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Sleep quality, sleeping postures, and sleeping equipment in patients with ankylosing spondylitis

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Background/aim: Inflammatory back pain, spinal stiffness, and limited spinal mobility are characteristic features of ankylosing spondylitis (AS). Sleeping postures can affect and/or reflect sleeping disturbances. The aim of the study was to evaluate sleeping postures and sleep disturbances in patients with AS.

Materials and methods: Seventy-seven patients with AS and 49 healthy controls were enrolled. The Pittsburgh Sleep Quality Index (PSQI) and the Insomnia Severity Index (ISI) were applied to both groups. The most common sleeping postures were noted.

Results: There was no significant difference between the groups in terms of sleeping postures. Total PSQI and ISI scores were higher in the AS group than in the controls (P = 0.004 and P = 0.038, respectively). The selection of sleeping postures of active and inactive patients were similar. The number of pillows used was not the same in the AS and control groups (P = 0.016). The frequency of customized bed use was higher in the AS group compared to the control group (P = 0.004).

Conclusion: Sleep disturbances are more of a problem in patients with AS compared to healthy patients and in active AS patients compared to inactive ones. However, sleeping postures do not seem to affect either sleep disturbances or disease activity in patients with AS.

Key words: Ankylosing spondylitis, sleeping postures, sleeping disturbances

1. Introduction

Ankylosing spondylitis (AS) is a chronic inflammatory disease that primarily affects the axial skeleton at a prevalence of 0.3%–0.5%. The characteristic symptoms of AS include inflammatory low back pain resulting from spinal inflammation, limitation of spinal motions, and morning stiffness. In time, a typical AS posture results from ankylosing and syndesmophytes. This is a typical radiological finding (1).

Sleep disturbances are common conditions that have a prevalence rate of between 10% and 34%, depending on the samples observed and method used. Their prevalence increases in the presence of any chronic disorder (2), particularly in rheumatic diseases, with a prevalence of up to 80% (3,4). Sleep disturbances have many adverse physical and psychological effects (5). Pain and sleep affect each other. Sleep disorders may trigger the severity of pain by reducing the pain threshold, while pain may also lead to sleep disorders. Therefore, sleep disorders are more often seen in many rheumatic diseases characterized by pain (6,7).

Eighty percent of patients with AS are forced to move and wake up at night due to back pain, which leads to interrupted sleep. Moreover, it has been reported that sleep disorders are related with disease activity, limitation of movement ability, impaired life quality, and depression (3). Sleep disorders are commonly observed in AS, including impaired quality of sleep, sleep-onset insomnia, difficulty in waking up, and obstructive sleep apnea (OSA) syndrome (5,8–12). However, antitumor necrosis factor (anti-TNF) treatment has been shown to improve sleep disorders related to AS (13).

Several studies have examined the relationship between sleep postures and OSA syndrome and gastroesophageal reflux. Additionally, some studies have referred to the relationship of pillow usage with cervical pain and sleep (14–19). Since AS leads to spinal inflammation and posture abnormality, it is likely to cause changes in sleeping

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postures and therefore may result in sleep disorders. In this study, we aimed to examine the relationship between the disease and sleeping postures and sleep disorders in patients with AS.

2. Material and methods

2.1. Patient selection

Seventy-seven patients who were diagnosed with AS according to the Modified New York criteria for classification (20) and 49 healthy volunteers (healthy control, HC) were enrolled in the study. Exclusion criteria were applied to individuals under 18 and above 80 years old, as well as to those with any infections and those who were pregnant. The protocol of this study was approved by the institutional ethics committee and all of the participants gave informed consent before being enrolled in the study. Detailed histories of all the participants were obtained, and systemic and rheumatologic examinations were performed. Patients were also investigated in terms of previous treatments related to AS, as well as comorbidities. Body weight, height, and axial skeletal size were recorded for patients with AS.

2.2. Disease activity and severity scoring

Using the Bath AS Disease Activity Index (BASDAI), the Bath AS Metrology Index (BASMI), and the Bath AS Functional Index (BASFI), disease activity, spinal mobility, and functional state of AS patients were assessed, respectively. In order to assess their quality of life, the Ankylosing Spondylitis Quality of Life (ASQoL) scale was used. Severity of pain was assessed using a 10-cm visual analog scale (VAS) (21–27).

2.3. Psychological evaluation

Psychological status was assessed using the Hospital Anxiety and Depression Scale (HADS), which is a composite scale consisting of 14 questions, 7 of which refer to depressive symptoms (HADS-D) and 7 of which refer to anxious symptoms (HADS-A). Patients with a HADS-D score of above 7 were considered as having depression, while those with a HADS-A score over 10 were accepted as having anxiety disorder (28).

2.4. Assessment of sleep quality

Sleep quality and sleep duration, along with the presence and severity of sleep disorders, were assessed with the help of the Pittsburgh Sleep Quality Index (PSQI) in both the patient and control groups. A total of 18 items were categorized into 7 components, each of which either comprised one item or more. These 7 components included subjective quality of sleep (component 1), delayed sleeping (component 2), sleep duration (component 3), sleep efficiency (component 4), sleep disorder (component 5), use of sleeping aids (component 6), and daytime malfunction (component 7). The sum of the 7 components yielded a total PSQI score ranging between 0 and 21. A score above 5 was considered as impaired quality of sleep (29).

2.5. Insomnia Severity Index (ISI)

A short index that could be filled out by the patient was developed in order to assess the severity of insomnia. The purpose of this index was to determine both the subjective symptoms and consequences of insomnia and the degree of stress and anxiety due to insomnia. Each of the scale items, consisting of 7 questions, were scored between 0 and 4, with a total score ranging from 0 to 28. The items in the scale included difficulty in falling asleep, difficulty staying asleep, waking up too early, satisfaction from sleep patterns, deterioration in daily functionality, awareness of sleep-induced deterioration, and level of stress caused by sleep problems (30).

2.6. Sleeping postures

Common sleeping postures include: 1) yearner (tilting over one side with both arms stretched forward), 2) starfish (lying back with both arms stretched up around the pillow), 3) log (tilting over on one side with both arms extending down), 4) soldier (lying on the back with arms resting at the sides of the body), 5) freefall (lying on the stomach with the head turned to the side, and the arms stretching above and around the pillow), and 6) fetus (snuggling in the fetal position). Apart from these, others were classified as 'other sleeping postures' (31,32). The sleeping postures of each participant were recorded. The patients were then asked whether they used any customized beds, auxiliary materials, or pillows (33).

2.7. Laboratory analysis

As required in routine practice, fasting blood glucose, creatinine, cholesterol, complete blood count, erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP) levels were measured using the appropriate methods.

2.8. Statistical analyses

Statistical analysis was performed using SPSS 21.0 for Windows (IBM Corp., Armonk, NY, USA). Results were given as mean ± standard deviation (SD). Statistical differences between the groups were identified with Student's t-test for parametric data and the Mann–Whitney U test for nonparametric data. A chi-square test was used to compare the categorical variables. Correlation analysis was performed using the Pearson correlation coefficient. $P < 0.05$ was considered to be significant.

3. Results

Demographical and laboratory data for both the HC and AS groups are given in Table 1. No significant difference was found between these groups in terms of age, sex, and body mass index (BMI) ($P > 0.05$ for all). The mean duration of symptoms for AS patients was 10.76 ± 6.66

Table 1. Demographic and laboratory data of healthy controls and patients with ankylosing spondylitis.

	AS (n = 77)	HC (n = 49)	P
Age (years)	40.54 ± 10.19	38.06 ± 10.78	0.202
Sex (female), n (%)	37 (48.1)	28 (57.1)	0.355
BMI (kg/m2)	26.79 ± 4.44	25.61 ± 3.74	0.130
History of smoking, n (%)	29 (37.7)	10 (20.4)	0.245
Duration of disease (years)	4.59 ± 4.85	-	-
Symptom duration (years)	0.76 ± 6.66	-	-
Morning stiffness (min)	31.79 ± 58.31	-	-
Back pain during the day (due to AS) (0–10 VAS)	4.95 ± 3.53	-	-
Back pain during the night (due to AS) (0–10 VAS)	5.82 ± 3.29	-	-
BASDAI	4.89 ± 2.70	-	-
BASFI	2.78 ± 2.76	-	-
BASMI	2.24 ± 2.02	-	-
ASQoL	8.54 ± 5.77	-	-
HADS-A	8.48 ± 4.79	6.96 ± 4.41	0.077
HADS-D	8.15 ± 4.03	7.93 ± 3.55	0.769
Anxiety, n (%)	31 (40.3)	12 (24.5)	0.054
Depression, n (%)	39 (50.6)	24 (48.9)	0.742
ESR (mm/h)	18.28 ± 15.87	12.91 ± 10.77	0.040
CRP (mg/dL)	8.75 ± 10.18	4.11 ± 2.34	<0.001

AS: Ankylosing spondylitis; HC: healthy controls; BMI: body mass index; BASDAI: Bath Ankylosing Spondylitis Disease Activity Index; BASFI: Bath Ankylosing Spondylitis Functional Index; BASMI: Bath Ankylosing Spondylitis Metrology Index; ASQoL: Ankylosing Spondylitis Quality of Life Scale; VAS: visual analog scale; HADS: Hospital Anxiety and Depression Scale; HADS-D: HADS depression score; HADS-A: HADS anxiety score; ESR; erythrocyte sedimentation rate; CRP: C-reactive protein.

years with a mean duration of disease of 4.59 ± 4.85 years. The mean value of the BASDAI in AS patients was 4.89 ± 2.70. BASFI, BASMI, and ASQoL values were found to be 2.78 ± 2.76, 2.24 ± 2.02, and 8.54 ± 5.77, respectively. Only 3 patients had peripheral arthritis and 5 patients had enthesopathy. At the time of our study, 49 patients were receiving nonsteroidal antiinflammatory drugs, 32 patients were receiving sulfasalazine, and 22 were using anti-TNF treatment. Additionally, there was no significant difference in the frequency of anxiety and depression between the AS and HC groups (P > 0.05 for both). In the AS group, ESR and CRP values were found to be higher compared to the HC group (P = 0.040 and P < 0.001, respectively) (Table 1).

The total PSQI value was higher in the AS group compared to the HC group (8.03 ± 4.64 vs. 5.86 ± 2.54, P = 0.004). In addition, the mean ISI value was significantly higher in the AS group when compared to the HC group (9.71 ± 7.40 vs. 7.14 ± 6.14, P = 0.038). When compared to the HC group, subjective quality of sleeping (component 1) (1.40 ± 1.04 vs. 1.00 ± 0.82, P = 0.018), sleeping duration (component 3) (1.26 ± 0.99 vs. 0.69 ± 0.74, P = 0.001), and sleeping disorder (component 5) (2.16 ± 0.88 vs. 1.66 ± 0.68, P = 0.001) were found to be significantly higher in the AS group. However, sleep delay (component 2), sleeping efficiency (component 4), use of sleeping pills (component 6), and daytime malfunction (component 7) values were relatively higher in the AS group (P > 0.05 for both groups). Moreover, the number of pillows used was not the same in the AS and HC groups (P = 0.016), and no significant difference was found in pillow placement sites (P > 0.05). Additionally, the frequency of using customized beds was higher in the AS groups compared to the HC group (P = 0.004) (Table 2).

There was no significant difference between the AS and HC groups in terms of sleeping postures (P = 0.347) (Table 3). In the AS group, disease duration, acute phase reactants levels, and BASDAI, BASFI, BASMI, PSQI, ISI, HADS-A, and HADS-D scores were similar among the patients who

Table 2. Sleep index and scores of the study groups.

	AS (n = 77)	HC (n = 49)	P
Total PSQI	8.03 ± 4.64	5.86 ± 2.54	0.004
ISI	9.71 ± 7.40	7.14 ± 6.14	0.038
Subjective sleep quality (component 1)	1.40 ± 1.04	1.00 ± 0.82	0.018
Sleep delay (component 2)	1.25 ± 0.96	0.98 ± 0.78	0.112
Sleep duration (component 3)	1.26 ± 0.99	0.69 ± 0.74	0.001
Sleep efficiency (component 4)	0.92 ± 1.20	0.55 ± 0.96	0.058
Sleep disorders (component 5)	2.16 ± 0.88	1.66 ± 0.68	0.001
Sleep medication use (component 6)	0.25 ± 0.78	0.06 ± 0.24	0.056
Daytime dysfunction (component 7)	1.14 ± 0.94	0.91 ± 0.84	0.177
Pillow use			0.016
Never use a pillow, n (%)	4 (5)	0 (0)	
Use a pillow, n (%)	57 (74)	46 (93)	
Use two or more pillows, n (%)	16 (20)	3 (6)	
Pillow placement site (head, other)			0.347
Head, n (%)	63 (81)	45 (91)	
Other, n (%)	10 (12)	4 (8)	
Special bed use, n (%)	15 (19)	1 (12)	0.004
Impaired sleep quality, n (%)	19 (24)	12 (24)	0.964

AS: Ankylosing spondylitis; HC: healthy controls; PSQI: Pittsburgh Sleep Quality Index; ISI: Insomnia Severity Index.

preferred different postures (P > 0.05 for all). On the other hand, the ASQoL, VAS, and patient global assessment scores were higher in AS patients who preferred the fetus posture to the yearner posture (P = 0.008, P = 0.001, and P = 0.01, respectively) (Table 3).

Total PSQI values were found to be significantly higher in the active AS group compared to those in the AS group under remission (10.07 ± 4.41 vs. 4.68 ± 2.66, P < 0.001). Likewise, the value of the ISI was statistically significantly higher in the active AS group compared to that of the AS group under remission (12.17 ± 7.28 vs. 5.00 ± 4.96, P < 0.001). In the active AS group, the severity of insomnia was significantly higher than in the AS group under remission (12.17 ± 7.28 vs. 5.00 ± 4.96, P < 0.001) (Table 4). Additionally, while values related to subjective sleeping quality (component 1), delay in falling asleep (component 2), sleeping duration (component 3), sleeping efficiency (component 4), sleeping disorder (component 5), and daytime malfunctioning (component 7) were significantly higher in the active AS group (P < 0.001 for all), there was no significant difference in the use of sleeping pills (component 6) between the two groups (P > 0.05) (Table 4). There was also no statistically significant difference between the active and quiescent AS groups in the number of pillows used and the use of customized beds (P > 0.05 for both groups) (Table 4). Moreover, the pillow placement sites of active and inactive patients with AS were also similar (P > 0.05) (Table 5).

4. Discussion

In this study, preferred sleeping postures and sleep disorders were assessed in patients with AS. The AS group exhibited a lower sleeping quality and higher severity index for insomnia compared to the HC group. In addition, low sleeping quality and high severity index for insomnia were observed in the active AS subgroup compared to the quiescent AS subgroup. However, there was no difference between the AS and HC groups in terms of preferred sleeping postures. Likewise, there was no correlation between sleeping postures and disease activity. While the number of pillows used differed in the AS and HC groups, no significant difference was found in terms of pillow positioning. In addition, the frequency of using customized beds was higher in the AS group compared to the HC group.

Table 3. Preferred sleeping postures in the patients and controls.

	AS (n = 77)	HC (n = 49)	P
Yearner posture, n (%)	19 (24.7)	17 (34.7)	0.123
Starfish posture, n (%)	5 (6.5)	3 (6.1)	0.933
Log posture, n (%)	5 (6.5)	5 (10.2)	0.456
Soldier posture, n (%)	4 (5.2)	0	0.230
Freefall posture, n (%)	12 (15.6)	10 (20.4)	0.488
Fetus posture, n (%)	30 (39.09)	14 (28.6)	0.235
Other postures, n (%)	2 (2.6)	0	0.447

AS: Ankylosing spondylitis; HC: healthy controls.

Table 4. Sleep index and scores of active and quiescent patients.

	Active AS (n = 52)	Quiescent AS (n = 25)	P
Total PSQI	10.07 ± 4.41	4.68 ± 2.66	<0.001
ISI	12.17 ± 7.28	5.00 ± 4.96	<0.001
Subjective sleep quality (component 1)	1.68 ± 1.03	0.88 ± 0.83	0.001
Sleep delay (component 2)	1.53 ± 1.01	0.78 ± 0.67	0.001
Sleep duration (component 3)	1.51 ± 1.04	0.71 ± 0.62	<0.001
Sleep efficiency (component 4)	1.19 ± 1.29	0.36 ± 0.75	0.001
Sleep disorders (component 5)	2.57 ± 0.61	1.41 ± 0.82	<0.001
Sleep medication use (component 6)	0.31 ± 0.86	0.12 ± 0.61	0.338
Daytime dysfunction (component 7)	1.43 ± 0.94	0.60 ± 0.64	<0.001
Pillow use			0.610
Never use a pillow, n (%)	2 (3)	2 (8)	
Using a pillow, n (%)	38 (73)	19 (76)	
Using two or more pillows, n (%)	12 (23)	4 (16)	
Pillow placement site			0.115
Head, n (%)	41 (78)	22 (88)	
Other, n (%)	9 (17)	1 (4)	
Special bed use, n (%)	11 (21)	4 (16)	0.593
HADS-A	9.54 ± 4.96	6.29 ± 3.76	0.006
HADS-D	8.74 ± 3.47	6.79 ± 4.85	0.052
CRP (mg/dL)	10.41 ± 11.05	4.36 ± 3.40	0.001
ESR (mm/h)	22.23 ± 17.31	9.96 ± 7.87	<0.001

AS: Ankylosing spondylitis; HC: healthy controls; PSQI: Pittsburgh Sleep Quality Index; ISI: Insomnia Severity Index; HADS-D: HAD depression score; HADS-A: HADS anxiety score; ESR: erythrocyte sedimentation rate; CRP: C-reactive protein.

Table 5. Preferred sleeping postures of active and quiescent patients.

	Active AS (n = 52)	Quiescent AS (n = 25)	P
Yearner posture, n (%)	11 (21.1)	8 (32)	0.304
Starfish posture, n (%)	4 (7.6)	1 (4)	0.545
Log posture, n (%)	2 (3.8)	3 (12)	0.196
Soldier posture, n (%)	2 (3.8)	2 (8)	0.451
Freefall posture, n (%)	7 (13.4)	5 (20)	0.462
Fetus posture, n (%)	24 (46.1)	6 (24)	0.067
Other postures, n (%)	2 (3.8)	0 (0)	0.554

AS: Ankylosing spondylitis.

Sleep is an important hemostatic feature in humans and in many other living things (6). Sleep disorders have been found to be associated with important morbidities such as impaired quality of life, psychiatric problems, impaired cognitive functions, impaired daytime functioning, and increased risk of injury. The adverse effects of sleeping disorders on health also lead to important economical loses (2). Pain and sleep share common mechanisms linked to cognitive and neuroendocrinal changes. While sleeping disorders may contribute to emerging and painful diseases, pain may also lead to developed or exacerbated sleep disorders. The relationship between pain and sleep has been observed in many rheumatic diseases (6).

Clinical and epidemiological studies have demonstrated that sleeping disorders could lead to musculoskeletal pain and fatigue, affect mood and general well-being, and cause many rheumatic disorders (5). Patients with rheumatic inflammatory diseases are seen to have higher rates of sleeping disorders as compared to the normal population (5). It was also demonstrated that the occurrence and severity of sleeping disorders increased with the incidence of several noninflammatory rheumatic diseases such as osteoarthritis and fibromyalgia as well as inflammatory diseases such as rheumatoid arthritis, systemic lupus erythematosus, Sjögren's syndrome, and spondyloarthritis (SpA) (3,5,6,34).

Sleeping problems are relatively common in patients with SpA (69%), and these problems play a significant role in the increased levels of fatigue in SpA (3). A previous study demonstrated that most AS patients had to wake up several times during the night in an effort to alleviate back pain. Polysomnographic studies have revealed delays and interruptions during sleep in patients with AS. This may lead to several motor and functional challenges (35).

Batmaz et al. (8) demonstrated impaired scores of subjective sleep quality, habitual sleep efficiency domains, and global PSQI scoring (sleep quality) in patients with AS compared to controls. In the same study, the global PSQI score was positively correlated with an increased level of pain, a low quality of life, an increase in the scoring of depression, increased disease activity, and limitation of movement ability (8). Additionally, Li et al. (12) found that the global PSQI score is significantly higher in AS and that 58.6% of patients have sleeping disorders. Moreover, correlations have been established among ESR, CRP, pain, morning stiffness, BASDAI, BASFI, depression, and anxiety. However, there was no correlation of global PSQI with duration of disease and BASMI (12).

In our study, as well, sleeping quality was lower while the insomnia severity index was higher in the AS group compared to the HC group. Moreover, when compared to the HC group, values for subjective sleeping quality, sleeping duration, and sleeping disorder were significantly higher in the AS group. Furthermore, previous studies demonstrated that a close relationship between sleeping quality and disease activity exists, and that disease activity and sleeping disorders improved with anti-TNF treatment (13,36). In our study, lower sleeping quality and higher insomnia severity index were observed in the active AS group compared to inactive patients. Moreover, the component values for subjective sleeping quality, delay in falling asleep, sleeping duration, sleeping efficiency, sleeping disorder, and daytime malfunctioning were significantly higher in the active AS group.

Body postures have been shown to be involved in the development and intensification of some diseases (14–16,37–39). More than 50% of OSA cases are caused by body postures. Positional OSA causes more respiratory problems in the supine posture (14). Anatomical and physiological changes may occur in the upper respiratory tract based on gravity in the supine posture. Patients with moderate to severe OSA demonstrate respiratory problems more frequently in the supine posture (15,37). Body posture affects the apnea–hypopnea index in mild

to moderate cases of OSA. However, the index destabilizes in the supine posture with a further decreased saturation. Therefore, patients with OSA demonstrate less supine posture during REM sleep (15,37).

Body postures have significant effects on respiratory parameters. In one study, when the body slowly changed from a supine to a prone posture, all of the respiratory parameters were observed to improve (38). In another study, the right lateral decubitus posture was shown to cause much acid exposure in the esophagus as compared to other postures. The left lateral decubitus posture was found to be preferred in patients who suffered from nocturnal gastroesophageal reflux as it caused less exposure to acid (16). Another study demonstrated a significantly higher intraocular pressure in the left lateral decubitus posture as compared to the supine posture (39). To the best of our knowledge, there is no study examining the relationship between AS and sleeping postures in the literature.

In our study, there was no significant difference between the AS and HC groups in terms of sleeping postures. Moreover, the selected postures of active and inactive patients were also similar. In the AS group, disease duration, acute phase reactants levels, and BASDAI, BASFI, BASMI, PSQI, ISI, HADS-A, and HADS-D scores were similar among patients who preferred different postures. These results support the claim that sleeping postures do not change with the presence of AS, disease activity, and sleeping disorder. On the other hand, the ASQoL, VAS, and patient global assessment scores were higher in the AS patients who preferred the fetus posture to the yearner posture, which suggests that AS patients might have preferred the fetus posture in the presence of certain clinical activity components.

Pillows are designed to support both the head and the neck in a neutral posture in order to minimize biomechanical stress on cervical bodies during asleep. Biomechanical stress is related to many waking symptoms such as cervical pain and stiffness, headaches, and scapular or arm pain. Cervical symptoms are also affected by both the hardness and the shape of the pillow (40). In our study, the numbers of pillows used were different in the AS and HC groups, but there was no significant difference in pillow placement site. Additionally, the frequency of using customized beds was higher in the AS group compared to the HC group. There was also no statistically significant difference between the active and remission AS groups in the numbers of pillow used, the pillow placement site, or the use of customized beds. This suggests that materials adjusting physical posture, such as pillows and customized beds, result in structural posture changes rather than disease activity. Moreover, the absence of differences in sleeping postures between the AS and HC groups may result from the patient's protection of their preferred posture using posture-support material.

In conclusion, patients with AS show higher rates and more severity of sleep disorders, and this becomes more evident in the active state of AS. Additionally, preferred sleeping postures do not change depending on disease activity status, which may result from the protection of preferred posture using support materials such as pillows and customized beds in AS patients.

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