

Using the Study of Osteoporotic Fracture Frailty Index for Frailty Assessment in An Aging and Developing Country

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Abstract

Objective: Frailty is one of the most important geriatric syndromes. In frailty, there is a cumulative decline in multiple physiological systems, a decrease in resistance to stress factors, resulting in vulnerability to adverse outcomes. In clinical practice, it is very important for physicians, especially those in the field of geriatrics, to recognize this syndrome. The aim of this study was to validate the Turkish version of the study of osteoporotic fracture (SOF) frailty index in geriatric population.

Materials and Methods: This study was performed in a geriatric medicine outpatient clinic. The study was conducted with 267 patients aged 65 and over. Patients with acute disease, delirium, diagnosis of malignancy and who did not give informed consent were excluded from the study.

Results: The median [interquartile range (IQR)] age of patients was 72 (68-78) and 64% of the participants were female. The median (IQR) SOF score was 1 (0-1). When frailty was examined within two groups [robust (robust + pre- frail) and frail group] the concordance of FRAIL and SOF score was strong (Cohen's K: 0.652, $p < 0.001$) and the concordance of CFS and SOF score was also strong (Cohen's K: 0.611, $p < 0.001$).

Conclusion: The results showed that the Turkish version of the SOF index is a valid scale for determining frailty in outpatient clinics.

Keywords: Older, frailty, scale, SOF index, correlation

Introduction

Frailty is one of the most important geriatric syndromes. In frailty, there is a cumulative decline in multiple physiological systems, a decrease in resistance to stress factors, resulting in vulnerability to adverse outcomes. (1). Frailty is associated with increased mortality, hospitalization, disability, falls, fractures, worsening mobility, desolation, depression, cognitive decline, dementia and admission to long-term care (1-12). The prevalence of frailty increases as age increases in the community-dwelling older adults. While this rate is 4% between the ages of 65 and 69, it rises to 26% at the age of 85 and over (13).

Many scales are available to screen and assess frailty. Fried's frailty criteria, clinical frailty scale (CFS), edmonton frail scale,

FRAIL scale are some of these scales (1,14-20). There are two basic approaches on which frailty scales are bases (21). The first approach involves the physical components defined by Fried et al. (1). The second approach includes social, psychological and cognitive components as well as physical components (14). When choosing an ideal frailty scale, a clinician should consider the instrument's validity and ultimate purpose across the field of interest (22,23).

In 2008, the osteoporotic fractures study (SOF) research group developed a simpler index to define frailty. This scale evaluates frailty with 3 components. These are weight loss, inability to get up five times without using arms, and person reporting low energy. It is practical to use this index in clinical settings (24). In previous studies SOF index was found to be a predictor of falls,

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disability, non-spine and hip fractures, emergency department (ED) admissions, overnight hospitalizations and deaths (24-26).

In clinical practice, it is very important for physicians, especially those in the field of geriatrics, to recognize this syndrome. For this, frailty scales that can be used practically and quickly are needed. SOF index is a practical and easy-to-apply scale compared to other scales. The purpose of this study was to validate the Turkish version of the SOF frailty index in geriatric population.

Materials and Methods

Participants

This study was performed in a geriatric medicine outpatient clinic. The study was conducted with 267 patients aged 65 and over. Patients with acute disease, delirium, diagnosis of malignancy and who did not give informed consent were excluded from the study. In order to assess its test-retest reliability, the scale was performed on 20 patients by the same geriatrician (ii) seven days after the first administration. For interrater reliability, the SOF scale was performed to 20 patients by two geriatricians (ii, MH) who were blind to each other's scores in a different examination room on the same day.

Data Collection

Comprehensive geriatric assessment was performed to all patients. Functional status was assessed with the Katz activities of daily living (ADL) and the Lawton-Brody instrumental ADL (IADL) (27-30). Mini nutritional assessment-short form (MNA-SF) was used for nutritional status assessment (31,32). Emotional status was evaluated with the Yesavage geriatric depression scale (YGDS) (33,34). The age, gender, medical history and medications used by the patients were noted down. Laboratory values were recorded from the hospital system.

SOF Index

Patients who scored 2 or more on the following items according to the SOF index were considered frail. These are: $\geq 5\%$ weight loss in the previous year (involuntary), unable to get out of a chair five times without using arms, and answering "no" to the question "do you feel full of energy". For item 1, the patient is asked whether there has been any weight loss, and if so, how much weight has been lost. For item 2, the patient is given the get up and sit test from the chair 5 times. For item 3, the patient is asked if he or she feel full of energy. Those with a score of 0 on these items were considered as robust, those with a score of 1 were considered as pre-frail, while those with a score ≥ 2 were considered as frail (24,25).

Reference Tools

The other 2 scales we used to assess frailty in the study are the FRAIL scale and the clinical frailty scale. The FRAIL scale is a form

consisting of 5 questions and evaluates the patient's fatigue status, resistance, mobility, weight loss and other diseases. By giving 0 or 1 point from each item according to the answers given by the patients; in total, 0 point is considered normal (non-frail), 1-2 points are pre-frail, and those with >2 points are considered frail (16,17). On the CFS, the patient is given a score from 1 (very active) to 9 (terminal disease) after clinical evaluation. At each step, frailty is graded both visually and with written instructions. At the fourth score, patients are evaluated as vulnerable, and at scores ≥ 5 , as frail (14,18). In the updated new version of CFS, the fourth score is also defined as frail (35).

Translation

Language validation was performed by forward-backward translation. Two native target language translators translated the original SOF index into Turkish. The Turkish version was checked and agreed by all authors. Then, the Turkish version was retranslated into English by two native speakers of English and bilingual in the target language. Three geriatric medicine specialists compared the back-translated version with the original version. Finally, the Turkish SOF index was applied face-to-face to 267 community-dwelling older. The participants had no difficulty understanding and answering all three questions of the test. Finally, this improved translation was adopted to conduct the reliability and validity study of the SOF index in Turkish language.

Statistics

IBM SPSS version 23 program was used in data analyses. As a result of the calculations made with the help of descriptive statistics obtained from the literature study, a statistically significant correlation of 0.19 effect size between 2 variables with 80% power at 95% confidence level would be found when samples with a minimum width of 267 were selected (Sample width was calculated using the PASS11 version program). Continuous variables were written as means \pm standard deviations or medians [interquartile ranges]. Frequency and percentage values were written for categorical variables. Mann-Whitney U test or Student's t-test was used for continuous variables, and χ^2 (chi-square) and Fisher precision tests were used for categorical variables. The construct validity of SOF index was analyzed by Cohen's Kappa. Intraclass Correlation Coefficient (ICC) was used to examine test-retest reliability and interrater reliability. Correlations between patients SOF score, CFS score and FRAIL score were calculated using the Spearman test. The p-value of <0.05 was considered statistically significant.

Ethical Statement

The study was performed in accordance with the guidelines in the Declaration of Helsinki. The Local Ethics Committee of Hacettepe University approved the study (ID: GO 21/1164). Oral and written details about the study were explained to the patients and their consent was obtained.

Results

There were 267 patients in the study. The median (IQR) age of patients was 72 (68-78) and 64% of the participants were female. The median (IQR) SOF score was 1 (0-1), the median (IQR) FRAIL score was 1 (0-2) and the median (IQR) CFS score was 3 (3-4). Number of frail patients were 52 (19%) according to CFS, 65 (24%) according to FRAIL scale and 58 (22%) according to SOF. Characteristics of the whole study group are shown in Table 1.

When we look at frailty as three groups (robust, pre- frail, and frail group) concordance of FRAIL and SOF score was strong (Cohen's K: 0.633, p<0.001) and the concordance of CFS and SOF score was moderate (Cohen's K: 0.404, p<0.001). FRAIL and SOF score were positively and strongly correlated (Spearman r=0.805, p<0.001). The correlation between the CFS and SOF score was moderate (Spearman r=0.578, p<0.001).

When frailty was examined within two groups [robust (robust + pre-frail) and frail group] concordance of FRAIL and SOF score was strong (Cohen's K: 0.652, p<0.001) and the concordance of CFS and SOF score was also strong (Cohen's K: 0.611, p<0.001). The correlation between the FRAIL and SOF score was strong (Spearman r=0.654, p<0.001) and the correlation between the CFS and SOF score was also strong (Spearman r=0.612, p<0.001). The concordance and correlation results of SOF score were given in Table 2.

When analyses were performed with the updated version of CFS (31), the concordance of CFS and SOF score was moderate (Cohen's K: 0.401, p<0.001) and the correlation between the CFS and SOF score was also moderate (Spearman r=0.460, p<0.001) results were given in Table 3.

Test-retest reliability of the SOF score was high (ICC: 0.939, CI: 0.846-0.976, p<0.001). The interrater reliability of the SOF score was also high (ICC: 0.981, CI: 0.953-0.993, p<0.001). Reliability results were shown in Table 4.

Discussion

With this study, we aimed to validate the SOF frailty measurement scale for frailty assessment. Results showed that Turkish version of the SOF is a valid and reliable scale for screening frailty in older people. It has high test-retest and interrater reliability. In

Table 1. Demographic properties and general characteristics of the study population

Patients (n=267)	
Age	72 (68-78)
Sex	
Women (n, %)	172 (64%)
SOF score	1 (0-1)
FRAIL scale	1 (0-2)
CFS	3 (3-4)
Number of drugs	5 (2-7)
Katz ADL	6 (6-6)
Lawton IADL	8 (7-8)
MMSE	27 (25-29)
Yesavage GDS	2 (0-5)
MNA-SF	14 (12-14)
Hemoglobin, g/dL	13.6 (12.3-14.6)
Creatinine, mg/dL	0.8 (0.69-1)
AST, U/L	20 (17-24)
Vitamin D, ng/mL	19.9 (11.2-28.8)
Vitamin B12, pg/mL	253 (176.5-348)
TSH, mIU/L	1.7 (1-2.5)
DM (n, %)	109 (41%)
HT (n, %)	170 (64%)
CAD (n, %)	51 (19%)
COPD (n, %)	13 (5%)

*Categorical values were given as number and percentages, continuous values were given as median (IQR)
 SOF: Study of osteoporotic fracture, CFS: Clinical frailty scale; ADL: Activities of daily living, IADL: Instrumental activities of daily living, MMSE: Mini-mental state examination, GDS: Geriatric depression score, MNA-SF: Mini nutritional assessment-short form, AST: Aspartate aminotransferase, TSH; Thyroid stimulating hormone, DM: Diabetes mellitus, HT: Hypertension, CAD: Coronary artery disease, COPD: Chronic obstructive pulmonary disease

Table 2. Results of correlation analyses between SOF and other frailty scales

Two group analysis (frail/robust)			Three group analysis (frail/pre-frail/robust)	
Kappa analysis			Kappa analysis	
	Cohen's Kappa	p	Cohen's Kappa	p
SOF-FRAIL	0.652	<0.001	0.633	<0.001
SOF-CFS	0.611	<0.001	0.404	<0.001
Correlation analysis			Correlation analysis	
	Correlation coefficient	p	Correlation coefficient	p
SOF-FRAIL	0.654	<0.001	0.805	<0.001
SOF-CFS	0.612	<0.001	0.578	<0.001

SOF: Study of osteoporotic fracture, CFS: Clinical frailty scale

Table 3. Results of correlation analyses between SOF and updated version of CFS

Two group analysis (frail/robust)		
Kappa analysis		
	Cohen's Kappa	p
SOF-CFS	0.401	<0.001
Correlation analysis		
	Correlation coefficient	p
SOF-CFS	0.460	<0.001

SOF: Study of osteoporotic fracture, CFS: Clinical frailty scale

Table 4. Results of reliability analyses of SOF scale

	ICC	p	95% CI
Test-retest	0.939	<0.001	0.846-0.976
Interrater	0.981	<0.001	0.953-0.993

ICC: Intraclass correlation coefficient, CI: Confidence interval

addition, the FRAIL and CFS total score and SOF were strongly correlated, while the updated version of CFS and SOF were moderately correlated.

It is of great importance for physicians who deal with geriatric patients not to miss the geriatric syndromes. Frailty is one of the most common geriatric syndromes. In the Frail TURK project, the prevalence of frailty in Turkey was found to be 39%. In another study conducted in Turkey, the prevalence of frailty among community-dwelling older people was 15.4-27.8%. In another study examining geriatric outpatient clinic patients, the prevalence of frailty ranged from 12% to 15% (36-38). Frailty can have negative consequences in the elderly, such as mortality, hospitalisation, disability, falls, fractures, worsening mobility, lower quality of life, depression, cognitive decline, dementia and admission to long-term care (1-12). It is important to recognize and diagnose frailty early in older patients. There is a need for a quick and practical scale which can be applied in clinical practice to recognize frailty. There are many tools used to diagnose frailty, but SOF frailty index stand out among them because it is practical and fast. Turkish validation of SOF frailty index was not performed. Our study demonstrated that Turkish version of the SOF is a valid and reliable tool.

It is necessary to give more importance to frailty as it causes negative consequences, high workload and economic burden. If frailty is detected early in older patients, the medical, biological, psychological and social status of the patient can be protected more easily. Frailty is a major risk factor for disability and death in geriatric patients and can be reversible with clinical interventions. Therefore, frailty evaluation is very important in defining the treatment plans of geriatric patients.

Comprehensive geriatric assessment (CGA) is the gold standard for frailty screening. In clinical practice, there is sometimes not enough time for comprehensive geriatric evaluation. To

be more practical, various tools have been developed in frailty screening. The most important advantage of the SOF index over other indexes is its simplicity and its practical application in the clinical setting. The SOF index includes two short questions answered with "yes or no" and a physical test that does not require special equipment. The test can be administered in less than 5 minutes. The SOF index was compared with the cardiovascular health study (CHS) index in two large studies and together with the CHS index effectively predicted adverse health outcomes (24,25).

There are many frailty scales to detect frailty. Among these; Fried frailty scale and FRAIL scale are suitable screening methods for both community-dwelling and inpatient older people (1,16). Tilburg frailty index and PRISMA-7 are mostly used in community-dwelling older people (39,40). CFS and Edmonton frailty scales are mostly used in hospitalized older patients (14,15). For pre-surgical risk assessment; CGA, CFS, Edmonton scale, FRAIL scale, Groningen frailty indicator are used in frailty screening (41,42). SOF frailty index is suitable for both community-dwelling and hospitalized older patients (24,25). In this study, we showed that the SOF index is valid and reliable in older Turkish outpatients.

While some of the frailty scales measure only the physical component, some also measure the social, psychological and cognitive component in addition to the physical component (1,14). CFS assesses cognitive frailty in addition to physical frailty, and is therefore more multidimensional. Edmonton scale assesses both cognitive and social frailty. SOF scale assesses only physical frailty. Therefore, while a strong correlation was found between SOF scale and FRAIL scale, moderate correlation was found between SOF scale and CFS in our study. It should not be forgotten that we screen only physical frailty with the SOF scale. Cognitive, social and emotional states should also be evaluated differently for a comprehensive assessment.

In our study, it was found that vitamin D levels were low in patients. The results in our study were compatible with the literature. Vitamin D deficiency is common in the older people and has many causes. Some of these causes are decreased daily sun exposure, diseases such as chronic renal failure and gastrointestinal malabsorption, and decreased oral intake (43,44). Low vitamin D levels are associated with various geriatric syndromes in the older people, such as frailty, sarcopenia, osteoporosis, falls and fractures (45-48). Vitamin D deficiency should be screened in older patients and treated if there is a deficiency.

This was a cross-sectional study. The ability of SOF scale to predict future disability or death rates could not be evaluated. Prospective studies are needed to determine the predictive value of the SOF index on disability or mortality. We would also like to add that, this study was carried out in a single center and

on outpatients. Therefore, it cannot be generalized for other settings such as nursing homes. Further studies at different settings are needed to generalize these results to the general population.

Conclusion

This study showed that the Turkish version of the SOF score is a valid scale for the assessment of frailty in outpatient clinics.

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Ethics

Ethics Committee Approval: The study was performed in accordance with the guidelines in the Declaration of Helsinki. The Local Ethics Committee of Hacettepe University approved the study (ID: GO 21/1164).

Informed Consent: Oral and written details about the study were explained to the patients and their consent was obtained.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: İ.İ., C.A., S.C., B.B.D., Design: İ.İ., D.K., C.B., P.Ü., Data Collection or Processing: İ.İ., Z.Ş., S.C., A.O.B., B.B.D., Analysis or Interpretation: M.H., C.A., M.G.O., M.C., Literature Search: İ.İ., M.H., A.D., Y.Ö., M.G.H., B.B.D., Writing: İ.İ., B.B.D.

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