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A Cross-Sectional Study On Association of Vitamin D Levels with Severity of Knee Osteoarthritis

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ABSTRACT

Introduction: Vitamin D deficiency is worryingly highly prevalent among patients with osteoarthritis and is associated with worsening joint pain and functional decline. Vitamin D reduces bone turnover and cartilage degradation, thus potentially preventing the development and progression of osteoarthritis. Osteoarthritis formerly characteristics, history of chronic illnesses, drugs including vitamin D and calcium supplementation, duration of daily sunshine exposure, prior or current involvement in sports, alcohol and smoking. **Objectives of the study**: The aim and objectives of our study were to estimate serum vitamin D levels in subjects with osteoarthritis and to correlate vitamin D levels with severity of symptoms of osteoarthritis. **Materials and Methods**: We included a total of 120 in the age group of 40-60 years diagnosed patients of osteoarthritis using American College of Rheumatology clinical criteria. A questionnaire captured patient demographics and clinical characteristics. Joint pain, stiffness and physical function severity were assessed and graded based on the Western Ontario and McMaster Universities Arthritis Index (WOMAC). We determined serum vitamin D levels by electrochemilumniscence immunoassay. **Results**: In the present study, we included 120 diagnosed cases of Osteoarthritis, out of which 102 were females and 18 were males respectively accounting for 85% and 9% respectively. In our study 94 subjects belong to age group >50 years and 26 were aged <50 years accounting for 78% and 21.66% respectively. We found that 52 patients had family history of OA and 68 patients had no history of OA accounting for 43.3% and 56.6% respectively. Chronic disease status was evaluated, we found that 70 were diabetic and 50 were hypertensive accounting for 58.33% and 41.66 % respectively. Similarly, BMI was evaluated, we found that 42 patients had BMI in the range of overweight and 56 were obese. Laboratory investigations were performed using random blood sample for the estimation of plasma vitamin D and ionised calcium. We found that 112 (93.3%) patients had normal serum calcium levels, out of 120 patients 44 (36.66%) had sufficient vitamin D levels, 54 (45%) had insufficient levels and 22 (18.33%) had deficiency of vitamin D. We evaluated clinical presentation in these patients, we found that 118 (98.33%) had pain in knee, 82 (68.33%) had morning stiffness, 46 (38.33%) had crepitus on active movement, 44 (36.66%) had tenderness over knee, 12 (10%) had bony enlargement and 8 (6.66%) had palpable warmth over knee. We correlated vitamin D levels with joint symptoms, we found no significance existed between vitamin D levels and pain in knee, morning stiffness, physical function and total WOMAC. **Conclusion**: In the present study, we did not find statistically significant correlation between vitamin D levels and severity of osteoarthritis. Further studies are required with more sample size to confirm our findings.

Key Words: *osteoarthritis, vitamin D, knee pain, joint stiffness, physical function and body mass index*

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INTRODUCTION

Vitamin D deficiency is worryingly highly prevalent among patients with osteoarthritis and is associated with worsening joint pain [1, 2] and functional decline [3]. VitaminD reduces bone turnover and cartilage degradation, thus potentially preventing the development and progression of osteoarthritis [4]. Osteoarthritis formerly characteristics, history of chronic illnesses, drugs including vitamin D and calcium supplementation, duration of daily sunshine exposure, prior or current involvement insports, alcohol and smoking. Weight and height were taken using a calibrated weighing scale and stadiometer respectively for body mass index calculation. Assessment of osteoarthritis symptom Severity (joint pain, stiffness and physical function) Joint pain, stiffness and physical function were assessed by the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) [5- 10]. The WOMAC tool consists of 24 items divided into 3 subscales each with ascore ranging from 0 to 4 where 0 = none, 1 = slight, 2 = moderate, 3 = severe, 4 = extreme. The total WOMAC score ranges from 0 to 96 and was determined by the sum of the pain, stiffness and physical function scores. Higher scores indicate more severe disease. The 3 subscales assessed: 1. Pain (5 items): during walking, climbing stairs, sleeping at night (in bed), resting (sitting or lying), and standing upright. 2.

Stiffness (2 items): after first waking (morning) and later in the day (evening). 3. Physical Function (17 items): descending stairs, ascending stairs, rising from sitting, standing, bending to floor, walking on even floor, getting in/out of a car, shopping, putting on socks, taking off socks, rising from bed, lying in bed, getting in / out of bath, sitting, getting on/off toilet, doing light domestic duties, doing heavy domestic duties.

AIM AND OBJECTIVES OF THE STUDY

The aim and objectives of our study wereto estimate serum vitamin D levels in subjects with osteoarthritis and to correlate vitamin D levels with severity of symptoms of osteoarthritis.

MATERIALS AND METHODS

A hospital based cross-sectional study was conducted at our hospital, to estimate the serum levels of vitamin D and to correlate the levels of vitamin D with severity of osteoarthritis in subjects with osteoarthritis.We included a total of 120 in the age group of 40-60 years diagnosed patients of osteoarthritis using American College of Rheumatology clinical criteria. A questionnaire captured patient demographics and clinical characteristics. Joint pain, stiffness and physical function severity were assessed and graded based on the Western Ontario and McMaster Universities Arthritis Index (WOMAC). We determined serum vitamin D levels by electrochemilumniscence immunoassay.

Sample collection and analysis: 4 mL of venous blood from each consented study patient aseptically was drawn into a plain blood sample tube (BD Vacutainer) and allowed the blood to coagulate at room temperature for not more than 4 h. The bloodsamples were then taken to a clinical chemistry laboratory at the study site, centrifuged immediately and stored at -20 °C in a refrigerator for up to 3 months.

Vitamin D levels were estimated by electrochemiluminiscencse method, it measures the concentration ranging from 4-100 ng/mL. We corrected serum calcium levels for albumin for deranged albumin levels using the following formula: Corrected calcium (mmol/L) = measured serum calcium + [(normal albumin − patient's albumin) Å~ 0.02]. Hypocalcaemia was defined as serum calcium concentration corrected for albumin < 2.2 mmol/L. The data were analysed and adjusted for age, sex, education, occupation, family history, body mass index (BMI) and calcium supplementation.

RESULTS

Table 1: Shows the socio-demographic, clinical and laboratory characteristics of the study subjects

Variable	Number of patients	Percentage
Age in years		
>50	94	78.33
<50	26	21.66
Gender		
Females	102	85
Males	18	9
Family history of OA		
Yes	52	43.3
No	68	56.6
Chronic disease		
Diabetes	70	58.33
Hypertension	50	41.66
Calcium supplementation		
Yes	8	6.66
No	112	93.33
BMI		
Overweight	42	35
Obese	56	46.66
Laboratory investigations		
Normal serum calcium level	112	93.33
Serum Vitamin D (ng/mL**)**		
Sufficient (>30 ng/mL)	44	36.66
Insufficient (20-29 ng/mL)	54	45
Deficient (<20 ng/mL)	22	18.33

Table 2: Shows the symptom presentation of subjects with Knee OA as per ACR criteria

Symptoms	Number of patients	Percentage
Pain in knee	118	98.33
Morning stiffness less than 30 minutes	82	68.33
Crepitus on active movement	46	38.33
Tenderness over knee	44	36.66
Bony enlargement	12	10
Palpable warmth over knee	8	6.66

Table 3: Shows the Spearman's rank correlation coefficient of the association between vitamin D and joint symptoms

Symptoms	r value	p value
Pain in knee	0.19	NS
Morning stiffness	0.12	NS
Physical function	0.08	NS
Total joint, stiffness, physical function (total WOMAC)	0.14	NS

DISCUSSION AND CONCLUSION

In the present study, we included 120 diagnosed cases of Osteoarthritis, outof which 102 were females and 18 were males respectively accounting for 85% and 9% respectively. In our study 94 subjects belong to age group >50 years and 26 were aged <50 years accounting for 78% and 21.66% respectively. We found that 52patients had family history of OA and 68 patients had no history of OA accounting for 43.3% and 56.6% respectively. Chronic disease status was evaluated, we found that70 were diabetic and 50 were hypertensive accounting for 58.33% and 41.66 % respectively. Similarly, BMI was evaluated, we found that 42 patients had BMI in the range of overweight and 56 were obese. Laboratory investigations were performed using random blood sample for the estimation of plasma vitamin D and ionised calcium. We found that 112 (93.3%) patients had normal serum calcium levels, out of 120 patients 44 (36.66%) had sufficient vitamin D levels, 54 (45%) had insufficient levels and 22 (18.33%) had deficiency of vitamin D. We evaluated clinical presentation in these patients, we found that 118 (98.33%) had pain in knee, 82 (68.33%) had morning stiffness, 46 (38.33%) had crepitus on active movement, 44 (36.66%) had tenderness over knee, 12 (10%) had bony enlargement and 8 (6.66%) had palpable warmth over knee. We correlated vitamin D levels with joint symptoms, we found no significance existed between vitamin D levels and pain in knee, morning stiffness, physical function and total WOMAC.

There was no correlation between serum vitamin D levels and the severity of joint symptoms suggesting that other mechanisms could be involved in the pathogenesis of osteoarthritis or simply that osteoarthritis is a degenerative disease not related to vitamin D in our settings. This finding is similar to a study in Turkey where 90% of the patients with knee osteoarthritis were vitamin D deficient (< 10 ng/ml) [9]. On the other hand, relatively low serum vitamin D concentrations were associated with higher joint pain scores in a cross sectional study among postmenopausal women in the USA. Low vitamin D levels were also associated with pain in a cross sectional study of a large-scale population from the Hertfordshire cohort study in United Kingdom [2]. Moderate vitamin D deficiency independently predicted incident, or worsening knee and hip pain over 5 years in a longitudinal population-based cohort study of randomly selected older adults in Australia [1]. There is paucity of data comparing serum vitamin D concentrations and physical function severity in patients with knee osteoarthritis using the WOMAC index.

Addressing factors that may impact vitamin D synthesis such as reduced outdoor activities, and type of clothing which reduces the required ultraviolet-B (UVB)- induced vitamin D production in the skin especially in dark skinned people is required. People with a naturally dark skin tone have natural sun protection and require at least three to five times longer exposure to make the same amount of vitamin D as a person with a white skin tone. Increased skin pigment reduces the capacity of skin to synthesize vitamin D3. A higher prevalence of vitamin D deficiencyis associated with immigrant background among children and adolescents in Germany. Also, we need to think about possible medications which interfere with vitamin D production in our population like anticonvulsants and HAART. Steroid and xenobiotic receptor and vitamin D receptor crosstalk mediates CYP24 expression and drug-induced osteomalacia. This high prevalenceof suboptimal vitamin D poses a particularly important public health issue as it 's an independent risk factor for total mortality in the general population [11-14].

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