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Gender- and age-related differences in laboratory, clinical, and functional outcomes in Turkish patients with ankylosing spondylitis: A cross-sectional, single-center study

Ankilozan spondilitli türk hastalarda laboratuvar, klinik ve fonksiyonel sonuçlarda cinsiyet ve yaşa bağlı farklılıklar: Kesitsel, tek merkezli bir çalışma

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Abstract

Objective: Identifying factors influenced by gender- and age-related differences may be critical for predicting disease progression and guiding clinical management in ankylosing spondylitis (AS). Therefore, this study aimed to investigate gender differences in laboratory, demographic, and clinical features. Additionally, it aimed to investigate gender differences in functional outcomes across age groups among Turkish patients with AS.

Methods: Patients with AS were enrolled in the present study. Demographic, laboratory, and clinical features were collected. Functional assessments included pain, disease activity, spinal mobility, lower-limb performance, static and dynamic balance, kinesiophobia, and fall-related concerns. Demographic and laboratory features and tumor necrosis factor alpha (TNF-α) from history were compared between genders. Functional features were compared between genders in two age groups (36-45 and 46-60 years).

Results: A total of 103 patients with AS participated in the present study. Erythrocyte sedimentation rates were significantly higher in women ($p=0.01$). In contrast, radiological stage levels, history of anti-TNF-α treatment, and the proportion of patients who were current or former smokers were significantly higher in men ($p<0.05$). In the 36-45 age group, dynamic balance scores and fall-related concerns were significantly higher in women than in men ($p<0.05$). In the 46-60-year age group, spinal mobility was significantly worse in men ($p<0.05$).

Conclusion: The findings of this study indicate that women aged 36-45 years may particularly benefit from targeted interventions to improve dynamic balance and reduce fall-related concerns. Among men aged 46-60 years, approaches that enhance spinal mobility and flexibility may be especially useful. Overall, these results highlight the importance of implementing gender- and age-specific monitoring and preventive strategies in clinical practice for patients with AS.

Keywords: Ankylosing spondylitis, gender, age group, spinal mobility, balance

Özet

Amaç: Cinsiyet ve yaşa bağlı farklılıklardan etkilenen faktörlerin belirlenmesi, ankilozan spondilitli (AS) hastalığın ilerlemesini tahmin etmek ve klinik tedaviye yön vermek açısından kritik öneme sahip olabilir. Bu nedenle, bu çalışma laboratuvar, demografik ve klinik özelliklerdeki cinsiyet farklılıklarını araştırmayı amaçlamıştır. Ayrıca, AS'li Türk hastalarda yaş gruplarına göre fonksiyonel sonuçlardaki cinsiyet farklılıklarını araştırmayı hedeflemiştir.

Yöntem: Çalışmaya AS hastaları dahil edildi. Hastaların demografik, laboratuvar ve klinik özellikleri toplandı. Fonksiyonel değerlendirmeler arasında ağrı, hastalık aktivitesi, omurga mobilitesi, alt ekstremite performansı, statik denge, dinamik denge, kinezyofobi ve düşmeyle ilgili endişeler yer aldı. Demografik, laboratuvar ve klinik özellikler cinsiyetler arasında karşılaştırıldı. Fonksiyonel özellikler iki yaş grubunda (36-45 ve 46-60 yaş grupları) cinsiyetler arasında analiz edildi.

Bulgular: Bu çalışmaya toplam 103 AS hastası katıldı. Eritrosit sedimantasyon hızı düzeyleri kadınlarda anlamlı olarak daha yüksekti ($p=0,01$). Buna karşın radyolojik evre düzeyleri, anti-tümör nekroz faktörü alfa (TNF-α) tedavi öyküsü ve hastaların halen veya daha önce sigara içenlerin oranı erkeklerde anlamlı derecede daha yüksekti ($p<0,05$). Otuz altı-45 yaş grubunda dinamik denge ve düşmeyle ilgili endişe puanları, kadınlarda erkeklere göre anlamlı derecede daha yüksekti ($p<0,05$). Kırk altı-60 yaş grubunda ise omurga hareketliliği erkeklerde istatistiksel olarak daha kötüydü ($p<0,05$).

Sonuç: Bu çalışmanın bulguları, 36-45 yaş aralığındaki kadınların dinamik dengeyi iyileştirmek ve düşmeyle ilgili endişeleri azaltmak için hedefli müdahalelerden özellikle faydalanabileceğini göstermektedir. Kırk altı-60 yaş arası erkeklerde, omurga hareketliliğini ve esnekliğini artıran yaklaşımlar özellikle faydalı olabilir. Elde edilen veriler klinik pratikte cinsiyet ve yaşa dayalı izleme ve önleme stratejilerinin önemini ortaya koymaktadır.

Anahtar Kelimeler: Ankilozan spondilit, cinsiyet, yaş grubu, omurga hareketliliği, denge

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Intoduction

Ankylosing spondylitis (AS) is a systemic, progressive rheumatic condition characterized by chronic inflammation of the spine and sacroiliac joints.[1] It has been estimated that the number of cases ranges from 1.30 to 1.56 million in Europe and from 4.63 to 4.98 million in Asia.[2]

The progression of AS is characterized by increasing spinal stiffness, reduced lumbar lordosis, and increased thoracic kyphosis. Spinal mobility is an important outcome in both observational and treatment studies on AS and serves as a predictor of poor prognosis.[3] Changes in spinal mobility can make it difficult for the body to maintain an optimal position and may be associated with an increased risk of falling.[4] Studies have shown that patients with AS have poorer balance compared with healthy individuals.[5] In addition, 66.6% of patients with AS have been reported to experience kinesiophobia, defined as fear of physical movement and activity.[6]

In AS, with respect to sex and age, the disease predominantly affects men, and age is linearly associated with the progression of spinal radiographic changes.[7-11] A study examining the progression of radiographic changes over time, with age groups in 10-year increments, suggested that spinal structural damage in AS progresses most rapidly in patients aged 30-39 years. [12] Given the availability of effective treatments for AS, it is essential for physicians to be aware of the distinctive features and management options of this disorder in the population. While studies have examined gender differences in populations such as those from Iran, Morocco, and Japan, data on the Turkish population are lacking.

The present study aimed to investigate gender differences in laboratory and clinical outcomes and functional variations across age groups among Turkish patients with AS.

Materials and Methods

Study Design and Patient Selection

This cross-sectional study was conducted at the Hatay Mustafa Kemal University of Medicine, Division of Rheumatology, Department of Internal Medicine from October 2022 to January 2023. The study protocol was conducted in accordance with the Declaration of Helsinki. Ethical approval for this study was obtained from the Clinical Research Ethics Committee of Hatay Mustafa Kemal University Faculty of Medicine (date: 02.02.2021, decision no: 03, protocol code: 2021/170). All participants provided written informed consent before enrollment.

A total of 136 patients with AS who attended the outpatient rheumatology clinic of Hatay Training and Reseach Hospital were screened for eligibility. Patients were included if they met the diagnostic criteria for AS[13] and were between 36 and 60 years of age. Exclusion criteria included the presence of other concomitant rheumatic diseases, orthopedic joint prostheses, spinal surgery, neuromuscular disorders, cognitive or psychiatric conditions.

Data Collection

The following demographic characteristics, laboratory features, and medical treatments were recorded: age, gender, body mass index (BMI), disease duration, radiographic level, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), diagnostic delay, history of anti-tumor necrosis factor alpha (TNF-α), and smoking status (current or former). Clinical outcomes assessed in all patients were pain, disease activity, spinal mobility, lower-limb performance, static balance, dynamic balance, kinesiophobia, and fall-related concerns.

Pain scores at rest and during movement were measured using the visual analogue scale (0-10 mm; 0 = no pain, 10 = severe pain).[14] Disease activity was evaluated using Bath Ankylosing Spondylitis Disease Activity Index (BASDAI), which consists of six questions assessing five major AS symptoms: fatigue, spinal pain, joint pain and swelling, localized tenderness, and morning stiffness (duration and severity). Each item is scored on a 1-10 scale, with final scores ranging from 0 (best) to 10 (worst).[15]

The spinal mobility was assessed using the finger-to-floor distance (FFD) and the Bath AS Metrology Index (BASMI). The BASMI is a composite index consisting of four spinal measurements (tragus-to-wall distance, lateral lumbar flexion, lumbar flexion, and cervical rotation) and one hip mobility measure (intermalleolar distance). Each measurement is scored 0, 1, or 2, and the five scores are summed, with higher scores indicating greater mobility impairment. For FFD, patients performed maximal lumbar flexion with the knees extended, and the distance from the tip of the middle finger to the floor was measured using a measuring tape.[16]

Lower extremity strength was assessed using the 30-second chair stand test.[17] Patients were seated in an armless chair with their backs straight, arms crossed over the chest, and feet approximately shoulder-width apart. and placed on the floor. They were instructed to stand up and sit down as quickly as possible for 30 seconds. The mean of the two trials was recorded as the patient's score.[17]

Dynamic balance was evaluated using the timed up and go (TUG) test, and static balance was assessed using the tandem stance test (TST). The TUG test measures the time (in seconds) required for a participant to stand from an armchair, walk 3 meters, turn, return, and sit down.[18] In the TST, participants stood with one foot in front of the other and arms crossed; the researcher recorded the time, up to a maximum of 30 seconds, or until participants moved or required support. The

test was repeated three times, and the average time was used for analysis.[19]

Kinesiophobia was assessed using the Tampa scale for kinesiophobia, which contains 17 items rated on a 4-point Likert scale (1 = strongly disagree, 4 = strongly agree).[20] Total scores range from 11 to 44 points, with scores ≥37 indicating high kinesiophobia.[21]. The Turkish version of the scale was used.[21]

Concern about falling was assessed using the falls efficacy scale-international (FES-I). which includes 16 questions regarding confidence in performing activities without falling. Each item is scored on a 1-4 scale (1 = not at all concerned; 4 = very concerned), with higher scores indicating greater fear of falling.[22] The Turkish version of the scale was used.[23]

Gender differences in demographic characteristics, laboratory features, and medical treatments were analyzed. For clinical outcomes, gender differences were examined in two age groups: 36-45 years and 46-60 years.

Statistical Analysis

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 21.0 (SPSS Inc., Chicago, IL, USA). A p-value of <0.05 was considered statistically significant for all analyses.

The normality of the data distribution was assessed using the Shapiro-Wilk test. Parametric tests were applied to normally distributed data, whereas nonparametric tests were applied to non-normally distributed data. The chi-square test was used to compare categorical variables.

Results

A total of 103 patients with AS met the inclusion criteria and were enrolled in the study. Fifty-two patients were in the 36-45-year age group (mean age = 40.38 years; 26 female patients) and 51 patients were in the 46-60-year age group (mean age = 52.37 years; 26 female patients).

As demonstrated in Table 1, ESR values were significantly higher in women (p=0.01); however, this difference is expected due to known sex-related physiological variations in ESR and is not considered clinically significant. In contrast, men had a significantly worse radiological stage, a higher proportion had a history of anti-TNF-α therapy, and a greater proportion were current or former smokers (p<0.001, p=0.033, and p=0.008, respectively). No statistically significant differences in BMI, CRP levels, age at diagnosis, diagnostic delay, or age at disease onset were observed between genders.

As shown in Table 2, clinical outcomes were analyzed by gender within two age groups (36-45 and 46-60 years). Among participants aged 36-45 years, dynamic balance (TUG test) and fall-related concerns (FES-I scores) were significantly higher in women than in men (p=0.005 and p=0.01, respectively). No significant gender differences were found for pain, disease activity, spinal mobility, lower limb performance, static balance, or kinesiophobia in this age group. In the 46-60 age group, spinal mobility measures (BASMI and FFD scores) were significantly worse in men (p=0.005 and p=0.003, respectively). However, no significant gender differences were found for pain, disease activity, lower-limb performance, static balance, dynamic balance, kinesiophobia, or fall-related concerns in this age group.

Table 1. Comparison of demographic features between genders

Variables Mean ± SD		Female (52)	Male (51)	P*
		Mean ± SD		
Age		45.81±6.37	46.84±7.88	0.46
BMI		28.47±4.58	27.90±4.10	0.50
Age at onset		35.62±9.02	32.36±9.68	0.08
Diagnose age		41.06±7.17	37.97±9.51	0.06
Diagnostic delay time		5.46±6.89	5.60±6.02	0.91
ESR		15.38±10.84	10.60±9.08	**0.01**
CRP		6.56±7.11	9.10±12.76	0.21
		n (%)	**n (%)**	**P****
Radiological stage	1	32 (61.5)	11 (21.6)	**<0.001**
	2	16 (30.8)	21 (41.2)	
	3	4 (7.7)	19 (37.3)	
History of having anti-TNF-alfa therapy	Yes	26 (50)	36 (70.6)	**0.033**
	No	26 (50)	15 (29.4)	
Smoking/ex-smoking	Yes	19 (36.5)	32 (62.7)	**0.008**
	No	33 (63.5)	19 (37.3)	

BMI: Body mass index, CRP: C-reactive protein, ESR: Erythrocyte sedimentation rate, SD: Standard deviation, TNF: Tumour necrosis factor

Table 2. **Comparison of age groups' clinical features data between gender**						
Variables	**36-45 age group (n=52)**		**p**	**46-60 age group (n=51)**		**p**
	Female (26)	**Male (26)**		**Female (26)**	**Male (25)**	
	Mean ± SD	**Mean ± SD**		**Mean ± SD**	**Mean ± SD**	
Age	40.54±2.48	40.23±3.70		51.08±4.35	53.72±4.29	
BMI	27.85±5.01	26.84±3.73	0.41	29.09±4.10	29.00±4.26	0.93
BASDAI	5.57±2.41	4.49±2.56	0.12	5.35±2.39	4.68±2.02	0.28
BASMI	6.80±2.11	7.42±1.57	0.24	7.38±2.43	9.36±2.30	**0.005**
Timed up and go (sec)	9.06±2.44	7.57±0.92	**0.005**	9.34±1.49	8.91±2.42	0.44
Tandem (sec.)	23.57±10.15	27.19±5.83	0.12	24.95±8.09	25.69±8.56	0.75
VAS-activity	4.84±3.67	4.57±3.18	0.77	5.65±3.42	4.96±3.00	0.44
VAS-rest	4.80±3.47	3.96±3.28	0.37	4.57±3.50	3.80±3.06	0.40
Sit-up-test	11.33±3.85	13.00±2.77	0.07	11.21±3.21	11.39±2.94	0.83
Falls efficacy scale-international	29.81±12.33	22.30±7.15	**0.01**	26.62±8.50	24.76±8.45	0.72
Tampa kinesiophobia	43.00±7.02	40.15±9.22	0.21	45.08±9.04	42.52±6.91	0.26
Finger to floor distance	-13.12±14.41	-12.20±12.88	0.80	-7.75±13.40	-19.99±14.58	**0.003**

BASDAI: Bath ankylosing spondylitis disease activity index, BASMI: The Bath AS metrology index, BMI: Body mass index, SD: Standard deviation, VAS: Visual analogue scale

Discussion

Gender-based comparisons revealed that women had higher ESR levels, while men exhibited more advanced radiological stages, greater use of anti-TNF-α therapy, and higher rates of smoking among Turkish patients with AS. No significant differences were observed between genders in BMI, CRP, age at diagnosis, or diagnostic delay. When analyzed by age group, women aged 36-45 had poorer balance and greater fear of falling, whereas men aged 46-60 showed more severe spinal mobility limitations. Notably, this is the first study to examine gender differences among Turkish patients with AS and provides valuable insights into the potential impact of gender on the clinical presentation and severity of the disease.

Understanding gender-specific differences in disease patterns is essential for improving diagnostic and treatment decisions for AS patients. Ibn et al.[24] reported that elevated CRP levels were significantly more prevalent among men in the Chinese population. In other studies, whereas Yacoub et al. found no differences in CRP among Moroccan patients with AS, Shahlaee et al.[25] reported that women had lower CRP levels.[24] In contrast, our study found no significant difference in CRP levels between genders in the Turkish population. Nevertheless, Turkish men had more severe radiographic damage, consistent with earlier studies.[24,26] This may relate to findings from previous research showing that women report greater peripheral joint pain and arthritis, which could be associated with fewer radiographic changes in the spine.[10,24,27] In our study, men had a higher prevalence of anti-TNF-α therapy use. Interestingly, a study in Japanese patients with AS[10] found that anti-TNF agents were more frequently prescribed to women, suggesting that differences in healthcare access, treatment-seeking behavior, or disease presentation may vary across populations.

Regarding age at diagnosis and diagnostic delay, Garrido-Cumbrera et al.[28] reported that female patients with axial spondyloarthritis (axSpA) experienced longer diagnostic delays than male patients (8.2 years vs. 6.1 years). However, studies in Moroccan and Iranian patients with AS found no gender differences in age at onset, diagnostic delay, or disease duration.[24,25] Among patients with axSpA across Europe, females reported a considerably longer diagnostic delay than males (6.1±7.4 vs. 8.2±8.9 years; $p<0.001$).[28] In In our study of Turkish patients with AS, no significant gender differences were observed in diagnostic delay, age at diagnosis, or age at disease onset.

In studies comparing disease activity between genders, including the European Map of axSpA and studies on Moroccan cohorts, females reported higher BASDAI scores.[24,28] Conversely, a study in China found no gender difference in BASDAI.[29] No prior studies have analyzed gender differences across age groups. In our cohort, no significant differences in BASDAI scores were observed between genders in either age group.

In Moroccan and Iranian patients with AS, men have been reported to exhibit higher BASMI scores and greater FFD scores.[24,25] Similarly, our study found that men in the 46-60 age group had higher BASMI and FFD scores than women, whereas no significant gender differences were observed in the 36-45 age group. These findings suggest that age may modulate the impact of gender on physical function in AS, highlighting the importance of stratifying patients not only by gender but also by age when assessing disease severity and planning management strategies.

Loss of balance and an increased risk of falls have been observed more frequently among patients with AS than among healthy individuals.[30] However, to date, the literature lacks studies specifically comparing balance performance and fall-related concerns between genders across age groups within

this population. Our study addressed this gap by showing that women aged 36-45 exhibited significantly poorer dynamic balance and greater concern about falling than men of the same age. No significant gender differences were observed in the 46-60 age group. These findings suggest that younger female patients (aged 36-45) with AS may be at higher risk for impaired dynamic balance and fear of falling, underscoring the value of age- and gender-specific assessments to guide targeted interventions and reduce fall-related complications

Kinesiophobia has been reported in 53.3% of patient with AS,[31] and AS patients exhibit a significant 12% reduction in lean mass in the arms and legs.[32] To date, no studies have specifically compared kinesiophobia and lower limb endurance between genders across age groups in patients with AS. In our study, no significant gender differences were observed in either age group, suggesting that gender does not appear to be a determining factor for kinesiophobia or lower limb endurance in this population.

Study Limitations

This study has several limitations. First, the study population was restricted to patients aged 36-60 years, limiting generalizability to other age groups. Second, the sample size was relatively small, which may have reduced the statistical power of the analyses. Third, the single-center design may have introduced selection bias. Future research would benefit from a multicenter study with a larger and more diverse observational cohort to strengthen the validity and applicability of the findings. Larger national studies using community-based cohorts or nationwide patient registries are needed to more accurately assess gender differences in AS and its prevalence in Türkiye.

Conclusion

The findings suggest that younger women (36-45 years) experience poorer balance and greater fear of falling, whereas older men (46-60 years) demonstrate more pronounced spinal mobility limitations. Among Turkish patients, women exhibited less radiological damage, while men showed more severe spinal involvement and a higher rate of advanced therapy use, possibly reflecting a more aggressive disease course. These observations highlight the need for targeted clinical assessment and management strategies tailored to both gender and age to optimize outcomes in patients with AS.

Ethics

Ethics Committee Approval: Ethical approval for this study was obtained from the Clinical Research Ethics Committee of Hatay Mustafa Kemal University Faculty of Medicine (date: 02.02.2021, decision no: 03, protocol code: 2021/170).

Informed Consent: All participants provided written informed consent before enrollment.

Footnotes

Authorship Contributions

Surgical and Medical Practices: G.K., M.P., Concept: G.Ku., M.P., Design: G.Ku., Data Collection and Processing: G.Ku., M.P., Analysis or Interpretation: G.Ku., M.P., Literature Search: G.Ku., M.P., Writing: G.Ku., M.P., G.K.

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