

Fear of Falling, Fall Risk and Disability in Patients with Rheumatoid Arthritis

Romatoid Artritli Hastalarda Düşme Korkusu, Düşme Riski ve Disabilite

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Objectives: This study evaluated frequency of fall, fear of falling (FOF), and fall risk in patients with rheumatoid arthritis (RA) and investigated the relationship of these with functional status, balance, gait, disability, disease activity, and atlantoaxial subluxation (AAS).

Patients and methods: Eighty-four female patients with RA and 44 healthy female volunteers were included in the study. Their fall history within the last year was questioned, and any use of an assistive device was recorded. The FOF was assessed using the Falls Efficacy Scale (FES). Tinetti balance and gait tests were performed for the evaluation of balance, gait, and fall risk. The disability in both groups was evaluated with the Health Assessment Questionnaire (HAQ). The disease activity was evaluated with the Chronic Arthritis Systemic Index. The presence of AAS was determined in the patient group using computed tomography imaging. The Beck Depression Inventory (BDI) and the 10-meter walk test were performed in both groups.

Results: Twelve (14.3%) subjects in the patient group reported one or more falls within the year. Fifty-six (66.7%) patients described FOF. Anterior AAS was present in 13 (15.4%) patients. According to the Tinetti total score, 33 (39.3%) patients had low, 48 (57.1%) patients had medium, and three (3.6%) patients had high fall risk. The Tinetti total score ($R^2=0.660$), HAQ ($R^2=0.030$) and BDI score ($R^2=0.027$) were detected to be the prominent independent risk factors affecting variations in FES scores. No relationship between AAS and fall history, FOF, or disease activity was determined.

Conclusion: The most important factors related to the fall risk and FOF were balance and disability level. Because of the increase in the osteoporotic hip fracture risk, the prevention of falls and the reduction of fall risk should be one of the most important rehabilitation goals.

Key words: Atlantoaxial subluxation; balance; disability; fear of falling; rheumatoid arthritis.

Amaç: Romatoid artritli (RA) hastalarda düşme sıklığı, düşme korkusu ve düşme riski değerlendirildi ve bunların fonksiyonel durum, denge, yürüme ve disabilite, hastalık aktivitesi ve atlantoaksiyel subluksasyon (AAS) ile ilişkisi araştırıldı.

Hastalar ve yöntemler: Çalışmaya 84 RA'lı kadın hasta ve 44 sağlıklı kadın gönüllü dahil edildi. Son bir yıl içindeki düşme öyküleri sorgulandı ve yardımcı cihaz kullanımı kaydedildi. Düşme korkusu Düşme Etki Ölçeği (FES) ile değerlendirildi. Denge, yürüme ve düşme riskinin değerlendirilmesi için Tinetti denge ve yürüme testi uygulandı. Disabilite her iki grupta da Sağlık Değerlendirme Anketi (SDA) ile değerlendirildi. Hastalık aktivitesi Sistemik Kronik Artrit İndeksi ile değerlendirildi. Hasta grubunda AAS varlığı bilgisayarlı tomografi kullanılarak araştırıldı. Her iki gruba Beck Depresyon Envanteri (BDE) ve 10 metre yürüme testi uygulandı.

Bulgular: Hasta grubundaki bireylerin 12'si (%14.3) son bir yıl içinde bir veya daha fazla düşme bildirdi. Elli altı hasta (%66.67) düşme korkusu tanımlıyordu. On üç hastada (%15.4) anterior AAS mevcuttu. Tinetti total skora göre 33 hastanın (%39,3) düşük, 48 hastanın (%57.1) orta ve üç hastanın (%3.6) yüksek düşme riski vardı. Tinetti total skoru ($R^2=0,660$), SDA ($R^2=0,030$) ve BDE skoru ($R^2=0,027$) FES skorlarındaki değişiklikleri etkileyen belirgin bağımsız risk faktörleri olarak tespit edildi. Düşme öyküsü ve AAS, düşme korkusu veya hastalık aktivitesi arasında ilişki tespit edilmedi.

Sonuç: Düşme riski ve düşme korkusu ile ilişkili en önemli faktörler denge ve disabilite düzeyi idi. Osteoporotik kalça kırığı riskindeki artış nedeniyle, düşmelerin önlenmesi ve düşme riskinin azaltılması en önemli rehabilitasyon hedeflerinden biri olmalıdır.

Anahtar sözcükler: Atlantoaksiyel subluksasyon; denge; disabilite; düşme korkusu; romatoid artrit.

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Fear of falling (FOF) is a risk factor in older adults. There is considerable evidence that FOF is a multifactorial syndrome resulting from a complex and dynamic interplay among physical, psychological, and social factors in older adults.^[1,2] Fear of falling is associated with restriction of physical activity, de-conditioning, poorer health-related quality of life (QoL), more falls, greater frailty, and increased mortality.^[1,3] Identification of risk factors for FOF could improve efforts to prevent the adverse outcomes of the fall.^[4]

Falls, FOF, and risk factors for falls have been thoroughly studied in the elderly population,^[1,5-8] but limited data exists in the literature about falls in patients with rheumatoid arthritis (RA).^[8-11] The risk of falls may be higher in RA patients because of the lower limb disease, muscle weakness,^[12] impaired mobility, gait disorders,^[13] balance, and postural instability.^[10,11] However, little is known about the occurrence of falls, fall risk, and FOF in RA and, to our knowledge, there is no study which has evaluated the relationship between atlantoaxial subluxation (AAS) and FOF in conjunction with fall risk in patients with RA.

The aim of the present study was to evaluate fall history, FOF, and fall risk in patients with RA and to investigate their relationships between the functional status, balance, walking speed, disability, disease activity, and presence of AAS.

PATIENTS AND METHODS

Eighty-four female patients (mean age 56.1±9.2 years; range 41 to 70 years) diagnosed according to the 1987 American College of Rheumatology (ACR) diagnostic criteria^[14] for RA and 44 healthy female (mean age 53.8±5.2 years; range 50 to 65 years) were included in the study. The patient group had been administered disease-modifying drugs (sulfasalazine, methotrexate, corticosteroids, leflunomide and their combinations). Those over 70 years old or below the age of 40 and patients with neurological disease, severe chronic obstructive pulmonary disease, chronic liver and kidney disease, or major psychiatric illness were excluded from the study. Approval was obtained from the local ethics committee, and patients were asked to sign the informed consent form in this study.

Demographic features of the patient and control groups along with the disease duration, duration of morning stiffness, Ritchie articular index (RAI),^[15] erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP) levels of the patient group were recorded. Disease activity was evaluated using the Chronic

Arthritis Systemic Index (CASI) which was calculated by the following formula: $13 \times \text{Health Assessment Questionnaire (HAQ)} + 0.21 \times \text{ESR} + 0.08 \times \text{visual analog scale (VAS) for pain} + 0.07692 \times \text{RAI}$.^[16] The patients were questioned about their fall history within the last year, and any use of an assistive device was recorded. The presence of AAS was determined in the patient group using computed tomography imaging by an experienced radiologist. Occipital headache, cervical myelopathy, upper and lower extremity weakness, numbness, and dizziness, which may be related to AAS, were assessed.^[17] The activities of daily living (ADL) of both groups were evaluated using the HAQ.^[18] The functional status of patients was assessed by the Steinbrocker functional classification (SFC).^[19]

Fear of falling in the patient and control groups was evaluated using the Falls Efficacy Scale (FES).^[5] The FES, consisting of 10 items, is a measurement to assess self-confidence in avoiding a fall while performing daily activities. In the FES, each item is rated between 1 (very confident) and 10 (a total lack of confidence).

The Tinetti Balance Test (TBT) and Tinetti Gait Test (TGT) were used to assess balance, gait, and fall risks.^[6] The Tinetti test is the functional assessment for balance and gait. The balance section consists of nine items and the gait section seven. The test is scored based on the subject's ability to perform specific tasks. Each test is evaluated in three sections and scored in a range from 0 to 2. The maximum score for balance is 16 points and for gait 12 points. The maximum total score is 28 points. The interpretation of the total score is as follows: 25-28 low fall risk, 19-24 medium fall risk, and <19 high fall risk.

Hand grip strength of the patient and the control groups was measured using a Jamar hand dynamometer (Jackson, MI 49203 USA) in a sitting position with the shoulder adducted and neutrally rotated, elbow flexed at 90°, and the forearm and wrist neutrally positioned. Grip strength measurements were repeated three times at 15 minute intervals and the average was calculated.^[20] In addition, 10-meter walking time (in seconds) and gait speed were measured for both groups. The Beck Depression Inventory (BDI) was applied to the groups.^[21]

Statistical analysis

Statistical analyses were performed using SPSS (SPSS Inc., Chicago, Illinois, USA) 16.0 version software for Windows. Comparisons between the groups were made using the Student's t test for normally distributed variables and the Mann-Whitney U-test for skewed

Table 1. Demographic features of patients and control group

	Patients group (n=84)			Control group (n=44)			p
	n	%	Mean±SE	n	%	Mean±SE	
Age (years)			56.1±9.2			53.8±5.2	0.063
Body mass index (kg/m ²)			29.2±5.7			28.7±3.5	0.073
Disease duration (years)			11.1±7.8			-	-
Fall history	12	14.3		0	0		-
Assistive device	6	7.1		-	-		-
Atlantoaxial subluxation	13	15.4		-	-		-
Steinbrocker functional classification							
Class I	27	21.1		-	-		-
Class II	15	11.7		-	-		-
Class III	42	32.8		-	-		-
Duration of morning stiffness (dak)			43.8±8*			-	-
Erythrocyte sedimentation rate (mm/h)			47.8±19.3			-	-
C-reactive protein (mg/dl)			1.6±0.18*			-	-
Ritchie articular index			12.2±8.1			-	-
Chronic arthritis systemic index			43.5±20.5			-	-

*: Mean ± standard error.

data. The Spearman Rank Correlation Test was used for correlation analysis. Nominal variables were compared between the groups by a chi-square test. $P < 0.05$ was acknowledged to be a statistically significant level. As a result of a single variable statistical analysis, a multiple stepwise linear regression analysis was used to explore risk factors associated with falls and FOF.

RESULTS

Comparison of patient group with control group

The demographic features of the patients and control subjects and the disease activity parameters of patients

are shown in table 1. There was no statistically significant difference between the patient and control group regarding age and body mass index. Hand grip strength, 10-meter walking time, gait speed, FES, TBT, TGT, HAQ, and BDI scores of patients were significantly worse than those of the control group (table 2).

Twelve (14.3%) subjects in the patient group reported one or more falls within the last 12 months. Fifty-six (66.7%) patients reported FOF. Six (7.1%) subjects used an assistive device (cane) for walking. Anterior AAS was present in 13 (15.4%) subjects. All AAS patients

Table 2. The mean values of Falls Efficacy Scale, hand grip strength, 10-meter walking time, Tinetti Balance and Gait Test, Health Assessment Questionnaire and Beck Depression Inventory scores of the patient and control groups

	Patient (n=84)			Control (n=44)			p
	n	%	Mean±SE	n	%	Mean±SE	
Falls Efficacy Scale			18.8±1.8*			5.5±3.2	0.001
Hand grip strength (kg)			17.9±5.6			28.5±2.9	<0.001
10-meter walking time (sn)			10.9±3.1			8.2±0.7	<0.001
Walking speed (m/sn)			0.9±0.2			1.2±0.1	<0.001
Tinetti Balance Test			13.1±2			15.1±0.9	<0.001
Tinetti Gait Test			10.8±1.1			12±0.0	<0.001
Tinetti total score			24.0±2.9			27.1±0.9	<0.001
Fall risk							
Low risk	33	39.3		44	100		-
Medium risk	48	57.1		-	-		-
High risk	3	3.6		-	-		-
Health Assessment Questionnaire			1±0.5*			0.2±0.1	<0.001
Beck Depression Inventory			25.9±13.9			16.9±1.9	<0.001

*: Mean ± standard error.

were asymptomatic, and subjects were incidentally detected during routine screening tests. No findings of myelopathy were diagnosed in any of the patients.

According to the SFC, 27 (21.1%) of patients were in class I, 15 (11.7%) in class II, and 42 (32.8%) in class III. A gait speed of below 1.4 m/sec, the minimum necessary for secure and adequate ambulation within the community, was reported in 69 (82.1%) of the patients.^[22] According to the Tinetti total score, 33 (39.3%) patients had low, 48 (57.1%) patients had medium and three (3.6%) patients had a high fall risk.

Comparison of faller and non-faller groups

Patients were divided into two groups: those with a fall history of at least once within the last 12 months (n=12) and those with no fall history (n=72). A longer duration of disease was observed in the group with fallers. Hand grip strength, FES, TBT, TGT, Tinetti total score, HAQ and CASI scores, ESR, CRP levels, 10-meter walking time, and gait speed were significantly worse in the fallers when compared

to the non-fallers (p<0.05). There were no statistically significant differences (p>0.05) between the two groups in terms of age, presence of AAS, BDI scores, or RAI. According to the Tinetti total score, nine (75%) fallers had a medium fall risk and three (25%) fallers had a high risk. According to the SFC, 27 (37.5%) of the non-fallers were in class I, 15 (20.8%) in class II, and 30 (41.7%) in class III. All subjects in the faller group were in class III (table 3).

Comparison of patients with FOF and without FOF

Rheumatoid arthritis patients with and without FOF according to the FES were divided into two groups. Twenty-eight patients whose FES score was measured grade '0' were assessed to be the group without FOF and 56 subjects with an FES grade greater than '0' were assessed to be the group with FOF. In addition to long duration of disease, hand-grip strength, TBT, TGT and Tinetti total scores, HAQ, 10-meter walking time, gait speed, BDI, and CASI index scores measured in the group with FOF were significantly worse than the values obtained

Table 3. The mean values of Falls Efficacy Scale, hand grip strength, 10-meter walking time, Tinetti Balance and Gait Test, Health Assessment Questionnaire and Beck Depression Inventory scores, functional status and disease activity parameters of faller and non-faller patients

	Fallers (n=12)			Non-fallers (n=72)			p
	n	%	Mean±SE	n	%	Mean±SE	
Falls Efficacy Scale			38±10.3			15.6±1.9*	<0.001‡
Disease duration (years)			12.6±2.1			11.9±8	0.067†
Age (years)			60±6			55.5±9.6	0.098†
Hand grip strength (kg)			14.5±4.9			18.5±5.6	0.008‡
Atlantoaxial subluxation	2	16.7		10	13.9		0.178¥
Beck depression inventory			30±12			25.2±14.1	0.123‡
Tinetti Balance Test			11±1.2			13.5±1.9	<0.001†
Tinetti Gait Test			9.5±0.5			11±1	<0.001†
Tinetti total score			20.5±1.7			24.5±2.7	<0.001†
Fall risk							<0.001†
Low risk	–	–		33	45.8		
Medium risk	9	75		39	54.2		
High risk	3	25		–	–		
Health Assessment Questionnaire			1.5±0.8			1±1.4	0.002‡
10-meter walking time (sn)			14.2±3.8			10.4±2.6	0.001‡
Walking speed (m/sn)			0.7±0.2			1.0±0.2	0.001‡
Erythrocyte sedimentation rate (mm/h)			60.5±16.4			45.7±19.1	0.015‡
C-reactive protein (mg/dl)			3.4±2.8			1.3±0.1*	<0.001‡
Ritchie Articular Index			12.5±4			12.1±8.6	0.056‡
Chronic Arthritis Systemic Index			66.8±13			39.6±19	<0.001‡
Steinbrocker Functional Classification							<0.001‡
Class I	27	37.5		0	0		
Class II	15	20.8		0	0		
Class III	30	41.7		12	100		

*: Mean ± standard error; †: Student t-test statistics; ‡: Mann Whitney U-test statistics; ¥: Chi square test statistics.

in the group without FOF ($p < 0.05$). There were no statistically significant differences between the two groups regarding age, the presence of AAS, RAI, and ESR ($p > 0.05$). According to the Tinetti total score, nine (16.1%) subjects presenting with FOF had low, 44 (78.6%) had medium and three (5.4%) had a high risk of falling. The fall risk in the group with FOF was found to be significantly higher than in the group without FOF ($p < 0.001$). According to the SFC, 21 (75%) of the group without FOF were in class I, six (21.4%) were in class II, and one (3.6%) was in class III; however, in the group with FOF, six (10.7%) were in class I, nine (16.1%) were in class II and 41 (73.2%) were in class III (table 4).

Correlation analysis

There was a significant correlation between the fall history and FES scores ($p < 0.001$, $r = 0.456$), TBT ($p < 0.001$, $r = -0.404$), TGT ($p < 0.001$, $r = -0.477$), Tinetti total score ($p < 0.001$, $r = -0.459$), HAQ ($p < 0.001$, $r = 0.424$), 10-meter walking time ($p < 0.001$, $r = 0.354$), and CASI index score ($p < 0.001$, $r = 0.467$) in the patient group.

A significant correlation was found in the patient group between FOF and BDI ($p < 0.001$, $r = 0.458$), TBT ($p < 0.001$, $r = -0.779$) and TGT scores ($p < 0.001$, $r = -0.768$), HAQ ($p < 0.001$, $r = 0.718$), SFC ($p < 0.001$, $r = 0.725$), and CASI index ($p < 0.001$, $r = 0.724$).

In the patient group, there were significant correlations between the HAQ and hand grip strength ($p < 0.001$, $r = -0.499$), BDI ($p < 0.001$, $r = 0.426$), TBT ($p < 0.001$, $r = -0.739$), TGT ($p < 0.001$, $r = -0.773$), Tinetti total score ($p < 0.001$, $r = -0.812$), 10-meters walking time ($p < 0.001$, $r = 0.654$), SFC ($p < 0.001$, $r = 0.813$), and CASI index ($p < 0.001$, $r = 0.974$).

No correlation was determined between AAS and fall history, FOF, functional disability, or disease activity.

Stepwise multiple linear regression analysis

As a consequence of univariate statistical assessments, stepwise multiple linear regression analyses were conducted to identify the multiple effects of independent risk factors on falls and

Table 4. The mean values of Falls Efficacy Scale, hand grip strength, 10-meter walking time, Tinetti Balance and Gait Test, Health Assessment Questionnaire and Beck Depression Inventory scores, functional status and disease activity parameters of patients with and without fear of falling

	Patients with fear of falling (n=56)			Patients without fear of falling (n=28)			p
	n	%	Mean±SE	n	%	Mean±SE	
Falls Efficacy Scale			26.3±13.5			0	<0.001†
Disease duration (years)			12.8±8.2			8±1.1*	0.006‡
Age (years)			57±8.7			54.4±10.2	0.098†
Hand grip strength (kg)			16.8±6			20.3±3.8	0.008†
Atlantoaxial subluxation	8	14.3		4	14.3		0.085¥
Beck Depression Inventory			29.2±12.7			19.1±2.6*	<0.001‡
Tinetti Balance Test			12.3±1.8			15±0.9	<0.001†
Tinetti Gait Test			10.3±0.9			11.8±0.3	<0.001†
Tinetti total score			22.6±2.5			26.8±1.2	<0.001†
Fall risk							<0.001‡
Low risk	9	16.1		24	85.7		
Medium risk	44	78.6		4	14.3		
High risk	3	5.4		-	-		
Health Assessment Questionnaire			1.4±0.2*			1±0.6	0.003‡
10-meter walking time (sn)			12.1±3.1			8.5±1.3	<0.001†
Walking speed (m/sn)			0.8±0.2			1.2±0.1	<0.001‡
Erythrocyte sedimentation rate (mm/h)			49±19.7			45±18.7*	0.0124‡
C-reactive protein (mg/dl)			1.7±0.2*			1.1±0.2*	0.023‡
Ritchie Articular Index			11.5±5.3			13.6±2.3*	0.067†
Chronic Arthritis Systemic Index			52.8±17.7			23.9±9.8	<0.001†
Steinbrocker Functional Classification							<0.001†
Class I	6	10.7		21	75		
Class II	9	16.1		6	21.4		
Class III	41	73.2		1	3.6		

*: Mean ± standard error; †: Student t-test statistics; ‡Mann whitney U-test statistics; ¥: Chi square test statistics.

FOF. The Tinetti total score ($R^2=0.660$), HAQ ($R^2=0.030$) and BDI score ($R^2=0.027$) were detected to be the apparent independent risk factors affecting variations in FES scores. The total Tinetti score demonstrated significant negative correlation with FOF, and the positive correlation between the scores of FES and BDI and HAQ was observed to persist. In accordance with the model including these three risk factors, the variables mentioned were determined to describe 71.7% (R^2) of the total changes in FOF. The independent risk factor with significant influence on fall history was the Tinetti total score which explained 22.1% (R^2) of the total variation (tables 5 and 6).

DISCUSSION

In this study, the most prominent factors that were shown to lead to falls and fall risks were the disability levels measured by the Tinetti Balance and Gait Tests and the HAQ. The effects of disease activity and muscular strength of patients on falls and fall risks were less prominent while age, ESR, and RAI were found to be ineffective.

Fear of falling and falls are problems not only for the elderly, but for patients with RA as well.^[8] Although 66.7% of our patients complained about FOF, only 14.3% of them presented with a fall episode at least once within the last year. Jamison et al.^[8] reported the rate of FOF in patients with RA as 60%; however, 35% of these patients had a fall episode within the last year. In this study, patients with FOF

were shown to suffer from more intense pain due to arthritis and had a longer walking time, which is known to be an indicator of reduced physical fitness. Fessel and Nevitt^[9] demonstrated that FOF was associated with poor physical function and the number of painful joints. In our study, the walking time was longer in the patients with FOF, and we found that the CASI score, which measures disability and number of tender joints, was higher in the patients with FOF and in those who were classified as fallers. We think that our patients with FOF had reduced physical fitness, and the severity of chronic arthritis had a poor affected on their fitness levels and increased the disability levels in RA patients.

The rate of one or more falls in the past year was reported to be 33% in patients with RA by Armstrong et al.^[10] According to a study by Jamison et al.,^[8] 35% of middle- and old-aged patients with RA had a history of a fall in the past year. In other studies, the fall rate was reported as 30% in elderly patients with RA,^[9] and 35.9% in elderly individuals living independently in the community.^[7] In our patients with RA (mean age 56 years), the fall rate of at least once within the last one year was 14.3%. Lower fall rates in our study as compared to other similar studies were considered to be due to the younger mean age of our patients.

Muscle strength is the most important factor affecting physical functions.^[23] Progressive reduction was reported in the hand grip strength of the patients with RA.^[24] Häkkinen et al.^[23] determined a correlation

Table 5. Regression models for fall history and fear of falling

Model	Factors added	Fear of falling		Fall history	
		R ²	Adjusted R ²	R ²	Adjusted R ²
1	Tinetti total	0.664	0.660	0.231	0.221
2	HAQ	0.698	0.690	-	-
3	BDI	0.728	0.717	-	-

HAQ: Health Assessment Questionnaire; BDI: Beck Depression Inventory

Table 6. The results of the multiple stepwise regression analysis for fall history and fear of falling

Variable	Fear of falling			Fall history		
	β	<i>p</i>	95% CI	β	<i>p</i>	95% CI
Tinetti total score	-2.996	<0.001	-4.127-1.865	-0.056	<0.001	-0.079-0.034
Health Assessment Questionnaire	3.267	0.004	1.091-5.443	-	-	-
Beck Depression Inventory	0.230	0.004	0.075-0.385	-	-	-

CI: Confidence interval.

between the HAQ disability score and hand grip strength. We found that there was a positive correlation between the HAQ scores and hand grip strength values in our patients. The HAQ measures a number of hand grip activities, so it is meaningful that the HAQ and grip strength were two closely related parameters.

Pain, stiffness and walking problems appear to be factors that restrict mobility in patients with RA.^[22] Armstrong et al.^[10] reported that factors associated with falls are self-reported impairment in lower-extremity functions, gait, and the ability to stand up in patients with RA. It is reported that the walking speed required for independent and safe ambulation in the community is 1.4 m/sec,^[22] and for home ambulation it is 0.4-0.5 m/sec.^[24] Häkkinen et al.^[23] reported that muscle strength is the most important factor affecting disability and walking speed, especially in female patients with RA, and they stated that the walking speed in 45% of their patient group was below 1.4 m/sec. However, in our study, the walking speeds of 82% of the patients were below 1.4 m/sec. The mean 10-meter walking time, which reflects lower physical condition, was lower and the HAQ disability score was higher in our patients compared with the patient group of Häkkinen et al.^[23] We consider that the lower values of walking speed in our patients were due to the higher disability levels and lower physical conditions in our patients.

Decreased bone mineral density in patients with RA was reported by Hall et al.^[25] The risk of osteoporotic hip fractures increased in patients with RA and doubled in patients treated with steroids.^[10,26] Functional impairment and vulnerabilities developing due to disease were reported to be the greatest cause of an increased risk of hip fractures in patients with RA. The increased risk of hip fractures among patients with RA may also occur due to the increased risk of falling.^[26] In a prospective one-year study, Hayashibara et al.^[27] showed that the fall incidence was 50% in female patients with RA. A multivariate analysis identified swollen joint count, use of antihypertensives or diuretics, one-leg standing time, and sway area measured by a stabilometer as significant parameters associated with falls.^[27] In our study, disease activity was correlated with FOF, but the most important factors associated with falls and FOF were impaired balance and the disability levels of the RA patients. Kaz Kaz et al.^[11] found that the risk factors associated with falls which are predictive

for hip fracture were increased in 89% of female RA patients (mean age 73 years). They reported that the HAQ scores and number of tender joints were the most common risk factors associated with falls. Disease duration, ESR, and steroid therapy were not associated with the risk of falls in the study by Kaz Kaz et al.^[11] In our study, 60.7% of our patients had a medium or high risk of falls. We found that balance and disability scores were the most prominent risk factors associated with increased fall risk, FOF, and falls. Similar to the study by Kaz Kaz et al.,^[11] the disease duration and ESR of our patients were not found to be associated with falls. Therefore, we thought that improving the balance and disability of RA patients is of major importance in preventing falls and fall-related complications.

Differing from other studies which evaluated FOF in RA, we evaluated the AAS, which may be a factor related with balance and gait problems. Atlantoaxial subluxation is frequently seen in patients with RA. After a 20-year follow-up, AAS was observed in 42% of patients with destructive RA.^[28] Cervical spine involvement is observed in patients with destructive RA after an average of 16 years. Half of the RA patients with cervical spine subluxation were asymptomatic. When the vertebrobasilar insufficiency or myelopathy findings occur due to subluxation, gait and balance problems may develop.^[17,29,30] In our study, the number of patients with AAS was 13 (15.47%). No correlation was determined between the existence of AAS and fall history, FOF, functional disability, or disease activity. All patients were asymptomatic, and there was no evidence of cervical myelopathy in our patients. The results may be due to the short mean disease duration of our patients.

The major limitation of this study was a limited sample size. Further studies are needed for the evaluation of the reasons for falls and fall risks in this patient population.

In conclusion, falls and FOF in patients with RA were found to be closely associated with the patient's disabilities and functional status. Patients with FOF were also determined to have marked gait and balance impairments. The most important factors associated with falls and FOF were impaired balance and the disability levels of RA patients. Since the risk of osteoporotic hip fractures in patients with RA is also high, the prevention of falls and a reduction in the risk of falls should be the one of the most important goals of rehabilitation.

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