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Evaluation of Vitamin D Levels in Patients Treated in Physical Medicine and Rehabilitation Service

Fiziksel Tıp ve Rehabilitasyon Servisinde Tedavi Alan Hastalarda D Vitamin Düzeylerinin Değerlendirilmesi

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Abstract

Objective: The background of our study is to detect the frequency of vitamin D deficiency in hospitalized patients who had been administered physical medicine and rehabilitation (PMR) programs and the distribution of vitamin D deficiency according to patient groups.
Materials and Methods: A total of 1210 patients (805 females and 405 males) who received a PMR program in the inpatient clinics of a secondary state hospital between 01.01.2017 and 01.08.2022 were retrospectively included in the study. Age, gender, hospitalization diagnosis, serum 25-hydroxyvitamin D [25(OH)D] values were recorded.
Results: The median age of the participants was 64 (54-72). The median 25(OH)D value was 13.16 (8.73-19.36). When the participants were categorized into groups considering the diagnoses for which they were applied the physical therapy program, and 25(OH)D values were compared, a meaningful difference was determined between the diagnosis groups (p=0.020). The lowest median value was found in the group with internal derangement of the knee, muscle, and tendon injury group, followed by the neurologic rehabilitation group. The highest median 25(OH)D level was determined in the orthopedic rehabilitation group. Vitamin D deficiency or insufficiency was found in 93,9% of the patients. The neurologic rehabilitation group had the highest severe deficiency ratio (38.1%).
Conclusion: Vitamin D deficiency is often seen in patients hospitalized in PMR services. Therefore, we think measuring vitamin D levels during hospitalization and providing replacement and maintenance treatments if deficiency is detected may improve rehabilitation outcomes.
Keywords: Vitamin D, deficiency, rehabilitation, inpatient

Öz

Amaç: Çalışmamızın amacı fiziksel tıp ve rehabilitasyon (FTR) servislerinde yatarak tedavi alan hastalarda D vitamini eksikliği oranını ve hasta gruplarına göre dağılımını belirlemektir.
Gereç ve Yöntem: Çalışmaya ikinci basamak bir devlet hastanesinin FTR servislerinde 01.01.2017-01.08.2022 tarihlerinde yatarak tedavi alan 805'i kadın ve 405'i erkek olmak üzere toplam 1210 hasta retrospektif olarak dahil edildi. Tüm hastaların yaş, cinsiyet, hastaneye yatış tanısı, hastaneye yatış tarihindeki 25-hidroksivitamin D [25(OH)D] değerleri kaydedildi.
Bulgular: Çalışmaya alınan hastaların yaş ortalaması 64'tü (54-72). Ortalama 25(OH)D düzeyi 13,16'ydı (8,73-19,36). Hastalar fizik tedavi programı aldıkları tanılara göre gruplara ayrıldığında ve 25(OH)D düzeyleri değerlendirildiğinde, tanı grupları arasında bulunan farklılık anlamlıydı (p=0,020). En düşük ortanca değeri dizin iç bozukluğu, kas ve tendon yaralanması olan grupta bulunurken; bunu nörolojik rehabilitasyon grubu izledi. En yüksek ortanca değeri ise ortopedik rehabilitasyon grubunda olan hastalarda bulundu. Hastaların %93,9'unda D vitamini eksiklik veya yetersizliği saptandı. En yüksek ciddi eksiklik oranı ise nörolojik rehabilitasyon grubundaydı (%38,1).
Sonuç: FTR servislerinde yatan hastalar D vitamini eksikliği açısından risk altında olan bir popülasyondan oluşmaktadır. Bu nedenle hastalarımızın servislere kabul aşamasında D vitamini değerinin rutin ölçüm yapılıp, replasman ve idame tedavilerinin yapılmasının optimal rehabilitasyon sonuçlarına ulaşabilmek açısından faydalı olabileceğini düşünmekteyiz.
Anahtar kelimeler: D vitamini, eksiklik, rehabilitasyon, yatan hasta

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Introduction

Vitamin D was first discovered in 1913 (1). Vitamin D, in the structure of a steroid hormone, is effective in bone metabolism and increases the absorption of calcium, phosphorus, and magnesium (2). Although its primary activity site is bone metabolism, vitamin D receptors are determined in many systems in the body (3). Vitamin D deficiency was found a factor in the etiopathogenesis of many diseases, including autoimmune diseases, depression, type 2 diabetes, heart diseases, cancer, sarcopenia, osteoporosis, and infections in some studies (4,5). Approximately 60% of adults worldwide have vitamin D deficiency (6). A serum 25-hydroxyvitamin D [25(OH)D] level below 20 ng/mL (50 nmol/liter) is defined as vitamin D deficiency, and a serum 25(OH)D level of 21-29 ng/mL (525-725 nmol/liter) is determined as vitamin D insufficiency (7). A serum 25(OH)D value below 10 ng/mL is thought to increase the risk of osteomalacia (8). Above the age of 70 years, decreased sun exposure and synthesis in the skin have a negative effect on vitamin D levels.

Vitamin D deficiency is often seen in children, adolescents, and the elderly people (9). Female gender, age, dressing style, living in a nursing house, hospitalization, and obesity are accepted as risk factors for low vitamin D levels (2,10). Some studies has shown that patients participating in inpatient rehabilitation programs have many risk factors for low vitamin D values, including senility, multiple co-morbid diseases, and decreased mobilization (11). Patients receiving inpatient treatment in physical medicine and rehabilitation (PMR) services are mostly treated for neurological rehabilitation, such as hemiplegia and paraplegia, orthopedic rehabilitation, degenerative joint diseases, and spine-related pain, such as cervical and lumbar disc lesions (12). Various studies found that low vitamin D levels were often in neurologic rehabilitation patients, and improvement in various neuromotor areas is observed with vitamin D replacement (13,14). Some studies showed that low vitamin D values lead to increased pain and analgesic consumption (15). Studies evaluating vitamin D supplementation on pain scores in participants with low vitamin D levels have showed conflicting results (16). It was found that adequate serum 25(OH)D values decreased risk of falls and fractures in the older people (3). The measurement of serum 25(OH)D levels and supplementation, if necessary, in patients receiving physical therapy programs in inpatient clinics may contribute to neuromotor development and decrease pain scores, the risk of fracture, and falls. For this reason, we aimed to assess vitamin D deficiency in rehabilitation patients and determine the groups at risk for low vitamin D levels.

Materials and Methods

Patients who received inpatient treatment in the PMR services of a secondary state hospital between 01.01.2017 and 01.08.2022 were retrospectively included in the study. Age, gender, diagnosis of hospitalization, 25(OH)D, calcium, phosphorus, and parathormone values during hospitalization were recorded. Ethical approval was obtained from the Ankara City Hospital Clinical Research Ethics Committee before study (decision no: E2-22-2357, date: 07.09.2022).

Statistical Analysis

All analyses were performed with SPSS 25.0 (IBM®, USA). The data of our study are presented with frequencies and percentages. Kolmogorov-Smirnov test was used for normality analysis. Numerical variables that did not show normal distribution were presented as the median and interquartile range (IQR: 25-75th percentile). The chi-square test was applied to compare categorical data between groups, and the likelihood ratio was used. For the comparison of numerical variables between more than two groups, the Kruskal-Wallis test was used because of non-parametric distribution. Spearman correlation analysis was used to assess the variables associated with serum 25(OH)D values. $P<0.05$ was accepted for statistical significance.

Results

Data from 1210 patients, 805 women, and 405 men were analyzed for the study. The median age of the participants was 64 (IQR: 25th-75th: 54-72). Patients with stroke, paraplegia, tetraplegia, multiple sclerosis, and Parkinson's disease were included in the neurological rehabilitation group. In contrast, the orthopedic rehabilitation group included patients receiving post-fracture and arthroplasty rehabilitation. Degenerative arthropathies and rheumatic diseases were grouped, and patients receiving treatment for cervical, thoracic, and lumbar disc lesions were grouped under the intervertebral disc lesions group. When the patients were evaluated according to the diagnostic groups, the group with the highest number of patients was the intervertebral disc lesions group. The distribution of the patients according to the diagnostic groups is shown in Table 1. No meaningful difference was determined between genders in terms of vitamin D levels (p=0.392). No correlation was determined between age and serum 25(OH)D values (p=0.064). The median level of 25(OH)D and the biochemical values of the participants are shown in Table 2.

Table 1. The distribution of the patients according to diagnostic groups

Diagnostic group	(n/%)
Degenerative and rheumatic diseases	137 (11.3)
Intervertebral disc lesions	438 (36.2)
Internal derangement of the knee, muscle, and ligament injuries	38 (3.1)
Lymphedema	19 (1.6)
Neurological rehabilitation	388 (32.1)
Shoulder pathologies	133 (11.0)
Orthopedic rehabilitation	38 (3.1)
Peripheric neuropathy or peripheric nerve lesions	19 (1.6)

A meaningful difference was determined between the groups when the patients were compared regarding 25(OH)D levels according to the diagnostic groups they received physical therapy program (p=0.020). The lowest median value was found in the group with internal derangement of the knee, muscle, and tendon injury, followed by the neurologic rehabilitation group. The highest median value was found in patients receiving orthopedic rehabilitation (Table 3).

Only 6% of patients (73/1210) had normal 25(OH)D values. No patient was found to have a toxic level (>150 ng/mL) of 25(OH) D. The distribution of patients according to serum 25(OH)D values is summarized in Table 4.

According to 25(OH)D deficiency classification of the patients according to the diagnostic group, severe deficiency was determined often in the neurological rehabilitation patients (38.1%), and the highest rate of normal levels was found in patients with lymphedema and peripheral neuropathic/ peripheral nerve lesions. There was only a significant difference in severe deficiency between neurological rehabilitation and patients in the disc lesions group (p=0.028). The categorization of 25(OH)D values according to the diagnostic group of the patients is shown in Table 5.

Table 2. 25-hydroxyvitamin D and other biochemical values of the participants

25-hydroxyvitamin D (ng/mL)	13.16 (8.73-19.36)
Calcium (mg/dL)	9.3 (9.0-9.6)
Phosphorus (mg/dL)	3.8 (3.4-4.3)
Alkaline phosphatase (IU/mL)	80.0 (67.0-94.0)
Parathormone (pg/mL)	49.1 (33.4-66.2)

Table 3. Serum 25-hydroxyvitamin D levels of the patients in terms of diagnostic groups

Diagnostic group	25-hydroxyvitamin D (ng/mL)*	p-value
Degenerative and rheumatic diseases	13.83 (8.27-20.53)	0.020
Intervertebral disc lesions	14.09 (9.65-20.70)	
Internal derangement of the knee, muscle, and ligament injuries	11.45 (8.50-17.34)	
Lymphedema	13.69 (9.58-16.24)	
Neurological rehabilitation	12.16 (7.82-17.84)	
Shoulder pathologies	12.99 (8.86-21.40)	
Orthopedic rehabilitation	15.57 (9.91-19.37)	
Peripheric neuropathy or peripheric nerve lesions	11.7 (7.60-25.03)	

*Median (interquartile range; 25-75th percentile)

Table 4. Distribution of the patients according to 25-hydroxyvitamin D level

Severe deficiency	<10 (ng/mL)	385 (31.8%)
Deficiency	≥10-20 (ng/mL)	535 (44.2%)
Insufficiency	≥20-30 (ng/mL)	217 (17.9%)
Normal	≥30 (ng/mL)	73 (6.0%)

Discussion

Vitamin D deficiency is seen worldwide. The role of 25(OH)D in the improvement of balance, gait speed, and functional capacity and in the decrease of falls and fractures were shown in many studies (11,17). In a meta-analysis study conducted in 2019, prevalence 25(OH)D deficiency in Turkey was found to be 63% (18). Our study found vitamin D deficiency in 76% and deficiency or insufficiency in 93.9% of patients hospitalized in PMR services. Vitamin D deficiency is often seen in patients hospitalized in PMR services. It was found vitamin D deficiency was more often in women; 25(OH)D deficiency were associated with age, and obesity in a study (10). We found no difference in vitamin D levels according to age and gender. This discrepancy may be related to the age distribution of the patients who participated in the studies. In a review conducted in 2021, it was reported that the frequency of low 25(OH)D levels was more often in elderly, obese, hospitalized patients, and nursing house inhabitants (19).

Table 5. The category of 25-hydroxyvitamin D deficiency of the patients regarding the diagnostic group

Diagnostic group	Severe deficiency (<10 ng/mL)	Deficiency (≥10-20 ng/mL)	Insufficiency (≥20-30 ng/mL)	Normal level (≥30 ng/mL)
Degenerative and rheumatic diseases (n=137)	43 (31.4)	57 (41.6)	30 (21.9)	7 (5.1)
Intervertebral disc lesions (n=438)	116 (26.5)	207 (47.3)	84 (19.2)	31 (7.1)
Internal derangement of the knee and muscle and ligament injuries (n=38)	13 (34.2)	17 (44.7)	5 (13.2)	3 (7.9)
Lymphedema (n=19)	5 (26.3)	12 (63.2)	-	2 (10.5)
Neurological rehabilitation (n=388)	148 (38.1)	164 (42.3)	60 (15.5)	16 (4.1)
Shoulder pathologies (n=133)	42 (31.6)	52 (39.1)	28 (21.1)	11 (8.3)
Orthopedic rehabilitation (n=38)	9 (23.7)	21 (55.3)	7 (18.4)	1 (2.6)
Peripheric neuropathy or peripheric nerve lesions (n=19)	9 (47.4)	5 (26.3)	3 (15.8)	2 (10.5)

Similarly, we also found a high frequency of 25(OH)D deficiency in the inpatient participants consisting of predominantly elderly patients.

The frequency of low vitamin D levels was determined in 95.2% of patients with paraplegia in the study by Özgirgin et al. (20). Although serum 25(OH)D values were meaningful lower in the patients with paraplegia, this difference was not clinically significant. Also, ambulation status was reported as an important factor affecting serum 25(OH)D values. The frequency of low vitamin D levels was determined in 83% of patients admitted to subacute rehabilitation clinics (21). Similar to these studies, we found frequency of low vitamin D levels in 95.9% of participants in the neurologic rehabilitation group, including patients with spinal cord injuries.

A research that examined the serum 25(OH)D values of hospitalized rehabilitation patients found that, frequency of 25(OH)D deficiency were more than the average of normal population in parallel with our data. Vitamin D levels of non-ambulatory patients were found to be lower than those of ambulatory patients, and it was recommended that attention should be paid to 25(OH)D values in people hospitalized in rehabilitation clinics (22). In a study conducted in our country, it was shown that 25(OH)D usement provided a meaningful improvement in balance and functional capacity in patients with hemiplegia (14). The optimal replacement dose may be planned with the determine of 25(OH)D values at the beginning of rehabilitation program. In a study conducted in a rehabilitation center serving elderly patients, 25(OH)D values were determined normal only 4% of the patients similar to our study (3).

Mobilization scores and serum 25(OH)D values were correlated with each other in a study conducted in an inpatient rehabilitation center. The study also reported that patients with low vitamin D values had prolonged durations of hospitalization. (23). The diagnosis of determine of low 25(OH)D values and supplementation can shorten the duration of hospitalization and thereby reduce the complications associated with prolonged hospitalization, and also may reduce healthcare costs.

When evaluated according to the diagnostic groups, the lowest median vitamin D value was found in patients with internal knee disorders, muscle and tendon injuries, and then in the neurologic rehabilitation group. Especially in knee pathologies, impaired ambulation and thus decreased sun exposure may be associated with this finding. In neurological rehabilitation patients, decreased sun exposure due to ambulation difficulties and decreased 25(OH)D production in the skin due to the older age group can cause for low 25(OH)D values. The fact that the highest median serum 25(OH)D value was found in patients receiving orthopedic rehabilitation may be caused from the supplement of 25(OH)D supplements in these patients after a fracture.

Study Limitations

Our study has some limitations. Lack of information about the function and mobilization status of the patients and the use of vitamin D supplements are limitations of our study. On the other hand, analyzing a high number of patients at risk for low 25(OH) D values and detecting a high frequency of low vitamin D levels among this population may be considered valuable aspects of our study.

Conclusion

Vitamin D deficiency is often seen in patients hospitalized in PMR services. We believe that the diagnosis and appropriate treatment of vitamin D deficiency may improve rehabilitation skills by improving muscle strength, balance and gait. So, we suggest that routine measurement of serum 25(OH)D levels at the begining time of rehabilitation may be beneficial.

Ethics

Ethics Committee Approval: Ethical approval was obtained from the Ankara City Hospital Clinical Research Ethics Committee before study (decision no: E2-22-2357, date: 07.09.2022).

Informed Consent: Retrospective study.

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Authorship Contributions

Concept: E.Ş.B., Design: E.Ş.B., G.D.K., F.B., Data Collection or Processing: E.Ş.B., F.B., Analysis or Interpretation: E.Ş.B., G.D.K., Literature Search: E.Ş.B., Writing: E.Ş.B.

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