ORIGINAL RESEARCH

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Falls in Older Women and Men: Associated Factors and Sarcopenia

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Abstract

Objective: Falls are the fifth leading cause of death among the older adults, and most of the risk factors of falls are modifiable. We aimed to investigate the clinical factors associated with falls comprehensively, by evaluating the sarcopenia components separately, in each gender.

Materials and Methods: This is a cross-sectional study. Six hundred thirty-three female and 269 male outpatients, underwent a comprehensive geriatric assessment, were included. Falls, in the previous 12 months, were recorded. Geriatric evaluation regarding frailty, depression, nutrition, cognitive functions, and disabilities were done with related scales. SARC-F determined sarcopenia risk, and probable sarcopenia was defined according to handgrip strength. Skeletal muscle mass index and muscle performance were measured by bioimpedance analysis and physical performance tests, including 4-meter gait speed (4-m GS) and timed up and go (TUG) tests, respectively.

Results: In the study population 35.2% of female and 30.9% of male patients experienced falls. In multivariate analysis, probable sarcopenia in women [odds ratio (OR): 1.56, p=0.034] and longer TUG test performance in men (OR: 1.06, p=0.020) were independently related to falls. In addition, both in women and men urinary incontinence (OR: 1.62, p=0.016 and OR: 1.95, p=0.045, respectively), sarcopenia risk defined by SARC-F (OR: 2.74, p≤0.001 and OR:4.79, p≤0.001, respectively) and depression (OR: 1.56, p=0.025 and OR: 1.93, p=0.046, respectively) were independently related with falls.

Conclusion: Depression, incontinence, and sarcopenia risk were independent associated factors for falls in both genders. SARC-F appears to be effective in both genders in predicting the risk of falls. However, muscle strength in women and muscle performance in men get high impact for the falls.

Keywords: Falls, sarcopenia, older adults, depression, incontinence, SARC-F

Introduction

Falls are the fifth leading cause of death in the older adults and emerge as an important public health problem. One-third of individuals over the age of 65 experience falls each year, increasing to 40-50% of individuals over 80 (1). The falls' significant consequences include death and increased health expenditures, aside from fractures, institutionalization, dependency, the decline in functionality, and fear of falling. The factors that cause the falls are mainly divided into three sub-categories, including extrinsic, intrinsic, and behavioral reasons. The leading intrinsic causes include decreased physiological systems controlling musculoskeletal, cardiovascular, visual, and vestibular systems and proprioceptive deterioration due to normal aging and pathological processes such as arthritis, diabetes, cerebrovascular disease (CVD), incontinence, and impaired vision, which are frequently seen in older adults (2). Furthermore, falls are commonly underlined in the studies as a poor outcome of geriatric syndromes such as frailty, sarcopenia, incontinence, depression, and cognitive impairment, which are again prevalent in older adults. Moreover, falls are also defined

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as a geriatric syndrome due to their characteristic unfavorable consequences like in other geriatric syndromes such as sarcopenia and frailty (3,4). When the intrinsic and extrinsic factors that cause falls are cumulatively combined, falls are unfortunately inevitably experienced in a substantial percentage of vulnerable older adults (5). Even in low-energy falls, poor outcomes such as femoral fractures and intracranial hemorrhages can be observed in older individuals (6,7). The majority of the intrinsic factors precipitating falls are among the modifiable and preventable causes of falls (8). Sarcopenia, again one of the modifiable risk factors of falls, is associated with standing balance disorder (5). Sarcopenia is characterized by decreased muscle mass and strength, and physical performance. Sarcopenia and each of its components may act as an important risk factor for falls (9). Though falls in the older adults has been investigated extensively in many studies, risk factors related to gender differences and sarcopenia have been seldom researched (10,11).

In this study, we aimed to define the associated clinical factors of falls in each gender separately, with a comprehensive evaluation, by considering demographic features, comorbidities, geriatric syndromes, and sarcopenia components, including muscle mass, muscle strength, and physical performance, and risk of sarcopenia by the SARC-F scale.

Materials and Methods

Participants and Study Design

The study was designed as cross-sectional. Patients, admitted to the geriatric outpatient clinic of a tertiary hospital between February 2019, and January 2020 and were included in the study. Patients were subjected to a comprehensive geriatric assessment. A structured questionnaire, inquiring information related to demographic data, diseases, drugs, falls, and geriatric syndrome scales, was applied. Recruitment to the study was determined among patients at their first admission to the geriatric clinic who were able to cooperate and complete the mobility tests with their aids if needed, and the questionnaires regarding comprehensive geriatric assessment. Patients 60 years and older were included in the study. Patients excluded from the study were determined as 1) active cancer patients, 2) patients with infectious diseases, 3) patients with acute diseases of organ systems, 4) patients dependent on wheelchair, not able to perform mobility tests, 5) advanced dementia [mini-mental state examination (MMSE) score <10 points] and patients with moderate dementia unable to cooperate in questionnaire and mobility tests and 6) patients with missing data regarding mobility tests and questionnaire. Falls were questioned as an experience of fall in the last 12 months. Falls were defined as an unexpected event in which the participants come to rest on the ground, floor, or lower level. The Charlson comorbidity index (CCI) was calculated according to existing diseases (12). Diseases with a high risk of falling like Parkinson's disease, CVD, and diabetes (DM) were included in the analysis among the dependent variables. Serum levels of 25(OH) D and vitamin B12 were recorded. Anthropometric measurements, including weight (kg), height (cm), and waist circumference (cm), were made by using standard methods. Body mass index (kg/m^2) was calculated as weight in kilograms divided by height in meters squared. Study was approved by Local Ethics Committee and it conforms to the provisions of the Declaration of Helsinki (date/decision no: 20.02.2019/2019/136). Informed consent form was received from all patients with intact cognition, and proxies of patients with impaired cognition.

Assessment of Geriatric Syndromes

Frailty was assessed according to the 5-item FRAIL scale with components: fatigue, resistance, ambulation, illnesses, and loss of weight. Frailty scores range from 0-5 (1 point for each component; 0= best to 5= worst) and scores 3-5 represents frailty (13). Depression was evaluated with the geriatric depression scale. Fourteen points and above are considered as depression (14). The nutritional evaluation was done with mini nutritional assessment tool (MNA). Higher scores indicate better nutritional status (15). Disabilities in daily living activities (ADL) and instrumental activities of daily living (IADL) were stated by the Katz and Lawton scales, respectively. Lower scores notice more dependent status in both scales (16,17). Cognitive status was assessed with the MMSE (18). Higher scores state better cognitive function. Urge or mixed type of incontinence was determined as self-report.

Sarcopenia and Physical Function Assessments

By measuring muscle strength with a dynamometer, the definition of probable sarcopenia was made according to the revised European Working Group's recommendations on sarcopenia in older people (19). With the help of a Jamar dynamometer, consecutive measurements were made three times from the dominant hand with regular rest duration. The measurements' average was calculated, and probable sarcopenia was defined according to handgrip strength (HGS) <16 kg in women and <27 kg in men. Physical performance was evaluated by 4-meter gait speed (4-m GS) and timed up and go tests (TUG) (20). The 4-m GS was applied at the usual pace, and time to complete the 4-meter walking distance on a marked ground was recorded in seconds. The TUG test was applied at usual pace again on a marked ground, while patients were sitting on an armchair (46 cm height); with the directive word of "go", patients were instructed to stand up from the armchair, walk three meters, turn and walk back to the chair and sit down again. Time to complete TUG test was recorded in seconds. In each performance test, a shorter time to complete the test pointed out a better functional performance. The help of a bioimpedance analysis detetermined skeletal muscle mass (SMM). Skeletal muscle mass was calculated by Johnson's formulae by getting ohm data from bioimpedance (21). Skeletal muscle mass index (SSMI) was obtained by dividing

SMM by height in square meters. Sarcopenia risk was defined by the SARC-F scale. SARC-F has five items: strength, assistance walking, rising from a chair, climbing stairs, and falls. Each item scored from 0 to 2. A total score of ≥4 indicates sarcopenia risk (22).

Statistics

A descriptive analysis was performed between fallers and non-fallers. Data normality was assessed by examining the results of Shapiro-Wilks test, histogram and q-q plots. A two-sided independent samples t-test and Mann-Whitney U test were conducted to compare the differences between continuous variables. The Pearson chi-square test or Fisher's Exact test was used to comparing categorical variables. Univariate and multiple binary logistic regression analysis were used to identify the associated clinical factors among fallers in each gender separetely. Odds ratios (OR) were calculated with 95% confidence intervals (CI). Significant variables ($p<0.10$) in univariate analysis were taken in to multiple models, and the backward stepwise selection was performed using likelihood ratio statistic at $p<0.10$ stringency level. Two separate models were built for multivariate analysis in each gender. Model 1 included all significant variables ($p<0.10$) in univariate analysis, except sarcopenia risk defined by the SARC-F scale, in each gender. Model 2 included all significant variables ($p<0.10$) in Model 1 plus sarcopenia risk defined by SARC-F scale. While age is highly correlated with falls, it is included in all models independent of revealed p-value in univariate analysis. The Hosmer-Lemeshow test results indicated the built binary logistic regression models' appropriateness to predict the falls' related independent clinical factors. Correlation matrices among the dependent variables showed significant but low collinearity (all p-values <0.600). Analyses were conducted using SPSS version 22.

Results

A total of 902 patients (633F/269M) were included in the study. Prevalence of falls in the total population was 33.9%. Falls prevalence' among women and men were, 35.2%, and 30.9% respectively and this difference was not significant ($p=0.116$). CCI was higher among fallers in women ($p=0.068$). Patients with Parkinson's disease experienced more falls both in men and women ($p=0.063$, $p=0.025$, respectively). Total scores of scales related to MMSE, MNA, Katz, and Lawton were significantly lower in fallers than non-fallers in both genders. Patients with geriatric syndromes, including frailty, depression, and urinary incontinence, experienced significantly more falls in both genders. In women, fallers were more prevalent among patients with probable sarcopenia ($p=0.005$), while in men, fallers completed the TUG test in a longer time ($p=0.019$). SMMI and the serum levels of 25(OH)D and vitamin B12 did not differ between fallers and non-fallers in both genders. The patients' clinical characteristics among fallers and non-fallers are presented in Tables 1 and 2 for women and men, respectively. In model 1 multivariate analysis, depression (OR: 1.56, CI: 1.06-2.28, $p=0.025$) urinary incontinence (OR: 1.71, CI: 1.16-2.52, $p=0.007$) and probable sarcopenia (OR: 1.56, CI: 1.03-2.35, $p=0.034$) were independently related with falls in women, while depression (OR: 1.93 CI: 1.01-3.71, $p=0.046$) and longer TUG test performance (OR: 1.06, CI: 1.01-1.09, $p=0.020$) were independently related with falls in men. In model 2 multivariate analysis, when the sarcopenia risk defined by the SARC-F scale incorporated into model 1, both in women and men urinary incontinence (OR: 1.62, CI: 1.09-2.40, $p=0.016$ and OR: 1.95, CI: 1.01-3.76, $p=0.045$ respectively) and sarcopenia risk defined by SARC-F (OR: 2.74, CI: 1.85-4.06, $p\leq0.001$ and OR: 4.79, CI: 2.46-9.34, $p\leq0.001$, respectively) were independently related with falls. Results regarding multivariate analysis of both models are presented in Tables 3 and 4, for women and men respectively.

Discussion

In this study, we observed that falls were more prevalent among women, as in previous studies, though fall prevalence' was not differ significantly in men and women (23). Falls-related clinical risk factors unique to women, such as less muscle mass, loss of menopause-related bone mineral density, and being prone to geriatric syndromes such as depression and frailty, are triggering reasons that increase the risk of falls in women compared to men (11,23). As a result of a comprehensive assessment in each gender, we observed that depression, urinary incontinence, and sarcopenia risk defined by SARC-F were independently associated with falls in both genders. Gender-specific independent associated clinical factors for falls were prolonged TUG test performance in men and probable sarcopenia, defined by HGS, in women.

Plenty of gender-specific, fall-related risk factors has been identified in numerous studies. Nevertheless, in a few studies, the same fall-related risk factors were evaluated concurrently in each gender (10,11,23). Gale et al. (10) reported that severe pain and diagnosis of at least one chronic disease were independently associated with falls in both genders, meanwhile sex-specific risk factors were incontinence and frailty in women, older age, high levels of depressive symptoms, and the inability to perform a standing balance test in men (23). In another study, Gale et al. (10) observed that older age was the only factor associated with increased risk of incident falls in both genders. Gender-specific risk factors related to incident falls were depressive symptoms, incontinence, never having married in women, and greater comorbidity, higher levels of pain, and poorer balance in men (10).

In this study, while examining the relationship between falls and sarcopenia, instead of the operational definition of sarcopenia

in EWGSOP, we analyzed the three components of sarcopenia, muscle mass, muscle strength, and physical performance separately. In addition, sarcopenia risk was defined practically by the SARC-F tool, recommended in case findings, in revised EWGSOP (19). In studies, SARC-F was suggested as a valid and consistent tool for defining individuals at risk of sarcopenia-related unfavorable outcomes (24). Recently, in studies conducted with both Parkinson's patients and community-dwelling postmenopausal patients, SARC-F has been shown to be effective in predicting the risk of falls in different patient populations (25,26). In agreement, we observed a significant independent relationship between falls and sarcopenia risk defined by SARC-F after incorporating all falls-related variables in multivariate models in each gender. In accordance, a recent study has demonstrated a significant correlation between hip fracture and sarcopenia (SARC-F ≥4) (27). Certainly, a leading cause of fractures is falls, and consequently, an association between SARC-F and falls might also be anticipated as in our study.

Muscle mass did not differ between fallers and non-fallers in our study, in both genders, though HGS was independently associated with falls in women, not in men. Our finding can be explained by the loss of muscle strength faster than muscle mass loss throughout life, and this loss is more pronounced in women (6). Although HGS does not directly reflect the lower extremity performance, it is significantly associated with climbing stairs, standing from a chair, and a six-minute walk test (28). Besides, growing evidence has demonstrated that muscle strength is more closely related to poor health-related outcomes such as fractures, falls, malnutrition, cognitive impairment, depression, sleep problems, and quality of life than to muscle mass (4,26). In a systematic review, muscle strength and gait/balance were implicated among the most highly correlated risk factors with falls (29). The TUG test has been suggested to assess gait and

Table 1. Characteristics of the patients among fallers and non-fallers with risk estimates, in women

Variables	Fallers n=223	Non-fallers n=410	p	*OR (95% CI)
Demographic characteristics				
Age	72.3 (8)	71.5 (7.2)	0.175	-
CCI	4.2 (1.5)	3.9 (1.4)	0.068	1.10 (0.99-1.22)
Number of drugs	4 (2-5)	3 (2-5)	0.282	1.03 (0.97-1.11)
DM, n %	111 (49.8)	194 (47.3)	0.306	1.15 (0.82-1.60)
PD, n %	8 (3.6)	4 (1)	0.025	3.55 (1.05-11.99)
CVD, n %	15 (6.7)	23 (5.6)	0.344	1.16 (0.59-2.28)
Geriatric syndromes				
Frailty, n %	96 (43.4)	137 (33.4)	0.008	1.49 (1.06-2.10)
Depression, n %	128 (59.3)	176 (43.9)	<0.001	1.88 (1.34-2.64)
MMSE, score	24.3 (4.9)	25.3 (4.2)	0.010	0.96 (0.92-0.99)
MNA, score	21.4 (4.6)	22.1 (4.2)	0.052	0.96 (0.93-1.00)
Urinary incontinance, n %	135 (60.5)	185 (45.2)	<0.001	1.84 (1.32-2.57)
Katz, score	10.6 (2.5)	11.3 (1.7)	<0.001	0.86 (0.79-0.93)
Lawton, score	11.3 (5.5)	12.9 (4.4)	<0.001	0.94 (0.90-0.97)
Anthropometric measures, physical performance and sarcopenia				
BMI kg/m²	31.0 (6.3)	31.4 (6.5)	0.570	0.99 (0.97-1.02)
Waist, cm	106.5 (12.9)	105 (15.4)	0.294	1.00 (0.99-1.02)
SMMI kg/m²	7.9 (2.5)	7.5 (1.4)	0.153	1.31 (0.95-1.35)
Probable sarcopenia, n %	71 (37.4)	95 (26.2)	0.005	1.70 (1.16-2.50)
4-m GS, s	5.4 (4-9)	5.45 (4-8.5)	0.913	1.02 (0.98-1.05)
TUG, s	12.0 (9.0-15.25)	11.3 (8.72-15.0)	0.300	1.01 (0.99-1.03)
Sarcopenia (SARC-F ≥4)	149 (66.8)	165 (40.2)	<0.001	3.01 (2.11-4.28)
Biochemical parameters				
25(OH)vit D	19.9 (14-27)	18.9 (12.5-27)	0.516	1.00 (0.99-1.01)
Vit B12	384 (286-560)	381 (285-539)	0.625	1.00 (1.00-1.00)

*Adjusted odd ratios (by age), mean (standard deviation), median (25^{th}-75^{th} percentile), p<0.05 is significant, CCI: Charlson comorbidity index, DM: Diabetes mellitus, PD: Parkinson's disease, CVD: Cerebrovascular disease, MMSE: Mini-mental state examination, MNA: Mini-nutritional assessment, BMI: Body mass index, SMMI: Skeletal muscle mass index, GS: Gait speed, TUG: Timed up and go test, OR: Odds ratio, CI: Confidence interval

Table 2. Characteristics of the patients among fallers and non-fallers with risk estimates in men

Variables	Fallers n=83	Non-fallers n=186	p	*OR (95% CI)
Demographic characteristics				
Age	74.7 (7.7)	73.8 (7.3)	0.403	-
CCI	4.7 (1.9)	4.5 (1.7)	0.557	1.04 (0.90-1.20)
Number of drugs	3 (1-5)	3 (1-5)	0.446	1.03 (0.94-1.14)
DM, n %	30 (36.1)	74 (39.8)	0.335	0.88 (0.51-1.50)
PD, n %	9 (10.8)	9 (4.8)	0.063	2.28 (0.86-6.06)
CVD, n %	5 (6)	10 (5.4)	0.516	1.09 (0.36-3.31)
Geriatric syndromes				
Frailty, n %	26 (31.3)	40 (21.5)	0.059	1.61 (0.87-2.98)
Depression, n %	34 (41.0)	40 (22.5)	0.002	2.41 (1.38-4.22)
MMSE, score	25.1 (4.5)	26.4 (3.6)	0.015	0.93 (0.88-0.99)
MNA, score	21.7 (4.5)	23.2 (4.0)	0.012	0.92 (0.86-0.98)
Urinary incontinance, n %	35 (42.2)	52 (28.0)	0.016	1.85 (1.08-3.19)
Katz, score	10.5 (2.5)	11.5 (1.5)	0.001	0.78 (0.68-0.90)
Lawton, score	11.2 (5.6)	13.0 (4.6)	0.005	0.93 (0.88-0.98)
Anthropometric measures, physical performance and sarcopenia				
BMI, kg/m²	28.0 (6.1)	27.8 (4.8)	0.772	1.01 (0.96-1.07)
Waist, cm	103 (14.0)	101.2 (12.8)	0.352	1.01 (0.99-1.04)
SMMI, kg/m²	9.5 (1.7)	9.8 (2.5)	0.598	0.95 (0.77-1.18)
Probable sarcopenia, n %	29 (37.2)	64 (37.9)	0.517	0.89 (0.49-1.60)
4-m GS, s	6.5 (4-8.25)	5.0 (3.6-7.1)	0.262	1.03 (0.97-1.10)
TUG, s	12 (8.0-17.0)	10.0 (7.0-13.4)	0.019	1.05 (1.01-1.08)
Sarcopenia, n % (SARC-F ≥4)	40 (48.2)	39 (21.0)	<0.001	3.62 (2.02-6.48)
Biochemical parameters				
25(OH)vit D	18.3 (13.5-23.7)	18.0 (13.4-25.4)	0.539	0.98 (0.95-1.01)
Vit B12	389 (268-583)	391 (269-516)	0.558	1.00 (1.00-1.00)

*Adjusted odd ratios (by age), mean (standard deviation), median (25^{th}-75^{th} percentile), p<0.05 is significant, CCI: Charlson comorbidity index, DM: Diabetes mellitus, PD: Parkinson's disease, CVD: Cerebrovascular disease, MMSE: Mini-mental state examination, MNA: Mini-nutritional assessment, BMI: Body mass index, SMMI: Skeletal muscle mass index, GS: Gait speed, TUG: Timed up and go test, OR: Odds ratio, CI: Confidence interval

Table 3. Binary logistic regression analysis for risk of falls in women

Variables	Multivariate			
	Model 1		Model 2	
	OR (95% CI)	p	OR (95% CI)	p
Age	-	-	-	-
CCI	-	-	-	-
PD	-	-	-	-
Frailty	-	-	-	-
Depression	1.56 (1.06-2.28)	0.025	-	-
MNA	-	-	-	-
MMSE	-	-	-	-
Incontinence	1.71 (1.16-2.52)	0.007	1.62 (1.09-2.40)	0.016
Katz	-	-	-	-
Lawton	-	-	-	-
Probable sarcopenia	1.56 (1.03-2.35)	0.034	-	-
Sarcopenia (SARC-F ≥4)	Not selected		2.74 (1.85-4.06)	<0.001

Model 1 included age, CCI: Charlson comorbidity index, PD: Parkinson's disease, MNA: Mini-nutritional assessment, MMSE: Mini-mental state examination, incontinence, Katz, Lawton and probable sarcopenia. Model 2 included sarcopenia (SARC-F ≥4) along with all variables in Model 1, OR: Odds ratio, CI: Confidence interval

Table 4. Binary logistic regression analysis for risk of falls in men

Variables	Multivariate			
	Model 1		Model 2	
	OR (95% CI)	p	OR (95% CI)	p
Age	-	-	-	-
PD	-	-	-	-
Frailty	-	-	-	-
Depression	1.93 (1.01-3.71)	0.046	-	-
MNA	-	-	-	-
MMSE	-	-	-	-
Incontinence	-	-	1.95 (1.01-3.76)	0.045
Katz	-	-	-	-
Lawton	-	-	-	-
TUG	1.06 (1.01-1.09)	0.020	-	-
Sarcopenia (SARC-F ≥4)	Not selected		4.79 (2.46-9.34)	<0.001

Model 1 included age, PD: Parkinson's disease, MNA: Mini-nutritional assessment, MMSE: Mini-mental state examination, incontinence, Katz, Lawton and timed up and go test (TUG). Model 2 included sarcopenia (SARC-F ≥4) along with all variables in Model 1, OR: Odds ratio, CI: Confidence interval

balance for evaluating the risk of falls in older individuals. It is also recommended to assess physical performance, as one of the sarcopenia components in EWGSOP (19). Here we observed that a longer time to complete the TUG test, as a low physical performance indicator, posed a significant association with falling in men, not women. Orwoll et al. (30) found that older men with the lowest activity/worst physical performance were at high risk for falling. Likewise, in the LIFE study, improved physical performance resulted in a reduction in men's serious fall injuries, but not in women (31). Our findings highlight the importance of muscle strength and physical performance in the definition of sarcopenia, in accordance with the literature (5). However, we did not observe an association between falls and the serum levels of sarcopenia related vitamins, 25(OH) D and vitamin B12.

In univariate analysis, we observed that frailty, depression, urinary incontinence, and lower scores in scales regarding nutrition, cognitive function, ADL, and IADL were significantly related to falls. The relationship between all these clinical conditions and falls has been established in previous studies (1,9-11). Multimorbidity defined by CCI was significantly associated with falls in the crude model in women, not in men, in line with the study of Chang and Do (11). After building models in each gender separately and including associated confounders, the multivariate analysis yielded the persistence of association of depression and urinary incontinence with falls, in both genders. Motor abnormalities leading to posture, balance, and gait impairments in patients with depression trigger falls (32). Moreover, in a prospective study, depressive symptoms increased the risk of falls, independent of antidepressant use and impaired executive functioning (33). Incontinence has been reported as a risk factor for falls for women in most previous studies (10,23). Gale et al. (23) attributed the loss of the relationship between falls and incontinence after multivariate analysis, which was significant in univariate analysis, to the low prevalence of incontinence in men. However, in our study, half of the women and one-third of the men had incontinence.

Study Limitations

Our study's strengths were that we evaluated the associated clinical factors of falls with a broad confounder with including geriatric syndromes and components of muscle markers related to sarcopenia in detail by considering the gender difference. Our study's limitations are; first, we did not group the drugs into the data in terms of the risk of falling; we only evaluated the number of drugs, whereas antidepressants, hypnotic drugs, etc., have a close relationship with falls. Second, we could not examine the relationship between sarcopenia and falls by defining operational sarcopenia according to EWGSOP. Very few patients whose SMMI was below the defined cut-off values and the prevalence of operational sarcopenia in both genders was too low to be included in the analyses. Third, the study design was cross-sectional; we could only argue about the associations between falls and related clinical factors, not the direct cause-effect relationship.

Conclusion

In conclusion there are similar associated factors in terms of falls for each gender as well as differences. Nevertheless, we did not observe a major difference in falls related clinical factors, between men and women. We observed that depression, incontinence, and sarcopenia risk were independently associated factors for falls in both genders. SARC-F appears to be effective in both genders in predicting the risk of falls. However, muscle strength in women and muscle performance

in men are substantial clinical factors for falls. While planning interventions to prevent falls, this discrepancy would be considered especially for exercise programs in each gender. Particularly exercise programs would be effective for improving sarcopenia and reducing depressive symptoms in older individuals. All the associated factors for falls, mentioned in the study, are modifiable and unfortunately commonly unnoticed in routine clinical evaluations in both genders, and consequently routine screening of these clinical syndromes in primary care would be cost-effective. The weighted effects of interventions, towards clinical factors associated with falls, on fall incidence should be investigated in future studies.

Ethics

Ethics Committee Approval: Study was approved by Local Ethics Committee and it conforms to the provisions of the Declaration of Helsinki (date/decision no: 20.02.2019/2019/136).

Informed Consent: Informed consent form was received from all patients with intact cognition, and proxies of patients with impaired cognition.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: F.F.Ö., S.A., T.S., N.Ş.D., B.M.G., Design: F.F.Ö., S.A., T.S., N.Ş.D., B.M.G., Data Collection or Processing: F.F.Ö., S.A., T.S., N.Ş.D., B.M.G., Analysis or Interpretation: F.F.Ö., S.A., T.S., N.Ş.D., B.M.G., Literature Search: F.F.Ö., Writing: F.F.Ö.

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