The relationship between vitamin D, vertebral deformity and quality of life in psoriatic arthritis

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ABSTRACT

Objective: The aim of this study is to investigate the relation between vitamin D levels, vertebral deformities, functional status, quality of life, acute phase reactants and enthesopathy in patients with psoriatic arthritis (PsA).

Patients and Methods: Fifty-two patients with PsA and 52 controls were enrolled to the study. Routine blood tests and serums 25-(OH)D3 were measured. The thoracic and lumbar vertebrae deformities identified in the radiographies were evaluated by a radiologist. Psoriatic Arthritis Quality of Life (PSAQoL) was used for evaluating quality of life and disease activity parameters for PsA were assessed. In PsA patients, correlations was performed between the 25(OH)-D3 levels and PGA (patient global assessment), PhGA (Physician global assessment), tender JC (joint count), HAQ-S (Health Assessment Questionnaire for the Spondyloarthropathies), PSAQoL, MASES (Maastricht Ankylosing Spondylitis Enthesitis Score) and BASDAI (Bath Ankylosing Spondylitis Disease Activity Index) values.

Results: The results showed that 25(OH)-D3 levels was not correlated with these values. ($p>0.05$ for $r = -0.171$, $r = -0.167$, $r=-0.069$, $r=-0.236$, $r=-0.062$, $r= -0.058$ and $r = -0.106$ respectively). It was determined that the PSAQoL score had a positive and statistically significant correlation with the PGA, swollen JC, CRP, HGD, tender JC, VAS-pain, HAQ-S, MASES and BASDAI values in PsA patients. ($p>0.05$ for $r=0.291$, $r=0.324$, $r=0.346$, $r=0.312$; and $p=0.001$ for $r=0.472$, $r=0.380$, $r=0.565$, $r=0.696$, $r=0.359$, $r=0.633$, respectively) Statistical analyses demonstrated that PsA patients with vertebral deformities had higher numbers of tender joints, more prolonged periods of morning stiffness, higher DAS28-ESR (Disease Activity Score) scores, and higher levels of vitamin D ($p<0.05$, $p<0.05$, $p=0.05$ and $p<0.05$, respectively). The multiple logistic regression analysis indicated that the only factor which had an effect on the development of vertebral deformities was the use of steroids.

Conclusions: This result has demonstrated that psoriatic arthritis has a considerable effect on patient quality of life. Most significant factors that affecting quality of life were physical pain and disability while vertebral deformities and 25-(OH)D3 had no significant effect.

Keywords: Vertebral deformities; Disease activity; Psoriatic arthritis; Quality of life; Vitamin D.

INTRODUCTION

Psoriatic arthritis (PsA) is a type of inflammatory arthritis associated with psoriasis. PsA can be identified with RF negativity and certain clinical features, such as DIP involvement, dactylitis, and asymmetric distribution of arthritis, spondylitis, enthesitis and HLAB27 association. PsA is classified in spondyloarthropathies due to these clinical features[1]. Most inflammatory rheumatic diseases have repercussion on bone metabolism[2,3]. Association between PsA and periarticular osteoporosis is well known[4,5]; however, there is limited number studies in the literature regarding systemic bone loss and bone turnover in PsA patients[6–9]. The clinical significance of osteoporosis is fracture predisposition. Vertebral fractures are generally asymptomatic, and may occur during daily activities. Vertebral deformities are associated with higher morbidity and mortality rates, and serve as a risk predictor for the occurrence of further osteoporotic fractures[10, 11].

Vitamin D is a significant determinant of bone mineral content and cortical thickness of biomechanical properties of the femoral neck. Vitamin D and related compounds have been used to prevent osteoporotic

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fractures in elderly. Lower concentrations of vitamin D were determined in males with vertebral deformities. It was found that Vitamin D and calcium combination reduces the risk of clinical vertebral and hip fractures[12-14]. Vertebral fractures are associated with back pain and disability. In a multicenter study from Europe individuals with prevalent vertebral fractures had significantly impaired quality of life and health status score[15]. A similar study showed that multiple vertebral deformities are associated with severe and disabling back pain[16]. On the other hand lower serum vitamin D levels without any vertebral or extra- vertebral fractures are associated with lower scores on quality of life and higher scores in pain evaluation[17,18].

The current study investigated the association between vitamin D levels, vertebral deformities, functional status, quality of life, acute phase reactants and enthesopathy in patients with PsA.

MATERIALS AND METHODS

The study included 52 patients diagnosed with PsA (23 males and 29 females) in accordance to the Classification Criteria for Psoriatic Arthritis (CASPAR)[19]. Also, 52 subjects (23 males, 29 females) who had been admitted to the outpatient clinic for other reasons/conditions constituted the control group of the study. Mechanical low back and neck pain, muscle strain, chondromalacia patella, grade 1 knee osteoarthritis and tenosynovitis such as lateral epicondylitis, de quervain tenosynovitis were the diagnosis of the individuals formed the control group. The PsA patients and the control group were thoroughly informed regarding the study and its procedures written informed consents were obtained from both group. Local ethical committee approval was also obtained. Gender, age, duration of disease, peripheral joint involvement, extra-articular involvement, family history, presence or absence of diabetes, hepatic and renal diseases, and history of previous surgeries were recorded in the study group.

The exclusion criterias for the PsA and control were: Inflammatory intestinal disease (Crohn's disease, ulcerative colitis), malnutrition, hyperparathyroidism, hyperthyroidism, renal and hepatic diseases, use of medications that might affect bone metabolism and the endocrine system (e.g. thyroxin, anticonvulsants, hormone replacement therapy). Patients with previous non-vertebral osteoporosis fractures were excluded. Also patients with inflammatory rheumatic diseases were excluded from the control group. Patients in both the PsA and control group were physically active (i.e. not limited or impaired in terms of physical movement) during the past 12 months. All participating female patients were premenopausal.

The medication history of patients in the PsA group was recorded. In addition to demographic data such as gender, age and body mass index (BMI); the patients' medical history the duration of their psoriasis, the duration of their arthritis symptoms, and their previous and current treatments with disease-modifying antirheumatic drugs (DMARDs), corticosteroids (CS) and/or biological agents were also recorded. The patients' cumulative steroid dose was calculated by multiplying the daily dose of prednisolone (or equivalent glucocorticoid) with the number of drug administered days.

The patients' physical examination involved the evaluation of the number of tender and swollen joints, the presence of dactylitis, the number of fingers and toes affected by dactylitis, the presence of enthesitis. To determine the count of tender and swollen joints (tender JC, swollen JC), the American College of Rheumatology (ACR) joint count was performed (68 tender and 66 swollen joints; hips are not assessed for swelling[20]. The presence or absence of enthesitis was determined by using the Maastricht Ankylosing Spondylitis Enthesitis Score (MASES). This score indicates the number of entheses that are painful upon palpation, and has a range of 0 to 13[21]. The severity of pain, and the patient's and doctor's global evaluations (the PGA and PhGA, respectively) were assigned with the aid of a 100 mm horizontal visual analogue scale (VAS).

The Disease Activity Score in 28 Joints (DAS 28) scale[22], the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI)[23] and the Disease Activity Index for Psoriatic Arthritis (DAPSA) scale[24] were used to determine the level of disease activity in the patients. The functional status was assessed using the Health Assessment Questionnaire for the Spondyloarthropathies (HAQ-S)[25].

The Psoriatic Arthritis Quality of Life (PSAQoL) was used to assess the quality of life for PsA patients. The Turkish adaptation and validation of this quality of life questionnaire was previously performed by Duruoz et al.[26]

LABORATORY ANALYSIS

25-(OH)D3 (normal: 8–60 ng/ml) levels, the intact

PTH (normal: 1.6–6.9 pmol/l), and alkaline phosphatase (ALP, normal: 30–120 IU/l) of patients in the PsA and control groups were analyzed using standard methods. The patients' C reactive protein (CRP) levels were assessed with the nephelometric method (normal: 0.2–5.0 mg/l), while their erythrocyte sedimentation rate (ESR) was assessed with the Westergren method (n: 0-20 mm/h). The patients' total calcium, ionized calcium, creatinine, urea, phosphorous, ALT, AST, total protein, and albumin levels in the blood were determined using a standard auto-analyzer.

RADIOLOGIC EXAMINATIONS

Anteroposterior and lateral thoracic and lumbosacral radiographies were taken from all participants. The thoracic and lumbar vertebrae deformities identified in the radiographies were evaluated by a radiologist (S.D) in accordance with the semi-quantitative method previously described by Genant et al.[27]. According to this method deformities in the anterior, posterior or middle parts of the vertebrae that resulted in a 20–25% (grade 1), a 25–40% (grade 2) or a >40% (grade 3) loss of height were classified as mild, moderate or severe deformities, respectively. Patients having at least one vertebra with at least a grade-1 deformity were considered as fractured.

STATISTICAL ANALYSIS

All data were analysed using the SPSS 18.0 package program. In order to assess the differences between the groups; the Student's t test was employed for variables with normal distribution, while the nonparametric Mann–Whitney U test was employed for variables with abnormal distribution. To evaluate the relationships between the variables of the PsA patient group; the Pearson correlation test was used for parametric variables, while the Spearmans correlation test was used for nonparametric variables. The multiple logistic regression analysis and the multiple linear regression analysis were used to identify the factors that affected vertebral deformity and quality of life, respectively. A p value of <0.05 was considered as being statistically significant.

RESULTS

The mean age of the 52 PsA patients (23 males, 29 females) was 41.9 ± 8.4 years, while the mean of the control group (23 males, 29 females) was 41.9 ±7.9. The mean BMI for the PsA and control groups was 29.18 ± 5.69 kg/cm2 and 28.93 ± 5.09 kg/cm2, respectively. There was no statistically significant difference between these two groups with respect to gender, age and BMI distribution (p>0.05). The duration of the disease varied between 1 to 180 months in the PsA patient group, (average: 58.52 ± 51.46 months).

The laboratory results indicated that in the PsA group the mean ESR level was 22.12 ± 20.02 and the mean CRP level was 8.54 ± 12.14 while in the control group these values are 10.92±11.89 and 2.48 ± 3.76 respectively. The mean 25(OH)-D3 level was 10.15 ± 6.48 mmol/l in the PsA group, compared to 13.99 ± 10.36 mmol/l in the control group. The mean VAS pain score was 4.38±3.13 in PsA group and it was 4.19±2.56 in the control group. While the differences between the groups with respect to the ESR, CRP and 25(OH)-D3 levels were statistically significant (p<0.005, p<0,005, p<0.05 respectively) there was no statistically difference with respect to the VAS pain values. The demographic, clinical data and laboratory parameters of the patients are shown in Table I.

In the PSA group the mean DAS28-ESR score was 3.43 ± 1.58, the mean DAPSA score was 7.64 ± 7, the mean BASDAI score was 4.39 ± 2.42, the mean PGA score was 4.69 ± 2, the average PhGA score was 3.69 ± 2, the mean HAQ-S score was 0.50 ± 0.50, the mean MASES score was 3.33 ± 4.138, and the mean PSAQoL score was 6.90 ± 6.28.

In PsA patients, correlations were performed between the 25(OH)-D3 levels and PGA, PhGA, tender JC, HAQ-S, PSAQoL, MASES and BASDAI values. The outcomes indicated that 25(OH)-D3 levels were not correlated with these values. (p>0.05 for r = -0.171, r = -0.167, r=-0.069, r=-0.236, r=-0.062, r= -0.058 and r = -0.106 respectively, Table II).

It was determined that the PSAQoL score had a statistically significant positive correlation with the morning stiffness, PGA, swollen JC, CRP, PGhA, tender JC, VAS-pain, HAQ-S, MASES and BASDAI values in PsA patients. (p>0.05 for r=0.291, r=0.324, r=0.346, r=0.312; and p=0.001 for r=0.472, r=0.380, r=0.565, r=0.696, r=0.359, r=0.633, respectively). The results are shown in Table III. The multiple linear regression analysis indicated that the HAQ-S and BASDAI scores affected the quality of life. An increase of 1 unit in HAQ-S resulted in an increase of 3.96 units in PSAQoL, while an increase of 1 unit in BASDAI resulted in an increase of 3.89 units in PSAQoL (Table IV).

Vertebral deformities were examined by Genant

TABLE I. DEMOGRAPHIC DATA, CLINIC DATA AND LABORATORY PARAMETERS OF PSA AND CONTROL GROUPS

	Psoriatic Arthritis Group (n=52)	Control Group (n=52)	p
Age (year)	41.98±8.4	41.94±7.9	>0.05
Gender (M/F)	23/29	23/29	>0.05
Body mass index (kg/m²)	29.18±5.69	28.93±5.09	>0.05
ESR (mm/h)	22.12±20.02	10.92±11.89	**<0.0001***
CRP (mg/l)	8.54±12.14	2.48±3.76	**<0.0001***
25(OH)D3 (ng/ml)	10.15±6.48	13.99± 10.36	<0.05**
PTH (pmol/l)	22.12±20.02	10.92±11.89	>0.05
ALP (IU/ml)	74.35±21.00	66.63±19.88	>0.05
Total Ca (mg/dl)	9.19±0.38	10.69±11.07	>0.05
Ionized Ca (mg/dl)	4.45±0.17	4.50±0.22	>0.05
VAS-pain (cm)	4.38±3.13	4.19±2.56	>0.05

ESR: Erythrocyte Sedimentation Rate; CRP: C-reactive protein, 25-(OH)D3: 25-hydroxyvitamin, D3; PTH: Parathyroid hormone; ALP: Alkaline phosphatase; total Ca: Total calcium; Ionized Ca: Ionized calcium; VAS: visual analogue scale; *.**:statistically significant

TABLE II. THE RELATIONSHIP OF 25(OH)-D3 LEVELS WITH DISEASE ACTIVITY PARAMETERS, FUNCTIONAL ASSESSMENT AND QUALITY OF LIFE INDICES

	Level of 25(OH)- D3	
	r	p
PGA	-0.171	>0.05
PhGA	-0.167	>0.05
Tender JC	-0.069	>0.05
HAQ-S	-0.236	>0.05
PSAQoL	-0.062	>0.05
MASES	-0.058	>0.05
BASDAI	-0.106	>0.05

PGA: Patients' Global Assessement; PhGA: Physician Global Assessement; JC: joint count; HAQ-S: Health Assessment Questionnaire for the Spondyloarthropathies; PsAQoL: Psoriatic Arthritis Quality of Life; MASES: Maastricht Ankylosing Spondylitis Enthesis Score; BASDAI: Bath Ankylosing Spondylitis Disease Activity Index; JC: joint count; r: correlation coefficient

TABLE III. THE RELATIONSHIP OF THE MEAN PSAQOL SCORES WITH DISEASE ACTIVITY PARAMETERS AND FUNCTIONAL ASSESSMENT INDICES

	PSAQoL	
	r	p
Duration of MS	0.291	<0.05*
PGA	0.472	<0.001**
PhGA	0.324	<0.05*
Swollen JC	0.346	<0.05*
Tender JC	0.380	<0.001**
VAS-Pain	0.565	<0.001**
CRP	0.312	<0.001**
HAQ-S	0.696	<0.001**
MASES	0.359	<0.001**
BASDAI	0.633	<0.001**

PsAQoL: Psoriatic Arthritis Quality of Life; MS: morning stiffness; PGA: Patients' Global Assessement; PhGA: Physician Global Assessement; JC: joint count; VAS: visual analogue scale; CRP: C-reactive protein; HAQ-S: Health Assessment Questionnaire for the Spondyloarthropathies; MASES: Maastricht Ankylosing Spondylitis Enthesis Score; BASDAI: Bath Ankylosing Spondylitis Disease Activity Index; r: correlation coefficient; *,**:statistically significant

method, which evaluates the vertebrae between the dorsal 4 to lumbar 5 regions. The vertebral deformity ratio was 19.2% in the PsA group, compared to 7.7% in the control group. This difference was not statistically significant ($p > 0.05$). Grade 1 deformity was detected in 11 vertebrae and grade 2 deformities in 4 vertebrae in the patients with PsA. In healthy control group grade 1 vertebral deformity was observed in 4 vertebrae. There was no grade 2 deformity in this group. Most of the deformities were at mid-thoracic and thoracolumbar regions (Table V and Figure 1).

Statistical analyses demonstrated that PsA patients with vertebral deformities had higher numbers of tender joints, more prolonged periods of morning stiff-

ness, higher DAS28-ESR scores, and higher levels of vitamin D (p<0.05, p<0.05, p=0.05 and p<0.05, respectively) (Table VI). The multiple logistic regression analysis indicated that the unique factor effecting the development of vertebral deformities was the use of steroids. As such, it was determined that the risk of vertebral deformity was 4.6 times higher in the patients using CS (Odds ratio=4.62, 95 % Confidence interval=1.42-15.03).

An evaluation of the medications being used by the patients revealed that 37 (71.2%) were receiving methotrexate (MTX), while 9 (17.3%) were receiving a biological agent. Among our patients, 23 (44.2%) were using oral CS, while 29 (55.7%) did not. The cumulative CS dose was 0.12–7.20 g (mean dose: 0.80 ± 1.71 g.); compared with the patients not using CS, no statistically significant difference was found between these two groups with respect to demographic and clinical parameters (p > 0.05). When the groups were evaluated with respect to vertebral deformities, a higher rate of deformities was observed in the group using CS (30.4%) in comparison to the group not

TABLE IV. FACTORS THAT AFFECTED THE QUALITY OF LIFE

Variables	b	t	p
HAQ-S	5.31	3.96	<0.001
BASDAI	0.87	3.89	<0.001

F=58.59, P<0.001,R2=0.53; HAQ-S: Health Assessment Questionnaire for the Spondyloarthropathies; BASDAI: Bath Ankylosing Spondylitis Disease Activity Index

TABLE V. VERTEBRAL DEFORMITIES IN PSA PATIENTS AND CONTROL GROUP

	PsA patients	Control group	
Vertebral deformity (%)	10 (19.2%)	4 (7.7%)	>0.05
Grade 1 deformity (number of vertebra)	11	4	
Grade 2 deformity (number of vertebra)	4	–	

F=58.59, P<0.001,R2=0.53; HAQ-S: Health Assessment Questionnaire for the Spondyloarthropathies; BASDAI: Bath Ankylosing Spondylitis Disease Activity Index

TABLE VI. COMPARISON OF CERTAIN DEMOGRAPHIC DATA, CLINICAL DATA, DISEASE ACTIVITY PARAMETERS AND FUNCTIONAL ASSESSMENT INDICES BETWEEN PSA PATIENTS WITH AND WITHOUT VERTEBRAL DEFORMITIES

	PsA patients with vertebral deformities (n=10)	PsA patients without vertebral deformities (n=42)	p
Age (year)	41.60±10.93	42.07±7.96	>0.05
Body mass index (kg/m²)	30.35±7.96	20.40±19.93	>0.05
Gender (F/M) (%)	7/3 (24/13)	22/20 (75.9/87)	>0.05
Duration of Ps (month)	217.20±88.26	181.00±132.74	>0.05
Duration of PsA (month)	81.70±57.47	53.00±49.05	>0.05
Tender JC	7.10±7.76	3.17±4.54	**<0.05***
Swollen JC	0.70±1.56	0.48±0.83	>0.05
Duration of MS	57.50±88.73	26.07±51.26	**<0.05***
HAQ-S	0.44±6.54	0.52±0.50	>0.05
DAS-28 ESR	4.25±1.52	3.23±1.55	**=0.05**
Dose of CS (g)	1.51±2.65	0.64±1.40	>0.05
PsAQoL	6.5±5.19	7.00±6.56	>0.05
DAPSA	11.00±9.40	6.84±7.46	>0.05
BASDAI	5.38±2.31	4.16±2.41	>0.05
25(OH)D3 (ng/mL)	14.50±7.80	9.12±5.76	**<0.05***

JC: joint count; MS: Morning Stiffness; HAQ-S: Health Assessment Questionnaire for the Spondyloarthropathies; 25-(OH)D3: 25-hydroxyvitamin D3; BASDAI: Bath Ankylosing Spondylitis Disease Activity Index; HAQ-S: Health Assessment Questionnaire for the Spondyloarthropathies; DAS 28: Disease Activity Score in 28 Joints; CS: corticosteroids; PsAQoL: Psoriatic Arthritis Quality of Life; DAPSA: Disease Activity Index for PSoriatic Arthritis; BASDAI: Bath Ankylosing Spondylitis Disease Activity Index; *:statistically significant

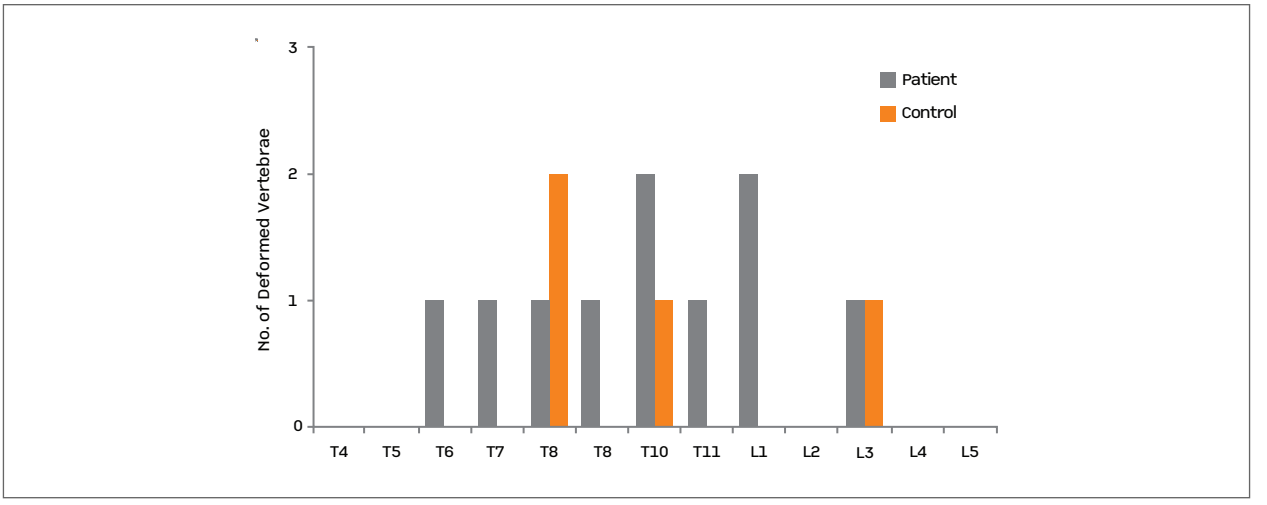

FIGURE 1. Distribution of vertebral deformities along the spine

using CS (10.3%). However, this difference was not statistically significant (p> 0.05).

DISCUSSION

In this study we determined that vitamin D levels were lower in PSA patients than the control group. There was a significant correlation between quality of life score and the parameters used to assess disease activity. Unlikely vitamin D were not associated with quality of life. Vertebral deformity rate was 19.2% among PsA patients, compared to 7.7% among control group. The duration of morning stiffness (MS), tender JC, DAS28--ESR and serum vitamin D levels of our PsA patients with fractures were significantly higher than the levels observed among PsA patients without fractures on other hand there was no significant difference between PsA patients with and without fractures with regards to the quality of life, as evaluated by the PsAQoL.

Vitamin D deficiency has been associated with impaired physical functioning and lower scores on quality of life and self-related health[17]. Korkmaz showed vitamin D levels affect quality of life in postmenopausal patients and Hlavaty showed vitamin D serum concentration correlated with health related quality of life in inflammatory bowel diseases[28,29]. Several studies have demonstrated that vitamin D supplementation could be useful in treatment of musculoskeletal pains[17,18]. In recent studies lower vitamin D levels have been found in the patients with psoriasis and PsA[30,31]. In a study with 121 patients who had inflammatory joint disease (85 rheumatoid arthritis, 22 psoriatic arthritis, 14 ankylosing spndylitis) implicated that the levels of 25(OH)-D3 in the patient group was lower than the levels observed in the control group[32]. In the present study, the mean 25(OH)-D3 level was 10.15 ± 6.48 mmol/l in the PsA patient group, compared to 13.99 ± 10.36 mmol/l in the control group. The difference between the groups was statistically significant. Among PsA patients, a negative correlation without statistical significance was observed between the 25(OH)-D3 levels and the PSAQoL, PGA, PhGA, tender JC, HAQ-S, MASES and BASDAI scores. According to our results the relationship between vitamin D and quality of life was not consistent with the literature.

Comparative studies have demonstrated that PsA patients have a burden of illness similar to the patients with rheumatoid arthritis (RA) or ankylosing spondylitis. Both the skin and joint-related effects of PsA have a considerable negative impact on the quality of life. Compared to patients with RA; PsA patients may experience even more pain and more limitations in movement and daily activities due to emotional problems associated with PsA[33]. Zachariae previously assessed psoriasis-related quality of life in a large sample of psoriasis patients and determined that approximately 30% of the patients in the study sample had arthritis, and the patients with arthritis exhibited greater impairment of psoriasis-related quality of life. Articular diseases have a considerable negative effect on health-related life quality. It is important to quantify the patients' perspective regarding the severity of their disease[34]. Another

study emphasized that pain has a great impact on the daily activities of PsA patients. In the same study the variable had the greatest effect on the HRQL models was the number of tender joints[35]. A study conducted by Husted JA demonstrated lower SF-36 scores for PsA patients with respect to physical functioning, pain, general health perception, and vitality. The highest SF--36 scores for the PsA patients were observed at the subject of mental health and social functioning[36]. The present study, the PSAQoL scores of the PsA group were lower than the scores observed in the control group. We also identified a significant correlation between quality of life score and the parameters used to assess disease activity. Regression analyses showed that two main factors affecting PSAQoL were HAQ-S and BASDAI scores. In our study population we have found that quality of life is related with pain and disease activity scales depending on pain, unlikely vitamin D was not associated with quality of life.

PsA patients frequently experience local and systemic bone loss, also have a higher osteoporotic fracture risk. However, the exact mechanism and cause for osteoporosis in PsA patients has not been elucidated[37]. Van der Weijden et al. reported a fracture rate of 24% in their study sample among PsA patients[38]. Current data on fractures in PsA patients is limited. A study by Pedreira et al. was conducted on 45 postmenopausal women with PsA (mean age: 60.5 ± 8.7), 52 psoriasis patients (mean age: 61.4 ± 9.1 yrs) and 98 healthy controls[39]. The rate of fragility fractures in PsA patients (33%) was considerably higher than the psoriasis patients (28.8%). Both rates were significantly higher than the healthy individuals; however, the study did not provide incidence data for fractures among healthy controls. Another study determined that 13% of the patients with psoriatic arthritis (19/155) had clinical low energy trauma fractures[40]. In our study, the vertebral deformity rate was 19.2% among PsA patients, compared to 7.7% among controls. The rates of vertebral deformity in Pedreira et al. study were higher than the rates observed in our series. This might have been due to the inclusion of postmenopausal patients in Pedreira et al., while in our study patients were entirely premenopausal. Busquets et al. also reported lower rates of vertebral deformity than the present study. This could be explained by asymptomatic fractures may have overlooked with the absence of thoracic and lumbar radiography procedures for all the patients in Busquets et al. study[40]. Further studies with larger study samples are necessary due to the limited amount of information regarding vertebral fractures in axial PsA patients.

In our study, vertebral deformities were predominantly localized to the same regions of the spine as in typical osteoporotic fractures, namely in the mid- and lower thoracic spine. This outcome indicated to the role and involvement of osteoporosis in the fractures of these patients. Van der Weijden et al. found that vertebral fractures in patients with PsA were mostly localized to the same vertebral regions[38]. In recent studies factors associated with vertebral deformity were assessed. Weijden et al. noted that the patients with vertebral fractures were generally older males, and the ESR, CRP and Bath Ankylosing Spondylitis Metrology Index (BASMI) levels of these patients were higher than the levels observed in patients without fractures however this difference was not statistically significant (38). Pedreira et al. described that the main cause of low-energy fractures among PsA patients was repeated falls and long disease duration[39]. Ghozlani et al. determined that the factors which had the greatest effect on the occurrence of vertebral deformities in patients with AS was the disease duration and the severity of the damage inflicted to the vertebra[41]. We found that the duration of MS, tender JC, DAS28-ESR and serum vitamin D levels of our PsA patients with fractures were significantly higher than the levels observed among PsA patients without fractures. In addition; there was no significant difference between PsA patients with and without fractures with regards to the quality of life, as evaluated by the PsAQoL. The higher levels of vitamin D in the patients with vertebral deformities could be associated with the previous vitamin D replacement therapy considering their risk factors in regular follow--up.

Due to the risk of post-steroid psoriasis flare and other possible adverse effects; generally systemic corticosteroids are not recommended for the treatment of psoriasis, and advised only for specific cases that do not require chronic use[42]. Nijs et al. (43) reported that CS use in RA patients led to a higher risk of symptomatic fractures and vertebral deformities. In a study about the rate of vertebral deformities with RA patients and healthy controls, although higher rate of deformities were observed in the group using CS (32.4%) compared to the group not using CS (24.1%), the difference was not statistically significant[44]. In current study, 44.2% of PsA patients used CS. However there was no significant difference between the groups using and not using CS with respect to demographic and clinical pa-

rameters, the multiple logistic regression analysis indicated that the single variable with the greatest effect on the occurrence of vertebral deformities was steroid use.

The results of our study have demonstrated that compared to the controls, vitamin D levels were lower among our PsA patients. Physical pain and disability were the two most significant factors that affecting our patients' quality of life. It was also determined that vertebral deformities and vitamin D levels had no significant effect on the quality of life of PsA patients.

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