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Clinical Frailty Scale and Body Mass Index as Independent Predictors of 2-year Mortality in Hospitalized Patients

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Abstract

Objective: This study aimed to investigate the effect of the clinical frailty scale (CFS) and body mass index (BMI) on the 2-year mortality prediction in hospitalized internal medicine patients.

Materials and Methods: A prospective observational study was conducted between January 2019 and February 2020. Subjects (18 years and older) admitted to the internal medicine wards and expected to stay for at least 72 h were included. Participants were evaluated within 48 h of admission. The Charlson comorbidity index (CCI) was calculated. Anthropometric measurements and handgrip strength were obtained within 48 h. CFS was used for frailty assessment. Cox regression analysis was performed for mortality analysis.

Results: One hundred eighteen patients were included. Fifty-eight of the (49.2%) patients were 65 years and over. In multivariate analysis, BMI and CFS were independently associated with 2-year mortality, regardless of age, sex, and CCI. The HRs for BMI and CFS were 0.898 [95% confidence interval (CI), 0.840-0.961; p=0.002] and 1.313 (95% CI, 1.002-1.719; p=0.048), respectively.

Conclusion: Higher CFS scores and lower BMI scores are independently associated with 2-year mortality in hospitalized internal medicine patients.

Keywords: Body mass index, clinical frailty scale, frailty, hospitalization, mortality

Introductıon

Frailty is a state of increased vulnerability to stressors and is also associated with multiple physiological systems that are interrelated with each other (1). It is a global public healthcare issue as the world is aging. Subjects living with frailty are at a growing risk of adverse outcomes, including hospitalization and mortality, causing higher healthcare costs (2). It is a known fact that subjects with frailty can dynamically transition between states (3). Therefore, it is crucial to detect and manage subjects who are living with frailty.

The prevalence of frailty in geriatric inpatients ranges from 48.8 % to 80%, depending on the evaluation tool used (4). There are several frailty instruments such as the FRAIL scale, Edmonton Frailty scale, and Clinical Frailty scale (CFS) (3,5-7). CFS is an easy and quick scale. It was developed to determine frailty in older adults and includes items such as comorbidity, cognitive impairment, and function (8). It assesses frailty using visual and written charts with nine graded pictures, ranging between 1 (very fit) and 9 (terminally ill). A score of ≥5 represents patients who are frail. CFS has been shown to be widely used in multiple settings. Several studies have been conducted, especially in hospital settings, and assessed its associations with adverse outcomes (9).

Body mass index (BMI) is also known to be a factor related to mortality. It is an index of malnutrition (10). Malnutrition (both undernutrition and obesity) plays a key role in the pathogenesis of frailty and sarcopenia (11). A recently published meta-analysis revealed a high overlapping prevalence of malnutrition and frailty in hospitalized older patients (12). On the other hand, obesity has a close relationship with type 2 diabetes mellitus and coronary artery disease (13). However, there are

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conflicting results regarding its effect on mortality, changing from condition to condition (14,15).

Obesity paradox, a term used to describe that overweight and obese patients with a particular disease may have better outcomes than normal weight patients, is another concern (16,17). For example, it has been claimed that the strength of the association between obesity and mortality weakens with increasing age (18). There is wide heterogeneity between studies regarding the relationship between obesity and mortality, especially in older patients (19).

In light of these data, we determined the effect of CFS and BMI on 2-year mortality in hospitalized internal medicine patients.

Materials and Methods

This prospective observational study was conducted between January 2019 and February 2020. Subjects (18 years and older), admitted to the internal medicine wards of a university hospital and expected to stay for at least 72 h, were included. Participants were evaluated within 48 h of admission, and they were followed up for at least 2 years or until death. The baseline characteristics of patients, including comorbidities, were recorded. The Charlson comorbidity index (CCI) was calculated (20).

Anthropometric measurements including height, weight, calf circumference (CC), and mid-upper arm circumference (MAC) were taken. Height and weight were measured while standing and recorded in meters and kilograms, respectively (TEM-BEKO 035x040, İstanbul, Turkey). BMI was calculated by dividing body weight in kilograms by height in meters squared (kg/m^2). CC was measured in the sitting position with 90° of knee flexion at the largest level of the leg. MAC was measured when the elbow was at 90° flexion. CC and MAC were recorded in centimeters. Handgrip strength (HGS) was measured by Takei digital grip strength dynamometer (Takei Scientific Instruments Co, Niigata, Japan) at a 90° flexion of the elbow with a neutrally rotated forearm and reported in kilograms. The thresholds of 16 kg for females and 27 kg for males were used, as recommended by EWGSOP-2 (21). The highest value of the three measurements was considered (22). Mini Nutrition Assessment-Short Form, and Nutritional Risk Score-2002 (NRS-2002) were performed to screen for malnutrition. Patients were grouped as malnourished (score ≤7), at-risk (score 8-11), and normal (score 12-14) according to the MNA-SF score (23). When the NRS-2002 score was ≥3, it meant nutritionally at risk (24). Frailty was assessed using the 9-point CFS. The score ranged from 1 to 9 (25).

Statistic

The IBM SPSS Statistics program version 23.0 was used for statistical analysis. The normality of variables was examined using visual (histograms and probability plots) and analytical methods. Categorical variables are presented as numbers and frequencies. Normally distributed variables are presented as mean ± standard deviation, non-normally distributed variables are presented as median (IQR, 25p-75p). Patients were divided into two groups as younger (<65 years) and older (≥65 years) to present baseline characteristics of patients. The χ^2 or Fisher's exact test was used to compare differences between the categorical variables as appropriate. Mann-Whitney U and Student's t-tests were used to compare non-normally and normally distributed variables, respectively. Cox regression analysis was performed to define the factors associated with 2-year mortality. Four models were constructed. Model 1 included age and sex; model 2 included age, sex, and CCI; model 3 included age, sex, CCI, and BMI; model 4 included age, sex, CCI, BMI, and CFS. The findings are shown as hazard ratios (HRs) and the corresponding 95% CI. The proportional hazard assumption and model fit were assessed using residual (Schoenfeld and Martingale) analysis. All analyzes were considered statistically significant when the p value was <0.05.

Results

A total of 118 patients were included in the analysis. Subjects were divided into two groups as younger (n=60) and older (n=58). The baseline characteristics of the patients are presented in Table 1. Causes of hospitalization, length of stay, CCI, MAC, CC, and MNA-SF categories were not different between the groups. Median BMI values of the younger and older groups were 25.8 (22.7-29.9), and 29.1 (25.5-32.1), respectively (p=0.008). The rate of patients with risk of malnutrition according to NRS-2002 was higher in the older group (p=0.001). The median CFS score was higher in the older group than the youngers (p>0.001). The rates of patients with low muscle strength were 38.6% (n=22) in the younger group and 74.5% (n=41) in the older group (p<0.001).

During the 2-year follow-up, 28.8% of patients died (21.7% of younger group, 36.2% of older group). Age (p=0.015), CCI (p=0.021), BMI (p=0.032) and CFS (p=0.001) were significantly associated with 2-year mortality in the univariate model (Table 2). Four different models were created and are presented in Table 3. In model 4, which included age, sex, CCI, BMI, and CFS, BMI and CFS were independently associated with 2-year mortality. The HRs for BMI and CFS were 0.898 (95% CI, 0.840-0.961; p=0.002) and 1.313 (95% CI, 1.002-1.719; p=0.048), respectively.

Discussion

This prospective cohort study demonstrated the independent effect of CFS and BMI on 2-year mortality prediction in hospitalized internal medicine patients. Whereas a higher CFS score was associated with a higher mortality risk, a lower BMI was associated with a higher mortality risk, regardless of age, sex, and CCI. In our study population, older patients had a higher CFS score. The rate of patients with low HGS and at risk of malnutrition was higher in the older group. This is not surprising as they are leading and challenging geriatric syndromes, especially for hospitalized older patients (12,26).

Recently, CFS has been widely used to predict adverse outcomes such as mortality in various settings (9). Although it was validated in geriatric patients (≥65 years), there are emerging studies suggesting its use at all ages (25). Welford et al. revealed that a higher CFS score was associated with a poor prognosis in hemato-oncology clinics. They supported the use of CFS in inpatients of any age (27). In another study, CFS was used in 18 years and older patients with cancer at an intensive care unit and was found to be associated with worse clinical outcomes among oncologic critically ill patients (28).

A multicenter retrospective cohort study with a median (IQR) age of 63.7 years (49.1-74.0 years) concluded that CFS predicted 1-year mortality well in critically ill patients (HR 1.26, 95% CI 1.21-1.31) after adjusting for confounders (29). A prospective multicenter cohort study was conducted in younger critically ill patients and supported the use of CFS in younger adults, not just in older adults (30). The results of our study are consistent with the literature. One-point increment in CFS was associated with 1.3-fold mortality risk in hospitalized internal medicine patients, regardless of age, sex, and comorbidities.

Another highlighted point of our study is the independent effect of BMI on mortality. We concluded that higher BMI scores were associated with lower mortality risk. A recently published, large sample size study conducted in geriatric medical departments presented the protective effect of BMI on mortality. They used standard BMI categories according to the World Health Organization in their study and emphasized the requirement of an ideal BMI for vulnerable groups (31). This result was similar to ours. In our study, the median (IQR) BMI scores were 25.8 (22.7-29.9) and 29.1 (25.5-32.1) for younger and older patients, respectively. On the other hand, we did not categorize patients according to BMIbecause the thresholds should be different for geriatric patients and patients living with frailty. In the light of these data, we evaluated BMI as a continuous variable and showed its effect on mortality irrespective of age, sex, CCI, and CFS. This striking point will provide a basis for future study designs. Kanenawa et al. presented a study similar to ours. They determined the impact of CFS on 2-year mortality after hospitalization for heart failure, regardless of stratification based on age, sex, BMI, and left ventricular ejection fraction. Therefore, they suggested the use of CFS as a prognostic tool in clinical settings (32).

There are some limitations to our study. First, CFS was not validated in younger patients. However, as there are so many studies supporting its use in younger patients, we used it for younger patients. Second, we evaluated BMI as a continuous variable and did not categorize it. We planned to investigate the effect of a 1-point change in BMI. Therefore, there are conflicting results regarding its use, especially for older adults. In this field, large sample size studies are needed, and the cut-off values for BMI should be assessed anew. In contrast, we highlighted the importance of using CFS and assessing BMI in hospitalized patients, regardless of age, sex, and CCI.

Conclusion

Higher CFS and lower BMI scores are independently associated with 2-year mortality in hospitalized internal medicine patients. Future comprehensive studies on the use of CFS in hospitalized patients and updating BMI cut-off values according to frailty and age categories are needed.

Ethics

Peer-review: Externally peer reviewed.

Authorship Contributions

Surgical and Medical Practices: Y.Ö., M.G., M.K., M.H., Concept: Y.Ö., M.G., M.K., C.B., B.B.D., M.C., M.H.,

Design: Y.Ö., M.K., M.H., Data Collection or Processing: Y.Ö., M.G., S.C., M.K., Analysis or Interpretation: Y.Ö., A.O.B., M.G., S.C., M.E., C.B., B.B.D., M.C., M.H., Literature Search: Y.Ö., A.O.B., M.G., S.C., M.E., M.H., Writing: Y.Ö., A.O.B., M.G., S.C., M.K., M.E. C.B., M.H.

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