Pre-FIM and FIM-Dis, CFS score and FI-MDS score. We combined Pre-FIM with either frailty index and called the resultants Prognostic index 1 (Pre-FIM divided by FI-MDS score) and Prognostic index 2 (Pre-FIM divided by CFS score). All variables, the Pre-FIM, FI-MDS, CFS, Prognostic indexes 1 and 2, were related to the index of successful rehabilitation, represented by FIM-Dis >89.

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 data, Student's t test, Pearson's correlation, and the Receiver Operating Characteristic curve, as appropriate. $P < 0.05$ was considered significant.

Results

The files of 48 consecutive patients who met the inclusion criteria were reviewed. Because of incomplete data 3 cases were excluded. Five patients could not complete rehabilitation because of intercurrent illness but are included in the intention to treat analysis. There were 34 women and 11 men; their median age was 80 years. The median pre-fracture frailty scores were FI-MDS = 9.45 (956% CI 6.9-10.3) and CFS = 4 (94% CI 3-5), both consistent with the subjects being vulnerable or mildly frail. The MMSE was computed in 40 patients who were able to collaborate – their median score was 26 (95%CI 23.4-27). The frailty indices correlated imperfectly with each other (r = 0.65), therefore were used separately in the subsequent analysis. The median Pre-FIM was 51 (95% CI 48-54) and the median FIM-Dis was 97.5 (95%CI 85.1-103). The mean length of stay was 22.5 days (SD 9.7). Sensitivities and specificities of the study variables versus FIM-Dis were computed by ROC curve analysis as illustrated in (Figure 1).

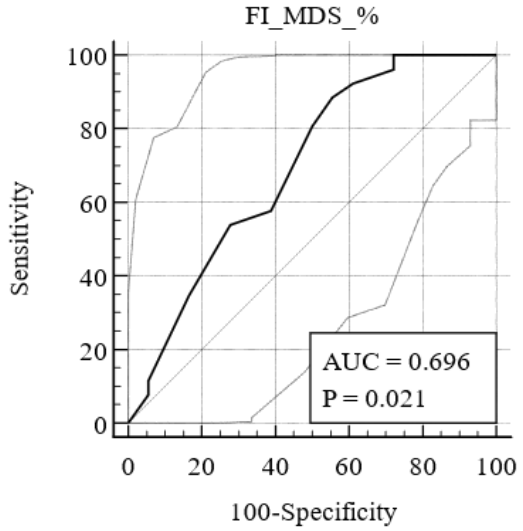

Figure 1: Pre-fracture FI-MDS prediction of FIM at the time of discharge. The best cutoff ≤10.3 had 80.77 % sensitivity and 50% specificity for FIM-Dis >89

The predictive power of the five variables concerning FIM-Dis >89, signifying that a person has the potential to be discharged home [11] is summarized in Table 1, focused on sensitivity >80%. The best predictor was Pre-FIM.

Variable	Criterion	Sensitivity (%)	Specificity (%)	P value	AUC
FI-MDS	≤10.3	80.8	50	0.021	0.696
CFS	≤5	92.3	33	0.011	0.706
Pre-FIM	>46	88.5	66.7	<0.001	0.858
Pre-FIM/FI-MDS	>3.7	92.3	50	0.002	0.747
Pre-FIM/CFS	>10	80.8	61	<0.001	0.791

Table 1: Sensitivity and specificity of variables in predicting success of rehabilitation based on ROC curve analysis.

Discussion

Success in rehabilitation after hip fracture is achieved when a patient can safely be discharged home (11). Yet, the outcome of rehabilitation 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 [5-18]. In practice, the use of one representative predictor of outcome, (e.g., FIM-Dis), is a necessary compromise [19] and was the outcome measure used in this study. The validity of FIM for determining the outcome of rehabilitation is established [15,17]. From a clinical perspective, a diagnostic tool based on a single standard measure and a defined threshold of success (e.g., FIM-Dis) is more practical and meaningful than values obtained from a composite model, and it also is most popular [19].

The question addressed in this study was whether success in rehabilitation after hip fracture can be predicted by simple beside measures, such as frailty indices and the PreFIM. Frailty as a predictor of short-term functional recovery after a pathological event has been investigated in varied conditions, such as trauma, general surgery, chemotherapy, kidney transplantation, and decisions to treat hyperparathyroidism [3-8]. A comprehensive literature survey investigated the association of frailty with an outcome, mostly in hospitalized patients. Functional recovery after hip fracture correlated inversely with the degree of frailty in previous studies [20-22] as well as in the present study. Both frailty tools, the FI MDS and CFS, fitted well to the population of the present study, where the patients' physical and cognitive limitations would impede on performance of motor tests and on self-reporting. The lower was the pre-fracture frailty score the higher was the probability of success in rehabilitation. Yet, the limited sensitivity and specificity of both the FI MDS and CFS reveal their inadequacy for decision management concerning older persons' rehabilitation after hip fracture.

Significantly better prediction was available by Pre-FIM, with 88.46% sensitivity and 66.7 % specificity for FIM-Dis >89. The preliminary FIM assessed by a dedicated nurse on admission-day was a valuable instrument to predict success in rehabilitation but not the pace of recovery. For the disadvantaged, a longer stay in rehabilitation compensated for slower improvement (22). Yet, results of the Pre-FIM, though statistically highly significant at p 0.002, would not meet the clinician's expectations facing a particular patient. In showing that a higher Pre-FIM corresponds to better odds to achieve FIM-Dis >89, and that higher CFS and FI-MDS scores correspond to worse odds to have FIM-Dis >89, we combined both parameters. The Prognostic index 1 (Pre-FIM/FI-MDS) and the Prognostic index 2 (Pre-FIM/CFS) were not better than Pre-FIM alone. Nevertheless, the ability of Pre-FIM to predict success of older persons inpatient rehabilitation after hip fracture is demonstrated.

Limitations of the study

First, the frailty indices as well as the PreFIM and FIMDis, are subject to personal interpretation. Second, the large gap between the PreFIM and FIMDis scores might appear unrealistic and not solely attributed to improvement of the patient's functioning. Additional factors might be involved in gap between the Pre-FIM and FIM-Dis. These are vanishing of the "frailty crisis" that related to fracture and surgery, the patients' progressive adaptation to the changing hospital environment, the nurses' assessment of Pre-FIM based on few information and short time for observation compared to FIM-Dis that benefited from multidisciplinary input and time for long observation. Nevertheless, the ability of Pre-FIM to predict success rehabilitation after hip fracture is demonstrated.

Conclusions

In conclusion, frailty tools are sensitive predictors of rehabilitation success after hip fracture, but low specificity limits their potential for clinical decision making. Overall, the Pre-FIM might provide an aid, beyond the geriatricians commonsense and frailty tools, in the first triage of patients intended for inpatient rehabilitation after hip fracture.

Statements

This study protocol was reviewed and approved by Beit Balev Ethics Committee in accordance with the World Medical Association Declaration of Helsinki, approval number BBL-0015-20. Informed consent was waived, given that the data was not collected for the purposes of the study.

Declarations

The authors have no conflicts of interest to declare.

There was no funding provided to this study.

Authors Contributions

The author's contribution were as follows: Jochanan Naschitz proposed the study hypothesis and conceived the study design, reviewed patient records, assessed the statics, wrote the article; Natalia Zaigraykin participated in reviewing patient data and writing the paper; Muhamad Badarny had assessed the FIM; Oxana Zaleysov reviewed clinical data and frailty scores.

All data analyzed during this study are included in this article. Further enquiries can be directed to the corresponding author.

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