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EFFECTS OF SERUM VITAMIN D DEFICIENCY ON KNEE OSTEOARTHRITIS

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ABSTRACT

Background: Normal bone and cartilage metabolism depends on the presence of vitamin D. Suboptimal levels of vitamin D have been shown to have adverse effects on calcium metabolism, osteoblastic activity, matrix ossification, bone density, and articular cartilage turnover there by influence the knee joint cartilage and lead to development and progression of knee Osteoarthritis (OA). So this study was an attempt to explore the status of serum vitamin D (25-OHD) levels in patients with knee OA compared with controls.

Methods: A total of 100 patients with knee OA and 100 controls were taken in the study. Serum 25-OHD was measured by the ELISA method and concentrations <20 ng/ml were considered as deficient levels. Mann-Whitney U test was used for comparisons of means and the association of vitamin D deficiency and knee OA was assessed using chi- square test with calculation of odds ratio (OR) and its 95% confidence interval (95% CI).

Results: The mean ages of cases and controls were 59.58±11.37 and 58.46±10.58 years, respectively (P=0.234). In the entire population the mean serum 25-OHD in OA patients was significantly lower than controls (P = 0.004*), but in subgroup analysis the OA patients aged >=60 years the mean serum 25-OHD was not significantly lower than controls (46.08±24.73 ng/ml vs 46.74 ± 24.31 ng/ml, P = 0.93) whereas in OA patients aged <60 years the mean serum 25-OHD was significantly lower than that of controls (P=0.00012*).

Conclusion: These findings indicate a significant association between serum 25-OHD deficiency and knee OA in patients aged < 60 years and suggest serum 25-OHD measurement should be done in any patient with symptoms suggestive of knee OA particularly at the initial stage of disease.

KEYWORDS :

INTRODUCTION

The term VITAMIN D specifically refers to the parental vitamin D produced endogenously by the action of sunlight on 7-dehydrocholesterol in skin or obtained from the dietary foodstuffs. [1]

As OA is characterized radiographically by loss of articular cartilage and changes in the bone surrounding the joint. Normal bone and cartilage metabolism depends on the presence of vitamin D. Suboptimal levels of vitamin D have been shown to have adverse effects on calcium metabolism, osteoblastic activity, matrix ossification, bone density, and articular cartilage turnover. [2-5] Studies of radiographic knee OA showed that low levels of serum and dietary vitamin D were associated with an increase in radiographic progression. [6] A higher than expected rate of vitamin D deficiency, has been reported in OA, indicates that these patients are at higher risk of disease progression [7,8]. Hence, knowledge of the serum status of VITAMIN D (25-OHD) may provide additional information for recognising patients at risk of progression. To date, few studies have addressed this topic so data on this subject are lacking. We therefore performed this study to determine the status of serum vitamin D levels in patients with knee OA compared to age- matched controls as well as we have tried to find the status of serum vitamin D levels in patients of different age group.

METHODS

In this study the Cases groups were 100 adults of both sexes above 45 years of age diagnosed as Osteoarthritis from Orthopedics OPD of Vardhaman Mahavir Medical College & Safdarjung Hospital, New Delhi and Controls were 100 apparently healthy adults of both sexes above 45 years of age without any history of joint pain and Vitamin D intake. Diagnosis of Osteoarthritis of knee was done as per the American College of Rheumatology criteria of age above 45 years. Radiographs were taken to confirm the diagnosis of OA by Kellgren and Lawrence scores (KL scores). The control group were again reviewed for no clinical features of knee OA based on history and clinical examination. Exclusion Criteria taken into consideration were those who had taken calcium and vitamin D supplements, patients of Rheumatoid arthritis, Gout, Congenital lower limb deformity, H/O severe trauma to the affected joint, Parathyroid disorder, H/O intake of Drugs that affect the levels of Vitamin -D like anti-TB drugs, anti-seizure drugs, anti-fungal drugs, anti-HIV drugs, corticosteroids as well as patients with KL Scores of 4.

Serum Vitamin D levels were estimated by ELISA technique. This assay utilizes a competitive ELISA technique with a selected monoclonal antibody recognising 25(OH) vitamin D. According to instructions of the manufacturer, Serum 25-OHD levels less than 20 ng/ml were considered as deficient. In statistical analysis the mean serum 25-OHD levels and proportion of serum 25- OHD deficiency were determined in groups and compared with the matched controls. Additional subgroup analyses were performed according to age particularly age groups of less than 60 years versus ≥ 60 years. Mann-Whitney U test was used for comparison of means. The association of vitamin D deficiency and knee OA was assessed using chi- square test with calculation of odds ratio (OR) and its 95% confidence interval (95% CI).

RESULTS

A total of 100 patients with mean (±SD) age of 59.58±11.37 years, median of 58 and 100 controls with mean (±SD) age of 58.4 ±10.58 years, median of 59 years old (P = 0.234) entered the study. In the entire population of OA, the mean serum 25OHD level in patients was lower than controls and the difference was statistically significant (36.26 ± 21.08 vs 44.36 ±22.28 ng/ml, P = 0.004*). Again serum 25-OHD deficiency was observed in 20% of patients versus 9% of controls (P = 0.04*) (Table 1). There by suggesting an association between serum 25-OHD deficiency and knee OA.

In subgroup analysis of subjects <60 years the mean serum 25-OHD level in patients was significantly lower (27.9 ± 12.23 vs 42.64 ± 20.52 ng/ml, P = 0.00012*) and proportion of serum 25-OHD deficiency was significantly higher in cases than controls (27.8% vs 8.6%, OR = 0.245 95% CI= 0.082-0.732, P = 0.01*). Whereas in populations aged 60 years and older there were no significant differences in means and proportions of serum 25-OHD deficiency between patients and controls (46.08 ± 24.73 vs. 46.74 ± 24.31 ng/ml, P = 0.93 and 10.8% vs. 9.5%; P = 1, respectively).

Additional analysis in regard to mean serum 25-OHD and serum 25-OHD deficiency demonstrated a significant difference between means and the proportion of serum-25- OHD deficiency according to age of less than 60 years compared with 60 years and older in the patient

group but not in the control group (27.89 ± 12.23 vs. 46.08 ± 24.73 ng/ml, P = 0.0008*, and 27.8% vs 10.8%, OR = 0.32 , 95%CI =0.105-0.955, P=0.04*, respectively).

In the entire study population serum 25-OHD deficiency was not homogenously distributed across age but was more frequent in subjects aged < 60 years compared with ≥60 years particularly in the patient group (P= 0.04*)(Table 1). In this age group there was a significant positive association between serum 25-OHD deficiency and knee OA.

Table 1:Mean s erum 25-hydroxy vitamin D (25-OHD) and proportion of serum 25-OHD deficiency in patients with knee osteoarthritis compared with controls according to age

SERUM 25-OHD	All OA (n=100) Vs Controls (n=100)	<60 yrs OA (n=54) Vs Controls (n=58)	≥60 yrs OA(n=46) Vs Controls (n=42)	<60 yrs OA (n=54) Vs >= 60 yrs OA (n=46)
Mean Serum 25-OHD (ng/ml)	36.26±21.08 vs. 44.36±22.28; P=0.004*	27.9±12.23 vs. 42.64±20.52; P=0.00012*	46.08±24.73 vs. 46.74±24.31; P=0.93	27.9±12.23 vs. 46.08±24.73; P=0.0008*
Serum 25-OHD deficiency , n(%)	20(20%) Vs. 9(9%); P=0.04*	15(27.8%) Vs. 5(8.6%); P=0.01*	5(10.8%) Vs. 4(9.5%); P=1	15(27.8%) Vs. 5(10.8%); P=0.04*
OR (95% CI)	0.395 (0.17-0.12)	0.25 (0.082-0.732)	0.86 (0.22-3.45)	0.32 (0.105-0.955)

DISCUSSION

The findings in this study suggests that there is a significant difference in the average Serum 25-OHD levels among cases and controls ; especially in a subgroup of patients with knee OA aged less than 60 years. Our finding were in congruence to studies done by McAlindon which suggested that low serum levels of Vitamin D were associated with progression of knee OA [6]. Ding C , in his study also found that Serum 25(OH)D levels were associated with decrease knee cartilage loss [9]. A longitudinal study done by Nancy E. Lane also suggested that low serum Vitamin D may be associated with Hip OA[10].

Based on current knowledge, knee OA should be considered a bone disease rather than a synovial disease [11,12]. Early joint structural changes such as cartilage defects, loss of cartilage volume, subchondral bone expansion and bone marrow lesions are present prior to the onset of joint symptoms and clinical OA [13]. Bone expansion in the tibial subchondral area play an initial role in the aetiology of knee cartilage defects and cartilage loss. These defects tend to progress in symptomatic knee OA. Prevention of cartilage damage or reducing their severity by intervention may retard OA progression [13].

Inadequate levels of serum 25-OHD in patients with knee OA is of major concern. Since at low tissue concentrations of serum vitamin D , bone response to pathophysiological processes is not optimal, vitamin D deficiency provides a susceptible background for OA progression [6,9,14,15]. Hence, serum 25-OHD measurement should be considered in any patients with symptoms suggestive of knee OA even before the appearance of radiographic changes. Improvement of serum 25-OHD to a sufficient level augments skeletal health and alters joint response to risk factors and retards progression of OA.

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