

Research Article

Are Evaluation Scores Reliable Predictors of 30-Day and 1-Year Mortality in Fragility Neck of Femur Fractures?

Efthymios Iliopoulos^{1*}, Reichan Molla Moustafa¹, Ioannis Kougioumtzis¹, Konstantinos Tilkeridis¹, Athanasios Ververidis¹,
Georgios Drosos¹

¹Metabolic Disease and Fragility Fractures Unit of Academic Department of Orthopaedics in General University Hospital of Alexandroupolis, Democritus University of Thrace, Greece

*Correspondence author: Efthymios Iliopoulos, MD, MBA(HSM), PhD, CCST(T&O), Assistant professor of Orthopaedics, Democritus University of Thrace, Greece; Email: iliopoulouse@gmail.com

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Abstract

Introduction: An aging population is one major concern of healthcare providers, with fragility fractures affecting individuals over the age of 65. While there are multiple tests available for predicting mortality, we have yet to define the best clinical assessment tool for fragility fractures. **Material and Methods:** All patients admitted in our hospital from 2017 until 2023 with fragility NOF fracture were included in the study. The collected data included demographic data and several scales, included the AMTS score, the new mobility score, the ASA grade, the Charlson Index, the Nottingham Hip Fracture score and the Sernbo score. The 30 day mortality was collected as well. Patients without full data were removed from the study.

Results: There were 380 patients forming the study cohort and after exclusions a total of 356 patients aged 81.73 ± 9.24 years, with fragility neck of femur fractures were finally included in the study. The patients had mean ASA grade of 2.36 ± 0.6 , while pre-operatively the NMS score was 5.77 ± 2.6 , the Charlson Score 4.17 ± 2.3 , the NHFS 5 ± 1.2 and the Sernbo score 15.23 ± 3.8 . The 30-day mortality was 9.5% and the 1-year mortality was 28.8%.

In the multivariate model with the 30-day mortality as dependent variable, all variables lose their unique significance. In the multivariate model with the 1 year mortality as dependent variable the only variable that retained its significance as independent predictive factor after a fragility neck of femur fracture was the new mobility score ($p=0.024$).

Conclusion: The multivariate analysis of the present study revealed that New Mobility Score is the only independent predictive risk factors for 1 year mortality after a fragility hip fracture. Although the Sernbo and NHFS scores are useful, they do not appear to predict the 30-day and the 1 year mortality of the patients in this cohort.

Keywords: Fragility Fracture; Mortality Prediction; New Mobility Score; Nottingham Hip Fracture Score; Abbreviated Mental Test Score; PROMs

Introduction

Frailty poses a major challenge to healthcare providers. Globally the incidence of hip fracture estimated to increase, as it is projected that the total number is going to reach 6.3 million until 2050 [1]. Fragility fractures affecting individuals over the age of 65, frequently coexist with sarcopenia, frailty and malnutrition. These can lead to complications, resulting to loss of independence and has a substantial incidence of mortality and morbidity. The postoperative mortality rate of hip fractures is 5-10% at 30 day and 19-33% at 1 year [2-4].

The identification of patients with a high risk of complications and mortality is essential in order to provide more tailored services to these patients. The last years many scores have been identified for this purpose. Frequently used postoperative outcome measurement tools include the American Society of Anesthesiology (ASA) score, Charlson Comorbidity Index (CCI), Nottingham Hip Fracture Score (NHFS), Abbreviated Mental Test Score (AMTS), Orthopedic-Physiological and Operative

Severity Score for the enumeration of Mortality and Morbidity (O-POSSUM), Estimation of Physiologic Ability and Surgical Stress (E-PASS), Mini-Mental State Examination (MMSE), Risk Model for Delirium (RD) and Barthel Index [5]. The new mobility score assesses pre-fracture mobility status and has good predictive ability for mortality [6]. Sernbo is an additional test which was created recently to aid the decision making for surgery type following femoral neck fracture. At the same time, it was found that it had a good predictive ability for mortality [7].

The aim of the present study is to evaluate the value of using the Sernbo score as a mortality predictor factor for fragility hip fractures. With the view to choose the most useful, quick and reliable clinical assessment tool that can help identify high-risk patients with an increased rate of mortality and morbidity.

Material and Methods

All elderly patients (>65yo) admitted in the Trauma and Orthopaedics Department of the General University hospital from July 2017 until June 2023 with fragility neck of femur fracture were included in the study. Younger patients (<65yo) and patients with high energy trauma patients with incomplete data were excluded from the study. The data were collected prospectively and anonymized for the local registry and analyzed retrospectively for the purpose of the present study. The collected data included demographic data and several scales, included the mental state (Abbreviated Mental Test Score, AMTS), the mobility state (New Mobility Score, NMS), the physical condition preoperatively (American Society of Anesthesiologists, ASA), the assessment of co-morbidity (Charlson Index), the risk of mortality (Nottingham Hip Fracture score, NHFS) and the survival (Sernbo score). The 30-day and one-year mortality was collected as well.

This research has been approved by the authors' affiliated institutions. Informed consent was obtained from all patients and relevant persons for publication. No identifiable information of the participants is included in the manuscript. Statistical analysis was performed using the SPSS version 23.0 statistical program (SPSS Inc., Chicago, IL, USA) and the statistical significance was set at the 0.05.

Results

A total of 380 patients were included in the study. After exclusions a total of 356 patients aged 81.73 ± 9.24 years, with fragility neck of femur fractures were included in the study. Most of the patients (71%) were female and the mean BMI of the cohort was 26.66 ± 4.91 . The patients had mean ASA grade of 2.36 ± 0.6 , while pre-operatively the NMS score was 5.77 ± 2.6 , the Charlson Score 4.17 ± 2.3 , the NHFS 5 ± 1.2 and the Sernbo score 15.23 ± 3.8 . The 30-day mortality was 9.5% and the 1-year mortality was 28.8%. Table 1 summarizes these results.

The monovariant analysis revealed that Gender had significant influence on the 30-day mortality ($p=0.05$). Age, BMI, AMTS, ASA grade, New Mobility Score, Charlson Index, NHFS and Sernbo Score did not affect significantly the 30-day mortality rate ($p=0.12, 0.41, 0.42, 0.98, 0.43, 0.94, 0.21$ and 0.75 respectively) (Table 2).

The one year mortality was related significantly with AMTS, New Mobility Score, NHFS ($p=0.03, 0.003, 0.017$ respectively). Gender, Age, BMI, ASA grade, Charlson Index and Sernbo Score did not have significant influence at the one year mortality ($p=0.06, 0.63, 0.16, 0.57, 0.82$ and 0.07 respectively) (Table 3).

In the multivariant model with the 30-day mortality as dependent variable, all variables lose their unique significance. In the multivariant model with the 1 year mortality as dependent variable the only variable that retained its significance as independent predictive factor after a fragility neck of femur fracture was the new mobility score ($p=0.024$) (Table 4).

	Frequencies (N)	Percent (%)	Mean $\pm$ SD
Age			81.73 ± 9.2
BMI			26.66 ± 4.9
Gender			
Female	254	71.3	
Male	102	28.7	

ASA Grade			2.36 ±0.6
New Mobility Score			5.77 ±2.6
Charlson Score			4.17 ±2.3
Nottingham Hip Fracture score			5 ±1.2
Sernbo score			15.23 ±3.8
30-day Mortality			
Alive	315	90.5	
Death	33	9.5	
1-year Mortality			
Alive	200	71.2	
Death	81	28.8	

Table 1: Descriptives, pre-operative scores and mortality data of the cohort.

					Mean ±SD	p value
Gender	Female		Male			0.05
30-day mortality: Alive	232		83			
30-day mortality: Death	19		14			
Age						0.12
30-day mortality: Alive					81.53 ±9.2	
30-day mortality: Death					83.88 ±8.4	
BMI						0.16
30-day mortality: Alive					27.09 ±5.2	
30-day mortality: Death					26.13 ±4.4	
ASA grade	Grade I	Grade II	Grade III	Grade IV		0.98
30-day mortality: Alive	14	190	92	17		
30-day mortality: Death	1	20	10	2		
AMTS						0.42
30-day mortality: Alive					7.34 ±2.7	
30-day mortality: Death					6.82 ±3.0	
New Mobility Score						0.43
30-day mortality: Alive					5.71 ±2.6	
30-day mortality: Death					6.15 ±2.7	
Charlson Index						0.94
30-day mortality: Alive					4.15 ±2.3	
30-day mortality: Death					4.15 ±2.5	
Nottinham Hip Fracture Score						0.21
30-day mortality: Alive					4.97 ±1.2	
30-day mortality: Death					5.27 ±1.7	
Sernbo Score						0.75
30-day mortality: Alive					15.23 ±3.7	
30-day mortality: Death					14.97 ±3.8	

Table 2: Monovariant analysis of 30-day mortality.

					Mean ±SD	p value
Gender	Female		Male			0.63
1-year mortality: Alive	144		56			
1-year mortality: Death	56		25			
Age						0.06
1-year mortality: Alive					80.61 ±9.5	
1-year mortality: Death					82.69 ±9.2	
BMI						0.024
1-year mortality: Alive					27.24 ±4.8	
1-year mortality: Death					26.11 ±5.1	
ASA grade	Grade I	Grade II	Grade III	Grade IV		0.57
1-year mortality: Alive	12	124	51	11		
1-year mortality: Death	3	55	21	2		
AMTS						0.03
1-year mortality: Alive					7.60 ±2.6	
1-year mortality: Death					6.63 ±3.2	
New Mobility Score						0.003
1-year mortality: Alive					6.28 ±2.6	
1-year mortality: Death					5.28 ±2.7	
Charlson Index						0.82
1-year mortality: Alive					3.72 ±2.2	
1-year mortality: Death					3.75 ±2.43	
Nottinham Hip Fracture Score						0.017
1-year mortality: Alive					4.82 ±1.1	
1-year mortality: Death					5.20 ±1.3	
Sernbo Score						0.07
1-year mortality: Alive					15.88 ±3.6	
1-year mortality: Death					15.15 ±3.4	

Table 3: Monovariant analysis of one year mortality.

	Significance (p) for 30-day mortality	Beta	Significance (p) for 1 year mortality	Beta
Age	0.190	1.037	0.666	1.008
BMI	0.642	0.981	0.378	0.973
Gender	0.116	1.923	0.956	1.018
ASA Grade	0.515	1.234	0.33	0.789
New Mobility Score	0.105	1.166	0.024*	0.865
Charlson Score	0.970	1.003	0.823	0.985
Nottingham Hip Fracture score	0.687	1.080	0.294	1.170
Sernbo score	0.963	1.004	0.338	1.059

Table 4: Multivariant analysis results for 30-day and 1 year mortality (significant score is marked with *).

Discussion

The present study demonstrates the importance of the use of different evaluation scores as mortality prediction tools for patients sustaining a fragility neck of femur fracture. From the scores used the new mobility score had the most significant predictive capability for the one year survival. The NHFS, the AMTS and the age were other factors related with the mortality.

The Nottingham Hip Fracture Score (NHFS) was created for mortality prediction in fragility fracture of the hip in 2008. It includes an assessment of seven variables: age, sex, co-morbidities, hemoglobin concentration, cognitive status evaluation with AMTS, living arrangements and history of malignancy [8]. The 30-day prediction ability has been validated separately and in many countries [9-11]. However, the one year mortality rate was significantly related to the NHFS. Other studies, besides using of 30-day and one-year mortality rates, examine the score for early hospital discharge [12]. In contrast to our study, Nelson M, et al., 2020 demonstrated the good predictive ability of the score for 30 days, 6 months and one year mortality ($p=0.001$), but the number of patients included in their retrospective data collection was only 130 compared to the 380 of the present study [13]. Reports from some European countries suggest that the NHFS may underestimate mortality in specific cohorts of patients with fragility hip fractures. To address these variations, certain amendments have been proposed to better account for individual differences in these countries [14,15]. It is possible that the Greek cohort exhibits similar discrepancies, indicating that the NHFS could be adjusted to better suit local needs.

The Sernbo score was initially created to assist in deciding whether you choose total or hemi arthroplasty for femoral neck fractures [7]. Later it was found that this score also has one-year mortality prediction ability [16]. However, in our study, Sernbo did not show prediction ability for one-year mortality. It should be mentioned that we used it for all hip fractures, whereas it was specifically designed for femoral neck fractures and this may have influenced our results. In a study by Mellner, et al., 2021, the use of Sernbo score reliably predicted the one-year mortality in the Swedish national registry, which included all hip fractures in the elderly [16]. Further studies in other countries could clarify if this score has different predictive values in different cohorts.

The mobility status before the frailty fracture it is attended to be most reliable predictor of recovery after the fracture in the geriatric population [6,17,18]. Another study establishes that patients with walking ability without assistance before surgery live longer up to 1 year and ten years ($p<0.001$) [19]. The new mobility score was created for mortality prediction by assessing the mobility status in various conditions such as at home, outside and shopping abilities [20]. A prospective study with 280 patients shows the mobility status, which was evaluated with new mobility score, is a self-sufficient predictor for early postoperative outcomes during hospitalization. In the present study, the NMS had predictive ability for one-year mortality only in monovariant analysis. It is crucial to note that while all scores lose their significance in multivariate analysis only the NMS had predictive ability as a score. This result is consistent with the literature so far [6,20,21].

The present study has its strengths and weaknesses. The data were collected prospectively for the local registry, detached from any study, eliminating any potential bias during the data collection process. The number of patients that were included in the study was low though, as larger numbers may affect the results differently.

Conclusion

Patients with fragility neck of femur fractures have high mortality risk. Different evaluation scores can be proven useful tools in the prediction of survival for these patients. The present study by using multivariant analysis, revealed that the new mobility score is the only independent predictive risk factors for 1 year mortality after a fragility hip fracture in the Greek population. Further studies should evaluate the predictive ability of mortality of other evaluation scores.

Conflict of Interests

As participants in this study, we collectively declare that none of us have any financial, personal or professional conflicts of interest that could inappropriately influence or appear to influence, the conduct, outcomes or reporting of this research.

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