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Relation Between Osteoporosis and Vitamin D Levels and Disease Activity in Psoriatic Arthritis

ORIGINAL INVESTIGATION

Erol Öten, Bedriye Başkan, Filiz Sivas, Hatice Bodur

ABSTRACT

Objective: This study investigated the relation between osteoporosis and vitamin D levels and the disease activity in patients with psoriatic arthritis (PsA).

Materials and methods: In this study, 58 patients with PsA and 58 healthy controls were included. Bone mineral density (BMD) measurements of patients and controls were performed using dual-energy X-ray absorptiometry. Complete blood count, serum 25(OH)D3, parathormone, C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), total calcium, ionized calcium, and phosphorous levels of all participants were measured. Disease activity was evaluated using the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI), Disease Activity Index for Reactive Arthritis (DAREA), and the Disease Activity Score 28 (DAS28). The functional status was evaluated using the Health Assessment Questionnaire for the spondyloarthropathies (HAQ-S), and enthesopathy was evaluated using the Maastricht Ankylosing Spondylitis Enthesitis Score (MASES).

Results: BMD values of the patients were significantly lower than those of the controls. There was a negative but statistically insignificant relationship between the lateral lumbar BMD values of the patients and clinical activity signs. Vitamin D levels of the patients were significantly lower than those of the controls. Although there was no correlation between vitamin D levels and ESR and CRP levels, a negative but statistically insignificant relation was found between vitamin D levels and BASDAI, DAREA, and DAS28. The level of CRP, BASDAI, MASES, DAREA, HAQ-S, and DAS28 scores were higher in the patients with osteoporosis; however, none of the differences were statistically significant.

Conclusion: In this study, the incidence of osteoporosis was higher and vitamin D levels were lower in patients than in controls.

Keywords: Inflammatory activity, osteoporosis, psoriatic arthritis, vitamin D

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Department of Physical Medicine and Rehabilitation, Ankara Numune Training and Research Hospital, Ankara, Turkey

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Correspondence
Bedriye Başkan, Department of Physical Medicine and Rehabilitation, Ankara Numune Education and Research Hospital, Ankara, Turkey
Phone: +90 312 508 40 00
e.mail: bmbaskan@gmail.com

INTRODUCTION

Psoriatic arthritis (PsA) is a chronic inflammatory arthritis associated with psoriasis (Ps) and is characterized by bony proliferation, osteolysis, and enthesitis (1). Patients with chronic inflammatory rheumatic diseases are at increased risk for developing osteoporosis, which leads to increased bone fragility and susceptibility to fracture, leading to reduced quality of life (2). Bone tissues are negatively affected by the disease process and its treatments (3). The clinical relationship between inflammatory rheumatic diseases and osteoporosis remains unclear. Besides chronic inflammation, various drugs used in the treatment, including methotrexate (MTX) and corticosteroids (CS), and immobilization due to joint pain are the primary risk factors that contribute to bone loss in these patients (4, 5). Furthermore, low vitamin D levels can lead to osteoporosis. Discussions regarding osteoporosis and bone structure in patients with PsA are ongoing (6, 7).

Limited studies have investigated the relationship between disease activity and/or functional status and bone density in patients with PsA. In our study, we evaluated osteoporosis and vitamin D levels to determine their relationship with disease activity and functional status in patients with PsA. The results of this study are expected to identify patients with PsA who are at high risk for osteoporosis for facilitating early diagnosis and treatment initiation to prevent morbidity or mortality.

MATERIALS and METHODS

In total, 58 patients diagnosed with PsA according to the Classification Criteria for Psoriatic Arthritis (CASPAR) criteria (8) and admitted to the Department of Physical Medicine and Rehabilitation, Ankara Numune Education and Research Hospital from March to June 2012 were included in the patient group and 58 healthy individuals

were included in the control group. Ethics committee approval was received for this study from the ethics committee of Ankara Numune Education and Research Hospital (2012/323-08.02.2012) and written informed consent was obtained from all individuals.

The exclusion criteria for both patient and control groups were prior hysterectomy and/or oophorectomy; diagnosis of intestinal, renal, or hepatic disease; history of fracture; malnutrition; cancer; ongoing fever or infection; <18 or >60 years of age; hyperparathyroidism or hyperthyroidism; thyroid hormone replacement therapy; exposure to anticonvulsants; treatment for osteoporosis; and unwillingness to participate in the study for any reason. All patients with PsA and controls had been physically active for the previous 12 months. All included female individuals were in the premenopausal period.

The patients were informed about the study, and written consent was obtained from them. Age, sex, occupation, marital status, Ps and PsA duration, peripheral joint involvement, history of chronic disease, medication use and surgical history such as appendectomy, colecistectomy, presence of dactylitis, and morning stiffness duration were recorded. Height and body weight of the patients and controls were measured, and their body mass indexes (BMIs) were calculated. Detailed physical examination, including evaluation of the spine and peripheral joints, was performed. The examination was performed in the enthesopathy regions proposed by MASES (9), and the enthesopathy score was calculated.

Disease activity levels of the patients were determined using the Disease Activity Score 28 (DAS28) (10), Disease Activity Index for Reactive Arthritis (DAREA) (11), and Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) (12). The functional status was evaluated using the Health Assessment Questionnaire for the spondyloarthropathies (HAQ-S) (13). A visual analog scale was used for patients' self-global evaluation and doctors' global patient evaluation (14, 15).

The levels of serum total calcium, ionized calcium, urea, creatinine, phosphorus, ALT, AST, total protein, and albumin were measured. Intact parathormone (PTH), alkaline phosphatase, and 25(OH) D3 levels in the patient and control groups were analyzed using standard methods. C-reactive protein (CRP) was measured with the nephelometric method, and the erythrocyte sedimentation rate (ESR) was measured with the Westergren method.

Bone mineral density measurement

Bone mineral density (BMD) values of the anterior-posterior lumbar spine (L1-L4 level), lateral lumbar spine (L2-L3 level), femoral neck, Ward's triangle, and total femur were assessed using a Hologic Discovery W series DEXA device (Hologic Inc., Bedford, MA, USA), and the results were evaluated as g/cm^2.

Statistical analysis

All data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 18.0 (IBM Corp.; Armonk, NY, USA) software package. Comparison between the two groups showing a normal distribution was made using the Student's t-test and that of nonparametric data using the Mann–Whitney U test. Differences in categorical variables between the two groups were calculated using the Fisher's exact test, and relationships between two variables were estimated using the Spearman's rank correlation coefficient. Statistical significance was set at $p<0.05$.

RESULTS

The patient group comprised 58 patients (25 males and 33 females) and the control group comprised 58 healthy individuals (26 males and 32 females). The mean age of the patients and controls was 42.56±8.4 and 42.94±7.9 years, respectively. The mean BMI of the patients and controls was 30.25±5.72 and 29.98±5.12 kg/cm^2, respectively. There was no statistically significant difference in the age, sex distribution, or BMI between the two groups ($p>0.05$). The disease duration in patients ranged between 8 months and 38 years (mean 16.03±10.52 years).

The mean ESR and CRP levels in the patients were 23.35±20.75 mm/h and 8.75±12.46 mg/L, respectively, and were significantly higher in patients than in controls ($p<0.0001$). The mean 25(OH) D3 level in the patient and control group was 11.25±7.48 and 14.79±10.53 ng/mL ($p<0.05$), respectively. There was no statistically significant difference in serum PTH, ALP, and total and ionized calcium levels between these two groups ($p>0.05$). The demographic features and laboratory parameters of the patients and controls are shown in Table 1.

Regarding medication use, two patients did not take any medicine, 29 were taking only MTX, five were taking a biological agent, four

Table 1. The demographic and laboratory parameters of patients with psoriatic arthritis and the control group

	Psoriatic arthritis (n:58)	Control (n:58)	P
Age (year)	42.56±8,4	42.94±7,9	> 0,05
Gender (M/F)	25/33	26/32	>0.05
Body Mass Index (kg/m^2)	30.25±5.72	29.98±5.12	>0.05
Duration of disease (year)	16.03±10.52		
ESR (mm/h) (n=0-20 mm/h)	23.35±20.75	8.98±12.76	<0.0001*
CRP (mg/dL) (n = 0.2–5.0 mg/L)	8.75±12.46	2.78±3.65	<0.0001*
25-(OH)D3 (mmol/L) (n=8–60 ng/mL)	11.25±7.48	14.79± 10.53	<0.05**
PTH (pg/L) (n=1.6–6.9 pmol/L)	22.47±20.82	11.05±12.08	>0.05
ALP (IU/mL) (n=30–120 IU/L)	75.38±21.97	67.37±19.45	>0.05
Total Ca (mg/dL)	9.75±0.45	11.89±11.54	>0.05
İonized Ca (mg/dL)	4.40±0.15	4.58±0.32	>0.05

ESR: erythrocyte sedimentation rate; CRP: C-reactive protein; 25-(OH)D3: 25-hydroxyvitamin D3; PTH: parathormone; ALP: alkaline phosphatase; total Ca: total calcium; ionized Ca :ionized calcium; *: statistically significant

Table 2. Disease activity and functional scores in psoriatic arthritis patients

	mean±SD	Min-max
BASDAI	4.56±2.28	0,5-9.5
HAQ-S	0.60±0.54	0-1.65
DAS 28	3.67±1.53	0.77-6.24
MASES	3.53±4.16	0-12
DAREA	7.74±7.83	0.132-34.192

BASDAI: Bath Ankylosing Spondylitis Disease Activity Index; HAQ-S: Health Assessment Questionnaire for the Spondylarthropathies; MASES: Maastricht Ankylosing Spondylitis Enthesis Score; DAS 28: Disease Activity Score in 28 Joints; DAREA: Disease Activity Index for Reactive Arthritis

Table 3. The bone mineral density values of the patient and control group

	Psoriatic arthritis (n:58)	Control (n:58)	p
Anterior-posterior lumbar (g/cm^2)	0.964±0.116	1.015±0.113	<0.05*
Lateral lumbar (g/cm^2)	0.717±0.124	0.794±0.137	<0.01 **
Femur neck (g/cm^2)	0.843±0.123	0.907±0.105	<0.01**
Femur Ward's (g/cm^2)	0.775±0.193	0.790±0.161	>0.05
Femur total (g/cm^2)	0.939±0.127	0.971±0.113	>0.05

were taking a biological agent plus MTX, one was taking a biological agent plus NSAID, 10 were taking MTX plus NSAID, and seven were taking only NSAID. Twenty-nine patients had a history of glucocorticoid use, but they were not using it currently.

The results of BASDAI, HAQ-S, MASES, DAS28, and DAREA tests are shown in Table 2.

BMD values of the anterior–posterior lumbar spine, lateral lumbar spine, and femoral neck as assessed by DEXA scanning were significantly lower in patients than in controls ($p<0.05$, $p<0.01$, and $p<0.01$, respectively). No significant difference was noted between the total femoral and Ward's triangle measurements ($p>0.05$). The results are given in Table 3.

Patients with PsA were further divided into those with and without osteoporosis according to their lateral lumbar BMD values. A lateral lumbar BMD value of 0.650 g/cm^2 was taken as the threshold and the patients who had values lower than that were regarded as having osteoporosis. (According to Hologic Inc., this corresponds to a −2.5 T score for the age group of 30–40 years old.) Thus, osteoporosis was found in 31% of patients with PsA in our study.

The laboratory and clinical parameters of the patients with or without osteoporosis were compared. There was no significant difference in the mean ESR or CRP levels ($p>0.05$). Although the difference was statistically insignificant, CRP levels were higher in patients with osteoporosis. In patients with osteoporosis, serum 25(OH)-D3 levels were lower, but again the difference between the two groups was statistically insignificant ($p>0.05$). While there was no difference in ALP or total or ionized calcium levels between the two groups ($p>0.05$), PTH levels were significantly higher in patients with osteoporosis ($p<0.05$). BASDAI, MASES, DAREA, HAQ-S, and DAS28 scores were higher in patients with osteoporosis, but the differences between the two groups were statistically insignificant ($p>0.05$). The results are shown in Table 4.

Table 4. Comparison of psoriatic arthritis patients with and without osteoporosis

	Osteoporosis positive (n:18) (mean±SD)	Osteoporosis negative (n:40) (mean±SD)	P
ESR (mm/h)	21.63±20.60	22.33±20.05	>0.05
CRP (mg/L)	12.14±18.20	6.94±8.01	>0.05
25-(OH)D3 (ng/mL)	9.92±7.68	10.25±5.99	>0.05
ALP (U/mL)	74.25±17.96	74.39±22.45	>0.05
Total Ca (mg/dL)	9.18±0.43	9.20±0.36	>0.05
İonized Ca (mg/dL)	4.44±0.17	4.46±0.18	>0.05
PTH (pg/L)	60.39±21.93	47.10±15.34	<0.05*
BASDAI	5.08±2.53	4.08±2.34	>0.05
MASES	3.81±4.69	3.11±3.91	>0.05
HAQ-S	0.64±0.63	0.44±0.44	>0.05
DAS28	3.77±1.55	3.27±1.59	>0.05
DAREA	10.33±9.29	6.44±7.07	>0.05

ESR:erythrocyte sedimentation rate; CRP:C-reactive protein; 25-(OH)D3: 25-hydroxyvitamin D3; PTH: parathormone; ALP: alkaline phosphatase; total Ca: total calcium; ionized Ca :ionized calcium; PTH: parathormone; BASDAI: Bath Ankylosing Spondylitis Disease Activity Index; HAQ-S: Health Assessment Questionnaire for the Spondylarthropathies; MASES: Maastricht Ankylosing Spondylitis Enthesis Score; DAS 28: Disease Activity Score in 28 Joints; DAREA: Disease Activity Index for Reactive Arthritis; *:statistically significant

No statistically significant relationship was found between the use of glucocorticoids, MTX, or biological agents and osteoporosis ($p>0.05$).

The relationship between 25(OH)D3 level and disease activity was investigated in patients with PsA. No significant relationship was seen between ESR and CRP levels and 25(OH) D3 level ($r=0.24$ and $r=0.36$, respectively, $p>0.05$). In the patient group, negative correlations were found between BASDAI, DAREA, and DAS28 scores, but these were statistically insignificant ($r=-0.106$, $r=-0.67$, and $r=-0.39$, respectively, $p>0.05$). The results are given in Table 5.

There was no significant relationship between BMD values and disease activity parameters (ESR, CRP, BASDAI, DAS28, DAREA, and HAQ-S) in patients with PsA. A significant positive correlation was found between the anterior–posterior lumbar and femur neck BMD values and MASES ($r=0.283$ and $r=0.301$, respectively, $p<0.05$). The results are summarized in Table 6.

There was a negative correlation between the cumulative steroid dose and anterior–posterior and lateral lumbar BMD values, but the

difference was statistically insignificant (r=–0.73 and r=–0.100, respectively, p>0.05). A similar relationship was not found for femoral BMD values. A negative correlation was found between femur neck BMD values and PTH level (r=–0.279, p<0.05), and there was a significantly positive correlation between BMI and femur neck and total BMD values (r=0.379 and r=0.496, respectively, p<0.05).

DISCUSSION

Osteoporosis is a disease characterized by low bone mass and microarchitectural deterioration of bone tissue and is common in patients with spondyloarthropathies. Periarticular osteoporosis is a recognized clinical feature in patients with PsA, but only a few studies on systemic bone loss and bone turnover in these patients have been conducted (6, 16). In our study, BMD values were found to be significantly lower in patients with PsA than in controls. In our patients, the rates of osteoporosis were 0%, 31%, 0%, 7.7%, and 28.8% for the anterior lumbar spine, lateral lumbar spine, total hip, femur neck, and Ward's triangle, respectively. The presence of osteoporosis in our patients might depend on a variety of factors, including inflammatory activity, history of medication use (MTX and CS), and low vitamin D levels. Busquets et al. (17) studied 155 patients with PsA, of which 66% were given steroids and found that the rates of osteoporosis were 7%, 6%, and 11% for the lumbar spine, femur neck, and total hip, respectively, in the patient group, but no significant differences in BMD values were found compared with the control group. The incidence of osteoporosis in postmenopausal women with PsA (28%) was found to be higher than in men (9%) and premenopausal women (4%). The low osteoporosis rate might be due to the premenopausal women included in this study. Hofbauer et al. (5) conducted a study of 116 peripheral patients with PsA who had not received CS and DMARD therapy for at least 12 months beforehand and who had not used CS for longer than 6 months, and they observed osteoporosis only in one woman (1.75%) and six men (10.2%).

Dreiher et al. (17) analyzed 7,936 patients with Ps and 14.835 control subjects and found that 12.4% of the patients and 11.2% of the control group subjects had osteoporosis. Also, women had a greater rate of osteoporosis than men in both the patient and control groups, and postmenopausal estrogen deficiency was thought to be a contributing risk factor rather than psoriasis in the etiology of osteoporosis. Similarly, osteoporosis was significantly higher in male patients with Ps than in control subjects (17). In our study, we decided to study premenopausal women in both the patient and control groups to exclude the effect of menopause on osteoporosis.

Grazio et al. (18) reported in a study of 69 patients with PsA who did not receive osteoporosis therapy and had no diseases affecting bone metabolism that the rates of osteoporosis were 7.2%, 1.4%, and 2.9% for the anterior lumbar spine, total hip, and femur neck, respectively. Inflammatory disease activity and decreased mobility were suggested to play a substantial role in the loss of bone mass (18). In Attia et al.'s (19) study of patients with Ps and PsA and controls, the rates of osteoporosis were 17.6%, 5.9%, and 17.6% for the anterior lumbar spine, femur neck, and Ward's triangle,

Table 5. The relation between serum 25-(OH)D3 and disease activity parameters in the patient group

	25-(OH)D3	
	r	p
ESH	0.24	>0.05
CRP	0.36	>0.05
BASDAI	-0.106	>0.05
DAREA	-0.67	>0.05
DAS 28	-0.39	>0.05

ESR: erythrocyte sedimentation rate; CRP: C-reactive protein; BASDAI: Bath Ankylosing Spondylitis Disease Activity Index; DAS 28: Disease Activity Score in 28 Joints; DAREA: Disease Activity Index for Reactive Arthritis

Table 6. The relation between bone mineral density values and disease activity parameters in the patient group

		ESR	CRP	BASDAI	MASES	HAQ-S	DAS28	DAREA
Anterior-posterior lumbar	r	0.026	-0.071	0.223	0.283	0.190	0.101	0.325
	p	>0.05	>0.05	>0.05	<0.05*	>0.05	>0.05	>0.05
Lateral lumbar	r	-0.143	0.068	-0.095	-0.137	-0.010	-0.104	0.224
	p	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05
Femur neck	r	-0.033	-0.044	0.042	0.301	0.002	-0.045	-0.031
	p	>0.05	>0.05	>0.05	<0.05*	>0.05	>0.05	>0.05
Femur Ward's	r	-0.129	-0.217	-0.016	0.260	-0.093	-0.159	-0.121
	p	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05
Femur total	r	0.081	0.118	0.041	0.213	-0.094	0.050	0.006
	p	>0.05	>0,05	>0.05	>0.05	>0.05	>0.05	>0.05

ESR: erythrocyte sedimentation rate; CRP: C-reactive protein; BASDAI: Bath Ankylosing Spondylitis Disease Activity Index; HAQ-S: Health Assessment Questionnaire for the Spondylarthropathies; MASES: Maastricht Ankylosing Spondylitis Enthesis Score; DAS 28: Disease Activity Score in 28 Joints; DAREA: Disease Activity Index for Reactive Arthritis; *: statistically significant

respectively, in patients with PsA (19). In their study, Frediani et al. (6) observed that two-thirds of patients with PsA had lower BMD values than healthy control subjects regardless of age, sex, or menopausal status. The patients had no history of exogenous CS use and were divided into three groups: men, premenopausal women, and postmenopausal women. Among the patients with PsA, demineralization in at least one skeletal region was observed in 67% of premenopausal women (marked in 11%), 100% of postmenopausal women (marked in 47%), and 80% of the men (marked in 29%). Prevalence of osteoporosis in PsA varies depending on the effect of demographics and clinical and therapeutic variables on bone mass.

In our study, the anterior–posterior, lateral lumbar, and femur neck BMD values measured using DEXA in patients with PsA were significantly lower than controls. No significant differences were found for Ward's triangle or total femoral BMD values. DEXA is currently the most widely used bone density measurement procedure. Anterior–posterior measurements of the spine include the posterior elements, vertebral bodies, and vertebral discs, allowing simultaneous exploration of cortical and trabecular bone (20). The typical features of spondyloarthropathies, such as syndesmophytes, calcification of the ligaments, and fusion of the facet joints, increase the error rate and lead to artificially high BMD values, especially in late-stage disease. Although statistically insignificant, there was a positive correlation between the disease duration and BMD values in our study, further supporting this hypothesis. Lateral DEXA of the lumbar spine is considered to be superior to anterior–posterior measurements because posterior elements and end plates might be framed out of the lateral imaging area. Thus, the vertebral body, which is rich in trabecular bone, can be assessed accurately. Lumbar spine BMD is usually measured in anterior–posterior projection in studies investigating osteoporosis in PsA. Different from other studies, lateral spine measurements were performed in our study to minimize the error rate. While osteoporosis was not identified in anterior–posterior lumbar BMD assessment in patients or controls, low BMD values were observed in lateral projection in both groups, and the rate of osteoporosis was significantly higher in patients with PsA.

The cause of bone mineral loss in patients with PsA is unclear. Several studies have suggested that chronic inflammation, prolonged immobilization due to pain, and medications such as MTX and glucocorticoids play a role in bone mineral loss (5). In our study, 10 patients (17.2%) were taking a biological agent, 43 (74.1%) were taking MTX, and 18 (31%) were taking NSAID. Previous medications of the patients included steroids, MTX, other DMARDs, and biological agents. Twenty-nine patients (50%) had a history of steroid use, although they were not using it currently. None of the patients had steroid treatment during the 12 months preceding the initiation of the study. No significant difference was noted regarding the prevalence of osteoporosis between the two groups of patients with or without a history of steroid use. There was a negative correlation between the cumulative steroid dose and anterior–posterior and lateral lumbar BMD values, but these differences were statistically insignificant. A similar correlation was not observed between the steroid dose and femoral BMD values. Thirteen out of 43 patients (30.2%) treated with MTX and six out of 10 patients (60%) receiving biological agent treatment had osteoporosis as detected by lateral lumbar BMD values. No statistically significant relation was observed between the presence of osteoporosis and the use of MTX or biological agents. In their study of 91 patients with PsA, Riesco et al. (21) could not find any significant relationship between BMD values and the use of steroids, DMARDs, or biological agents, and we also observed no significant relationships. This result was suggested to be attributed to the limited number of patients evaluated in the statistical analysis (21). Unfortunately, the number of patients included in our study might be insufficient to determine the effect of drug therapy on BMD.

The effect of inflammatory activity is one of the most important issues in the etiology of osteoporosis. Even the patients with no movement restriction in the early stage of the disease might experience bone loss caused by inflammatory activity (22, 23). In our study, BMD values of the patients in the PsA group were lower than controls; however, there was no significant relation between disease duration and BMD values. Although statistically insignificant, there was a negative correlation between lateral lumbar BMD values of the patients with PsA and the clinical parameters, including ESR, BASDAI, DAREA, and DAS28, and the numbers of swollen and tender joints. A similar correlation between BMD values and CRP levels was not found in this study. We saw no relationship between BMD values and the HAQ-S score measuring the quality of life of the patients. A positive correlation was noted between the MASES score and anterior–posterior lumbar and femur neck BMD values, and the link between new bone formation and inflammation at the enthesis might explain this positive correlation.

Frediani et al. (6) found low BMD values in patients with PsA compared with control subjects. They found no relation between BMD values and ESR or between CRP and disease duration, but they did find a negative correlation between HAQ-S score and both age and postmenopausal period (6). The study by Grazio et al. (18), although without a control group, suggests that there is no significant correlation between BMD values and DAS28, MASES, ESR, CRP, or morning stiffness duration, but there is a negative correlation between HAQ-S score and total hip BMD values. Accordingly, it has been concluded that reduced mobility associated with the reduction in individuals' functional capacity might lead to osteoporosis. Because the joints used in the calculation of DAS28 do not include the distal interphalangeal joints of the hand and foot, it has been advocated that its use with PsA should be limited (18). In our study, disease activity was assessed using DAS28 as well as by DAREA and BASDAI. In a study comprising patients with PsA and an equal number of control subjects, there was no difference in the prevalence of osteoporosis between the two groups, but there was a negative correlation between BMD values of anterior L2–L4 and ESR and DAS28 scores in patients with PsA, but not HAQ-S scores (21). In patients with PsA, no significant bone loss was found in some clinical studies (24, 25), whereas bone biopsies suggested a high turnover osteopathy (26).

In recent years, the role of vitamin D in not only calcium and phosphorus homeostasis and bone metabolism, but also immune system function, has been well established (27, 28), and the 1,25(OH)2D3 vitamin and its homologues suppress autoimmunity by modulating both the antigen-presenting cells and T-cells (29,30). In our study, serum vitamin D levels were significantly lower in patients with PsA compared to the control group. The mean 25(OH)D3 level

was 11.25±7.48 ng/ml in patients and 14.79±10.53 ng/ml in control subjects. No significant correlation was found between vitamin D level and ESR or CRP. There was a negative, but statistically insignificant, relationship between clinical activity signs, including BASDAI, DAREA, and DAS28, and vitamin D level. One study investigating the relationship between disease activity in patients with PsA and vitamin D levels found that there was a negative correlation between CRP and vitamin D levels. Vitamin D deficiency was detected in 25.6% of the patients and in 9.3% in controls, and this difference was statistically significant (31). In another study, the serum 25(OH)D3 level was 21.70±12.17 mmol/l in patients with AS and 32.70±8.77 mmol/l in control subjects. Although statistically insignificant, a negative correlation was found between 25(OH)D3 level and ESR and CRP in the patient group. Vitamin D deficiency has been reported to indirectly lead to osteoporosis by causing an increase in inflammatory activity (32). In a study of 121 patients with RA, AS, or PsA, 51 patients (42.1%) had vitamin D deficiency. The mean vitamin D level of 22 patients with PsA included in the study was 15.5±8.5 mmol/l, but no correlation was detected between vitamin D levels and ESR, CRP, or DAS28 scores (33). While some studies show a significant relationship between vitamin D and disease activity, others argue otherwise. The common finding of these studies was vitamin D deficiency seen in patients with PsA, independent of different variables. Considering the effect of vitamin D on autoimmunity, these findings imply that vitamin D plays a role in the pathogenesis of the disease rather than disease activity.

When comparing the vitamin D level in patients with PsA with or without osteoporosis, no significant difference was seen. In patients with osteoporosis, the CRP level, which is a useful marker of disease activity, was higher, although this was statistically insignificant, and the ESR levels were similar between those with and without osteoporosis. The clinical activity signs, including DAREA, DAS28, BASDAI, HAQ-S, and the numbers of swollen and tender joints were higher in patients with PsA with osteoporosis, but the difference between the two groups was statically insignificant. These findings demonstrate that vitamin D plays a role in the pathogenesis of osteoporosis in patients with PsA rather than disease activity. The statistical insignificance of ESR and CRP levels might be related to the small number of patients, the inability of ESR and CRP levels to predict disease activity in PsA, or the cumulative effect of repeated attacks on demineralization?

CONCLUSION

In the current study, the incidence of osteoporosis was higher and vitamin D levels were lower among patients with PsA than among controls. We thought the increase in the incidence of osteoporosis might be related to disease activity. Regular monitoring of BMD is important to prevent disabilities and fractures in patients with PsA. Vitamin D is a hormone with immunomodulatory properties, and it is involved in the pathogenesis and disease activity of inflammatory rheumatic diseases, including PsA. Analysis of disease activity scores and vitamin D levels might be useful in detecting patients at risk of osteoporosis. Although the use of vitamin D in several diseases has been demonstrated in experimental studies, the studies of its use in the treatment of PsA, except for a few studies in the literature, are rare. Further studies that include a larger number of patients are needed to clarify the role of vitamin D in disease activity, pathogenesis, and treatment of PsA.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Ankara Numune Training and Research Hospital.

Informed Consent: Written informed consent was obtained from patients andatients' parents/who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Conceived and designed the experiments or case: EÖ., BB., FS., HB. Performed the experiments or case: EÖ., BB., FS., HB. Analyzed the data: EÖ. Wrote the paper: BB., FS. All authors have read and approved the final manuscript.

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