The Effects of Vitamin D in Patients with Subacromial Impingement Syndrome

Subakromial Sıkışma Sendromlu Hastalarda D Vitaminin Etkileri

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ABSTRACT

Objective: Vitamin D deficiency can cause pain and disability in many diseases. Subacromial impingement syndrome (SAIS) is a common reason for shoulder pain. In this study, we aimed to assess the relationship between vitamin D and the clinical features in patients with SAIS.

Methods: Patients with SAIS were evaluated, and age, gender, affected side, disease duration, 25-OH vitamin D, and other laboratory tests were recorded from patients' files. Also, patients' data on shoulder visual analog scale (VAS), shoulder range of motions (ROMs), and scores of Disabilities of the Arm, Shoulder, and Hand (DASH) were obtained. The patients were grouped according to their 25-OH vitamin D levels. (Group 1: <10 ng/mL, Group 2: 10-20 ng/mL, and Group 3: >20 ng/mL). Demographic and clinical features were compared between groups, and the relation of vitamin D with VAS, DASH scores, and ROMs were investigated.

Results: Eighty patients with SAIS were included in the study. The mean age of patients was 51.99±11.14 years. There were 35 female and 25 male patients. The mean disease duration was 6.32 months. VAS was statistically higher in Group 1 compared to Group 3. Also, shoulder pain was negatively correlated with 25-OH vitamin D level. There was no statistically significant relation between the 25-OH vitamin D level and DASH score or the 25-OH vitamin D level and shoulder ROMs.

Conclusion: Severe deficiency of vitamin D increases shoulder pain in patients with SAIS. Vitamin D deficiency should be taken into consideration in patients with severe shoulder pain in SAIS.

Keywords: Subacromial impingement syndrome, vitamin D, pain, disability, shoulder

ÖZ

Amaç: Subakromial sıkışma sendromu, klinikte omuz ağrısının en sık nedenlerinden biridir. Vitamin D eksikliği, birçok hastalıkta ağrı ve fonksiyon kaybına neden olabilmektedir. Bu çalışmanın amacı, subakromial sıkışma sendromu tanısı olan hastalarda, D vitaminin klinik özellikler, ağrı ve dizabilite ile ilişkisini araştırmaktır.

Yöntemler: Subakromial sıkışma sendromu tanısı ile başvurmuş olan hastaların yaş, cinsiyet, etkilenen taraf, hastalık süresi, 25-OH vitamin D ve diğer laboratur bulguları ile omuz hareket açıklıkları, omuz ağrıları için Vizuel Analog Skala (VAS) ve Kol-omuz-el dizabilite (DASH) anketinden aldıkları skorları hasta dosyalarından kaydedildi. Hastalar, 25-OH vitamin D düzeylerine göre 3 gruba ayrıldı (Grup 1: <10ng/mlt, Grup 2: 10-20 ng/mlt, Grup 3: <20ng/mL). Hastaların 25-OH vitamin D düzeyleri ile demografik ve klinik özellikleri arasındaki ilişki değerlendirildi.

Bulgular: Çalışmaya seksen hasta dahil edildi. Hastaların yaş ortalaması 51,99±11,14 yıldı. Çalışmaya dahil edilen hastaların elli beşi kadın, yirmi beşi erkekti. Ortalama semptom süresi 6,32 aydı. Grup 1'de VAS, Grup 3'e göre anlamlı şekilde yüksekti. DASH skorları ve eklem hareket açıklıkları incelendiğinde gruplar arasında istatistiksel anlamlı farklılık gözlenmedi. Ayrıca VAS ile 25-OH vitamin D arasında istatistiksel olarak negatif yönde anlamlı korelasyon saptandı.

Sonuç: Bu çalışma ile, subakromial sıkışma sendromu olan hastalarda vitamin D'nin ciddi eksikliğinin omuz ağrısı ile ilişkili olabileceği sonucuna varılmıştır. Bu yüzden şiddetli ağrısı olan subakromial sıkışma sendromu olan hastalarda D vitamini düzeyi de akılda tutulmalıdır.

Anahtar kelimeler: Subakromial sıkışma sendromu, D vitamini, ağrı, dizabilite

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INTRODUCTION

Subacromial impingement syndrome (SAIS) is a common reason for shoulder pain (1). SAIS is a spectrum of pathologies, including subacromial bursitis, rotator cuff tendinopathy, and rotator cuff tears (2, 3). SAIS has a progressive pathology in general (4). Bone disorders, muscle weakness, deterioration of the scapula humeral rhythm, poor posture, and inflammation in the bursa are the possible mechanisms of SAIS (2-5). Furthermore, it has been shown that inflammatory cytokines, matrix metalloproteinases (MMPs), and cyclo-oxygenases increased in the subacromial bursa of patients with SAIS and rotator cuff disease (6, 7). Therefore, mechanical factors as well as inflammatory processes are involved in the pathophysiology of SAIS (8).

Vitamin D has an important role in the muscle metabolism and functions. It supports protein synthesis and muscle cell growth. The relation of vitamin D with muscle mass, strength, and functions has been shown in many studies (9-11). Vitamin D deficiency results in degenerative changes in type II muscle fibers, including rotator cuff muscles, and hence muscles tend to tear (12). Vitamin D has an important role in muscle performance. Oh et al. (10) found that vitamin D decreased the fatty degeneration of the supraspinatus and infraspinatus while increasing muscle performance in patients with shoulder problems. It can also have a role in tendon remodeling through MMPs, and low vitamin D level may delay the recovery of rotator cuff tendon repair by upregulating MMP-9 (13-15).

The mechanical factors arising from the musculoskeletal system and various inflammatory mechanisms are responsible for SAIS, as mentioned above. Also, vitamin D has important roles in the musculoskeletal system and inflammatory processes (16). Therefore, it would be beneficial to investigate the clinical effects of vitamin D on SAIS. We aimed to investigate the effects of vitamin D on pain, disability, and shoulder range of motion (ROM) in patients with SAIS.

METHODS

Subjects

Patients who were admitted to the physical medicine and rehabilitation outpatient clinic between January 01, 2014 and June 30, 2014 and had shoulder pain due to SAIS were retrospectively assessed in this study. The diagnosis of SAIS was based on the clinical findings and magnetic resonance imaging (MRI). SAIS was defined as positive shoulder tests for painful arc, Neer, and Hawkins tests and subacromial bursitis and/or rotator cuff tendon pathology in MRI. Patients who had a detailed physical examination (shoulder ROMs and positive for painful arc, Neer, and Hawkins shoulder tests), clinic evaluation (shoulder visual analog scale [VAS] disease arm shoulder hand [DASH] score), laboratory tests (liver and renal function tests, calcium, phosphorous, 25-OH vitamin D, and parathyroid hormone [PTH]), and subacromial bursitis and/or rotator cuff tendon pathology in MRI were included in the study.

Patients who had infectious shoulder arthritis, liver and renal function disorders, any rheumatologic (rheumatoid arthritis or spondyloarthropathy) and neurologic disorders, intraarticular fracture, a history of shoulder operation, adhesive capsulitis, calcific tendinitis, tip 3 acromion, bilateral shoulder lesion, full thickness rupture of rotator cuff tendons, and incomplete documentation were excluded.

Procedure

Age, gender, the affected shoulder side, duration of shoulder pain, shoulder ROMs for abduction, flexion, external rotation and internal rotation, blood level of 25-OH vitamin D, shoulder pain VAS, and DASH scores were recorded. The blood level of 25-OH vitamin D was used to determine the vitamin D level in patients.

Shoulder pain was assessed using VAS (0–10 cm scale; 0 means no pain, 10 means severe pain). DASH is a 30-item questionnaire. It evaluates pain, tingling, stiffness, weakness, social function, work, sleep, and self-confidence in patients (17).

The immunechemiluminometric assay was used to determine the vitamin D level in patients. The serum concentration of PTH was determined using an electrogenerated chemiluminescence immunoassay technology.

Patients were divided into three groups according to previous literature (18, 19): Group 1: 25-OH vitamin D <10 ng/mL, Group 2: 25-OH vitamin D 10-20 ng/mL, Group 3: 25-OH vitamin D >20 ng/mL. The demographic features, ROMs, VAS, and DASH scores were compared. Furthermore, the correlations of 25-OH vitamin D with ROMs, VAS, and DASH scores were analyzed.

This study was approved by the local ethics committee of Bakirköy Dr. Sadi Konuk Trainining and Research Hospital and was conducted in accordance with the ethical standards in the Declaration of Helsinki.

Statistical Analysis

The statistical analysis was performed using the Number Cruncher Statistical System 2007 &PASS (Power Analysis and Sample Size) 2008 Statistical Software (Utah, USA). When data of the study were assessed, descriptive statistics (mean, standard deviation, median, frequency, ratio and minimum and maximum) were reported. In comparison to quantitative data, non-normally distributed variables were compared between the two groups using the Mann-Whitney U test and between two or more groups using the Kruskal-Wallis test. The Spearman's Correlation analysis was performed to assess the relationship of non-normally distributed variables. Results were evaluated at a significance level of a $p<0.05$.

RESULTS

Eighty patients who met the study criteria were included in this study. The patients' mean age was 51.99±11.14 years, and the symptom duration was 6.32±5.89 months. There were 55 (68.8%) female and 25 (31.3%) male patients. There were 22 patients in Group 1, 43 patients in Group 2, and 15 patients in Group 3.

Table 1 shows the comparison of demographic features, shoulder ROMs, VAS, and DASH scores of the three groups. There was a significant difference in VAS between the groups. The shoulder VAS was significantly higher in Group 1 compared to Group 3 ($p=0.01$). No significant difference was observed for shoulder VAS between Groups 1 and 2 or between Groups 2 and 3. In addition, there was a statistically significant difference in the PTH levels between the groups ($p=0.024$). According to binary comparisons, PTH in Group 1 was significantly higher than that

Table 1. Demographic and clinical characteristics of groups

	Group 1	Group 2	Group 3	p
Age, years	47 (34-75)	53 (24-73)	50 (24-69)	0.183
Duration of disease, months	5 (2-24)	4.5 (1-36)	6 (2-24)	0.417
Affected side, right/left	14/8	23/20	9/6	0.722
Flexion, degrees	150 (90-180)	140 (20-180)	160 (90-180)	0,138
Abduction, degrees	140 (60-180)	120 (30-180)	150 (80-180)	0.157
IR, degrees	70 (40-90)	60 (10-90)	70 (30-90)	0.084
ER, degrees	60 (30-90)	60 (15-90)	50 (10-90)	0.939
VAS (0–10)	8 (3-10)	7 (0-10)	6 (0-10)	0.022*
DASH	66 (25-102)	78 (38-126)	67 (41-119)	0.270
PTH (pg/mL)	50.1(17.9-114)	35.59 (18.2-198)	30 (22.7-44.1)	0,024*

Values are expressed as median (minimum–maximum) or number of patients; Group 1: 25-OH vitamin D <10 ng/mL, Group 2: 25-OH vitamin D 10-20 ng/mL, Group 3: 25-OH vitamin D>20 ng/mL; VAS: visual analog scale; DASH: disease arm shoulder hand score; PTH: parathyroid hormone; IR: internal rotation; ER: external rotation; *p<0.05

Table 2. Correlation analysis of shoulder roms, vas, and dash with 25-oh vitamin D

	25-OH vitamin D	
	r	p
Flexion, degrees	−0.014	0.904
Abduction, degrees	0.099	0.404
IR, degrees	−0.113	0.344
ER, degrees	−0.086	0.468
VAS	−0.308	0.006*
DASH	0.065	0.574
PTH (pg/mL)	−0.483	0.001*

ROMs: range of motions; VAS: visual analog scale; DASH: disease arm shoulder hand score; PTH: parathyroid hormone; IR: internal rotation; ER: external rotation; * p<0.05

in Group 3 (p=0.005). No statistically significant differences were detected for PTH between Groups 1 and 2 or Groups 2 and 3 (p>0.05). There was no significant difference in the DASH score and shoulder ROMs between the groups. The correlation analyses of 25-OH vitamin D with shoulder ROMs, shoulder VAS, and DASH scores are shown in Table 2. A significant negative correlation was detected between 25-OH vitamin D and VAS.

DISCUSSION

The results of this study demonstrated that severe deficiency of vitamin D (25-OH vitamin D <10 ng/mL) increases shoulder pain in SAIS. In addition, it was observed that shoulder pain increases in SAIS as the level of vitamin D decreases. However, according to our results, there was no relation between vitamin D and disability or vitamin D and shoulder ROM in SAIS. To the best of our knowledge, this is one of the first studies which investigated the clinical relations between SAIS and vitamin D.

Subacromial impingement syndrome (SAIS) is often accompanied by subacromial bursitis, rotator cuff tendinosis, and tendon tears (2). Subacromial bursitis is the major reason of pain and disability in SAIS (8). It has been shown that inflammatory cytokines (interleukin [IL]-1, IL-6, tumor necrosis factor [TNF-α]), MMPs, and cyclo-oxygenases increase in the subacromial bursa of patients with SAIS (6, 7, 20). SAIS and rotator cuff pathologies can be painful and associated with inflammation (6, 16). Particularly, substance P and IL-1 in the subacromial bursa were correlated with pain (8, 20). The suppression effect of vitamin D on inflammatory mediators (IL-1 and TNF-α) and MMPs has been reported in previous studies (13, 21-24). According to the results of this study, vitamin D is negatively correlated with shoulder pain in SAIS. One of the possible mechanisms may be the suppressive effect of vitamin D on inflammatory cytokines and enzymes. In addition, it was shown that vitamin D promoted the proliferation of tendon-derived cells that were obtained from the supraspinatus muscle (25). Hence, vitamin D has crucial effects on the tendons in the subacromial space. The reduction of vitamin D level in the blood may cause PTH to rise. In this study, PTH is significantly higher in Group 1 than in Group 3. PTH causes weakness of the bone–tendon junction by inducing general osteoporosis with subperiosteal bone resorption (26). Increased PTH in severe vitamin D deficiency may also negatively affect the tendons passing from subacromial space.

Pain due to vitamin D deficiency is usually seen in the low back, pelvis, hip, back, and rib bones (27). The relationship between low vitamin D levels and pain in patients with non-specific musculoskeletal pain has been shown in previous studies (28-31). Also, replacement therapy for vitamin D deficiency improves pain and other musculoskeletal symptoms in patients with widespread pain (31). Vitamin D has important roles in the inflammatory process and musculoskeletal system; therefore, the deficiency of vitamin D may also play role in SAIS, which is closely related with both the systems.

Vitamin D is also one of the most common nutritional deficiencies in the world (32). In this study, vitamin D levels were deficient in 81% of patients with SAIS. Therefore, low vitamin D levels should be considered for patients who have severe shoulder pain in SAIS.