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Evaluation of Vitamin D Levels in Women with Carpal Tunnel Syndrome

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Abstract

Background: **For decades, the role of vitamin D was limited to the formation and maintenance of bone as well as homeostasis of calcium and phosphate. Vitamin D is a steroid molecule, mainly synthesized in the skin from 7 dehydro cholesterol by ultraviolet irradiation or obtained through the diet. The major circulating metabolite of vitamin D is 25(OH) Vitamin D (25(OH)D), with a half-life of 21–30 days. Serum concentration of 25(OH) D is the most reliable biochemical index of vitamin status. Aim: The goal of the present study was to investigate the relationship between vitamin D levels and carpal tunnel syndrome (CTS)** ***Patients and Methods:*** **This study included 50 female patients with mild to moderate CTS and assessed their serum 25-hydroxyvitamin D levels. We included patients with a diagnosis of CTS based on both the clinical symptoms and positive neurophysiology. Controls (electrophysiological negative symptomatic patients) were evaluated 50 patients matched with sex and age clinically by rheumatologist.** ***Results:*** **the mean age of patients with CTS symptoms and control group were 49.2 ± 10.6 (range 21–54) and 49.7 ± 10.6 (range 20–55), respectively, with no significant difference between the two groups (p = 0.534). Patients with CTS symptoms had significantly lower 25(OH) D levels compared to controls. There's significance difference among the CTS patient regarding Boston Carpal Tunnel Questionnaire (BQ).** ***Conclusion:*** **a potential link between vitamin D status and the occurrence of CTS is suggested.**

Keywords: *CTS, Vit. D, Boston Carpal Tunnel Questionnaire*

Introduction

For decades, the role of vitamin D was considered to be limited to the formation and maintenance of bone as well as homeostasis of calcium and phosphate. Vitamin D is a steroid molecule, mainly synthesized in the skin from 7 dehydro cholesterol by ultraviolet irradiation or obtained through the diet. The major circulating metabolite of vitamin D is 25(OH) Vitamin D (25(OH)D), with a half-life of 21–30 days. Serum concentration of 25(OH) D is the most reliable biochemical index of vitamin status. vitamin D deficiency has been reported to play a potential role in non-specific persistent painful conditions[(1-3)]. Recently the broad range of actions of vitamin D has been increasingly recognized. Vitamin D plays a critical role in calcium homeostasis and

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bone health. Low level of vitamin D status is associated with a variety of diseases, such as cardiovascular disease and cancer hypertension, type 2diabetes[4-7]. The administration of vitamin D has been shown to reduce neurological injury or neurotoxicity in various animal brain systems and to improve myelination and recovery after nerve injuries. Low vitamin D is related to neuropathy in patients with diabetes, Sjogren's syndrome and, other neurodegenerative disorders. In addition, severe vitamin D deficiency is associated with the risk of mild cognitive impairment as well as dementia[8-12]. Carpal tunnel syndrome (CTS) is the most common entrapment neuropathy. Although there are many potential causes of median nerve compression, idiopathic CTS is the most common. There is no biomarker for CTS. A study on proteome alterations in serum found that vitamin D binding proteins were down-regulated in patients with CTS. However; no study has been conducted measuring serum vitamin D levels in patients with CTS. The aim of this study was to investigate whether vitamin D status is associated with CTS, by comparing vitamin D levels between CTS patients and healthy[13]. The aim of the present study was to investigate the relationship between vitamin D levels and carpal tunnel syndrome (CTS).

Patients and Methods

This study included 50 patients with mild to moderate CTS and assessed their serum 25-hydroxyvitamin D levels. Additionally, the pain level of each subject was evaluated using the Visual Analogue Scale and Boston carpal tunnel questionnaire is a disease-specific measure of self-reported symptom severity and functional status[14]. We included patients with a diagnosis of CTS based on both the clinical symptoms and positive neurophysiology. All controls (electrophysiological negative symptomatic patients) were evaluated 50 patient matched with sex and age clinically by rheumatologist in terms of sensorial findings in median nerve distribution, the Phalen's test and, Tinel's sign. Subjects with normal examination findings were enrolled as control in this study. We excluded patients with negative neurophysiology, those treated with osteoporosis medication or calcium/vitamin D supplementation and those diagnosed with a disease influencing mineral metabolism, such as chronic kidney disease, hyperparathyroidism, malignancy, inflammatory arthritis, liver disease and diabetes mellitus. We also excluded patients with associated nerve compression such as cubital tunnel syndrome or cervical radiculopathy.

Results

The mean age of patients with CTS symptoms and control group were 49.2±10.6 (range 21–54) and 49.7±10.6 (range 20–55), respectively, with no significant difference (p= 0.534) (Table 1). Patients with CTS symptoms had significantly lower 25(OH) D levels compared to controls (910.5±7.1 7.7±5.0, p=0.002) (Table 2) there's significance difference among the CTS patient regarding Boston Carpal Tunnel Questionnaire (BQ). A significance difference was seen among the CTS patient regarding the comparison of 25(OH) D vitamin level between electrophysiological confirmed CTS patients and electrophysiological negative symptomatic patients (Table 3).

Discussion

In our study, we have examined the association between CTS symptoms and vitamin D levels. Our findings point out the high prevalence of vitamin D deficiency. In a previous study, vitamin D deficiency was found in 66% of the participants, with lower levels detected during the spring and winter months[15]. In another study with Indonesian participants attending to a

Table1: Demographic data and 25 (OH) D vitamins level in electrophysiological confirmed CTS patients and electrophysiological versus negative symptomatic patients

	electrophysiological confirmed CTS patients N=50	electrophysiological negative symptomatic patients (control group) N=50	P value
Age	49.2 ± 10.6	49.7 ± 10.6	0.543
25(OH)D vitamin (ng/ml)	10.5 ± 7.1	7.7 ± 5.0	0.002

CTS (carpal tunnel syndrome)

rheumatology outpatient unit, higher prevalence of hypo vitamin D was found as compared to healthy controls[16]. Hypovitaminosis D has been reported in 83 % of patients with chronic back pain, with clinical improvement following vitamin D replacement[17]. Also, among a group of patients with lumbar spinal stenosis, vitamin D deficiency was associated with more severe pain[18].

Table 2: Boston Carpal Tunnel Questionnaire (BQ), in electrophysiological confirmed CTS patients versus electrophysiological negative symptomatic patients

	electrophysiological confirmed CTS patients (n=50)	electrophysiological negative symptomatic patients (control group) (n=50)	P value
Symptom severity scale score	2.89 ± 0.90 (3.00)	2.62 ± 0.94 (2.55)	0.074
Functional status scale score	2.34 ± 0.88 (2.25)	2.27 ± 0.99 (2.00)	0.023
Pain sum score	14.21 ± 5.50 (15.00)	13.47 ± 5.85 (14.00)	0.014

Data are presented as CTS Mean ± SD (median); CTS: carpal tunnel syndrome

In a cross-sectional population based study from the UK involving 6824 adult patients, chronic widespread pain was found to be related to vitamin D levels[19] Similarly, in a Norwegian study involving a multi-national ethnic population, a higher prevalence of hypo vitamin D was found among those with nonspecific musculoskeletal pain, fatigue, or headache[20]. Furthermore, an association between diabetic neuropathic pain, diabetic neuropathy and vitamin D levels has been suggested by several studies[21,22]. A significant association between Vitamin D insufficiency and composite paresthesia has been reported in, diabetic patients from 2001 to 2004 National Health and Nutrition Examination Survey[23]. In this study, we found that women with CTS were younger than 50 years old had significantly lower levels of vitamin D than age matched healthy control women or patients with other upper limb conditions. we investigated whether vitamin D status is associated with carpal tunnel syndrome. We also found that the incidence of CTS was higher in vitamin D deficient women than in non-deficient women, especially women <50 years old. Several studies suggest that vitamin D may have a neuro protective role. The administration of vitamin D has been shown to reduce neurological injury in animal models by several mechanisms[24]. prevention of nerve growth factor depletion and decrease in calcium mediated neurotoxicity through down-regulation of calcium channels[9]. In addition, vitamin D has been shown to have antioxidative functions, such as sequestration of free radical and reactive oxygen species, reduction of oxidative stress[25,26] and down-regulation of the expression of nitric oxide synthase these mechanisms have

been implicated in the pathogenesis of several neuro inflammatory and neuro-degenerative disorders[27]. There are also several studies that report the relationship between vitamin D and peripheral nerve disorders. A high prevalence of vitamin D deficiency is reported in patients with diabetic peripheral neuropathy[28] and vitamin D supplementation has been found to be effective for pain relief in diabetic patients with neuropathic pain. Furthermore, low levels of vitamin D are associated with neuropathy among patients with Sjögren's syndrome. In addition, animal studies reported that vitamin D contributes to myelination and recovery after peroneal nerve injury in rats and facial nerve injury in rabbits[29].

Table 3: 25 (OH) D vitamin level in electrophysiological confirmed CTS patients versus electrophysiological negative symptomatic patients

	With Vit. D deficiency#	Without Vit. D deficiency$	P value
electrophysiological confirmed CTS patients	19.8 SD 11.9	21.2 SD 9.2	0.054
electrophysiological negative symptomatic patients (control group)	20.8 SD 11.9	22.2 SD 9.2	0.023

CTS: carpal tunnel syndrome; # = serum vitamin D <20 ng/mL; $= serum vitamin D ⩾20 ng/mL

Vitamin D has been shown to activate the transcription of several myelin related genes [10], as well as stimulate expression of neurotrophins and increase axon growth. Therefore, further studies are needed to determine whether vitamin D supplementation would be helpful for patients with CTS. In our study, an association between vitamin D status and CTS was shown in patient less than 50 years old and low vitamin D level correlated with a lower age at presentation. We consider that low vitamin D levels may lead to a decrease in the neuro protective effect of vitamin D, resulting in earlier presentation of symptoms of CTS in women <50 years old. Finally, this cross-sectional study does not indicate a causal relationship but just an association between vitamin D and CTS; we lacked subject information on factors that can affect vitamin D levels, such as sun exposure time, seasonal variation and dietary habits.

Conclusion

This study suggests a potential association between vitamin D status and the occurrence of CTS. Further studies are necessary to confirm this relationship and to explore the potential role of vitamin D in the pathogenesis of CTS.

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