National Journal of Clinical Orthopaedics

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Bone mineral density and vitamin D level in patients with osteoarthritis of the knee

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Abstract
Background: Vitamin D deficiency is one of the most common and under-diagnosed medical conditions in the world, since a significant proportion of the population in many countries and regions around the world have low vitamin D levels.
Aim of the study: To evaluate bone mineral density and vitamin D level in patients with osteoarthritis of the knee.
Materials and methods: The study was conducted in the Department of Orthopedics of the Medical institute. For the study, we selected patients from the outpatient department of the Orthopedics department diagnosed with knee osteoarthrits. The diagnosis was confirmed by radiological studies. Patients taking osteotropic medication, with rheumatoid disease, plasmacytoma, nicotine or alcohol abuse, hypercortisolism, hyperthyreosis, primary hyperparathyroidism, hypogonadism were excluded from the study. A total of 100 patients were included in the study. After the grouping of the patients, the Serum 25(OH)D estimation of each patient was done by collecting blood from venipuncture site. The patients were grouped according to the Serum 25(OH)D level, >30 ng/dl and <30 ng/dl.
Results: A total of 100 patients were included in the study. The mean age of the subjects was 71.65 years. The patients were grouped into group 1, 2 and 3 based on their BMD scores. The number of patients in group 1 was 33, in group 2 was 42, and in group 3 was 25. The mean age of the patients in group 1 was 61.28 years, group 2 was 73.11 years and group 3 was 76.14 years. In Group 1, the number of patients with Serum 25(OH)D <30 ng/ml was 10 and Serum 25(OH)D <30 ng/ml was 13. In Group 2, the number of patients with Serum 25(OH)D <30 ng/ml was 22 and Serum 25(OH)D <30 ng/ml was 20. In group 3, the number of patients with Serum 25(OH)D <30 ng/ml was 15 and Serum 25(OH)D <30 ng/ml was 10.
Conclusion: Within the limitations of the study we conclude that, periodic screening of vitamin D levels in patients should be done and treated as needed, and thereby, reduce the risk of osteoarthritis and other complications.

Keywords: Vitamin D, osteoarthritis, knee joint

Introduction

Vitamin D deficiency is one of the most common and under-diagnosed medical conditions in the world, since a significant proportion of the population in many countries and regions around the world have low vitamin D levels [1, 2] The 25-hydroxyvitamin D level depends on various parameters, including the amount of solar ultraviolet B (UVB) irradiation (determined by the time of day, season latitude, skin pigmentation, and use of sunscreen), age, dietary habits, gender, obesity, and many others.[3]Osteoarthritis (OA) is a progressive and degenerative joint disease. Commonly affecting weight bearing synovial joints, OA is characterized by the degradation and loss of articular cartilage, abnormal subchondral bone growth and remodeling, and, in early stages, inflammation of the synovium [4] The complexity of OA has hindered attempts to understand its etiology which still remains elusive. There are, however, a range of risk factors known to associate with OA including age, gender, obesity, previous joint trauma, and genetics [5] It has been shown that the capacity of human skin to produce vitamin D decreases in old age. Furthermore, vitamin D levels are associated with other known risk factors of OA including body mass index (BMI), age, very heavy manual labour, and exercise [6]. Hence, the present study was conducted to evaluate bone mineral density and vitamin D level in patients with osteoarthritis of the knee.

Materials and methods

The study was conducted in the Department of Orthopedics of the Medical institute.

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The ethical clearance for the study was obtained from the ethical board of the institute prior to commencement of the study. For the study, we selected patients from the outpatient department of the Orthopedics department diagnosed with knee osteoarthrits. The diagnosis was confirmed by radiological studies. Patients taking osteotropic medication, with rheumatoid disease, plasmacytoma, nicotine or alcohol abuse, hypercortisolism, hyperthyreosis, primary hyperparathyroidism, hypogonadism were excluded from the study. A total of 100 patients were included in the study. Preoperatively, Bone material density (BMD) was assessed at the lumbar spine in anteroposterior (AP) and lateral projections of all the patients. Patients were divided into 3 groups based on their BMD scores:

Group 1: T-score: 0 to –1 - Physiological BMD
Group 2: T-score: –1 to –2.5 - Osteopenia
Group 3: T-score: 6 –2.5 - Osteoporosis

After the grouping of the patients, the Serum 25(OH)D estimation of each patient was done by collecting blood from venipuncture site. The patients were grouped according to the Serum 25(OH) D level, >30 ng/dl and <30 ng/dl.

The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student's t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistical significant.

Results

Table 1 shows the demographic characteristics of the patients. A total of 100 patients were included in the study. The mean age of the subjects was 71.65 years. The patients were grouped into group 1, 2 and 3 based on their BMD scores. The number of patients in group 1 was 33, in group 2 was 42, and in group 3 was 25. The mean age of the patients in group 1 was 61.28 years, group 2 was 73.11 years and group 3 was 76.14 years [Fig 1]. Table 2 shows the vitamin D levels in Group 1, 2 and 3. In Group 1, the number of patients with Serum 25(OH)D <30 ng/ml was 10 and Serum 25(OH)D <30 ng/ml was 13. In Group 2, the number of patients with Serum 25(OH)D <30 ng/ml was 22 and Serum 25(OH)D <30 ng/ml was 20. In group 3, the number of patients with Serum 25(OH)D <30 ng/ml was 15 and Serum 25(OH)D <30 ng/ml was 10. The results were comparable and were statistically non-significant [Fig 2].

Table 1: Characteristics of the patients

Parameters	Group 1	Group 2	Group 3
No. of patients	33	42	25
Mean age (years)	61.28	73.11	76.14
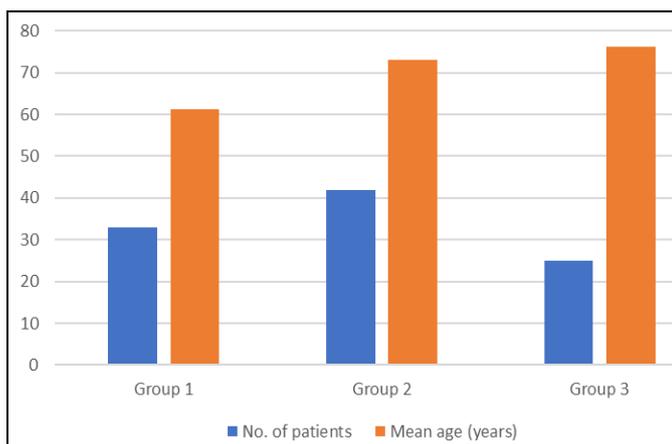
Fig 1: Demographic data

Table 2: Vitamin D levels in Group 1, 2 and 3

| Groups	Serum 25(OH)D		p-value
	<30 ngml^{-1}	>30 ngml^{-1}	
Group 1	20	13	0.22
Group 2	22	20	0.09
Group 3	15	10	0.11
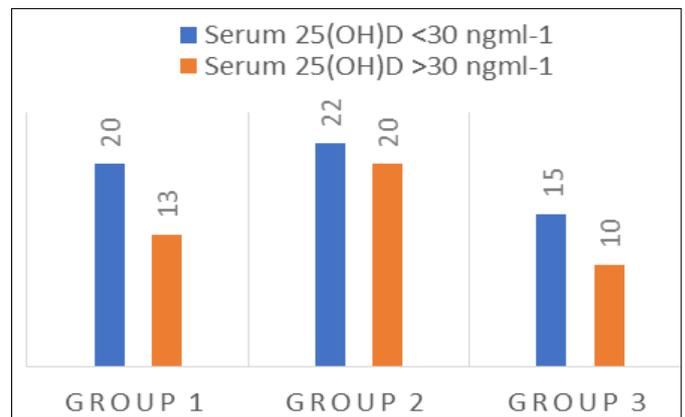
Fig 2: Vitamin D levels in Group 1, 2 and 3

Discussion

In the present study, we studied 100 patients. The number of patients in group 1 was 33, in group 2 was 42, and in group 3 was 25. The mean age of the patients in group 1 was 61.28 years, group 2 was 73.11 years and group 3 was 76.14 years. In Group 1, the number of patients with Serum 25(OH)D <30 ng/ml was 10 and Serum 25(OH)D <30 ng/ml was 13. In Group 2, the number of patients with Serum 25(OH)D <30 ng/ml was 22 and Serum 25(OH)D <30 ng/ml was 20. In group 3, the number of patients with Serum 25(OH)D <30 ng/ml was 15 and Serum 25(OH)D <30 ng/ml was 10. The results were comparable and were statistically non-significant. Cakar M *et al.* determined the association between serum concentrations of vitamin D and osteoarthritic knee pain. Vitamin D concentrations were measured with the 25 hydroxyvitamin D test in patients presenting with clinical symptoms of primary knee osteoarthritis. Osteoarthritis was graded on the Kellgren-Lawrence grading scale from anteroposterior and lateral radiographs. Height, weight, and body mass index (BMI) were recorded. Patients completed a 10-cm visual analogue scale (VAS) for indicating pain and the Western Ontario and McMaster Universities Arthritis Index (WOMAC). Vitamin D concentration was defined as severely deficient, insufficient, or normal. Of 149 patients (133 women), the mean age was 63.6 years. Mean vitamin D concentration was 11.53 ng/mL, and 90% patients were vitamin D deficient. Mean WOMAC score was 57.2, and VAS pain score was 7.5. Kellgren-Lawrence grade was 2 for 10 patients, grade 3 for 61, and grade 4 for 88. Mean BMI was 33.4. Mean values of VAS, WOMAC, and BMI did not differ by vitamin D status. They concluded that serum vitamin D concentration is not associated with knee pain in patients with osteoarthritis. Alkan G *et al.* investigated the effects of vitamin D deficiency on the functional status and disease prognosis of patients with knee osteoarthritis. The study comprised 100 patients that met the American College of Rheumatology criteria for a diagnosis of knee osteoarthritis. Each patient underwent knee radiography, the results of which were graded according to Kellgren and Lawrence radiographic grading scale; those that met the diagnostic criteria were included in the study. The visual analog scale (VAS), Nottingham Health Profile (NHP), Western Ontario and

McMaster Universities Osteoarthritis Index (WOMAC) and Lequesne Knee Osteoarthritis Index were used to assess patients' pain, function and quality of life. Complete blood counts, sedimentation rates and serum C-reactive protein, rheumatoid factor, alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, sodium, potassium, calcium, phosphorus, parathyroid and thyroid hormone levels were routinely recorded for each patient. Vitamin D levels were analyzed in winter (between November and February) using high performance liquid chromatography. Patients were divided into two groups, Group 1 and Group 2, according to the presence or absence of vitamin D deficiency. The groups did not differ significantly in terms of age, disease duration, sex distribution, presence of osteoporosis or radiographic stage of knee osteoarthritis. However, the NHP pain, physical activity, fatigue, social isolation, and emotional reactions subsets, WOMAC pain and physical function subsets and total score, Lequesne knee osteoarthritis index, and patient/physician VAS scores were significantly higher in Group 1 than in Group 2. Their study suggests that vitamin D deficiency exacerbates pain, dysfunction and a poorer quality of life in patients with knee osteoarthritis. Further longer-term studies are needed to investigate the effects of vitamin D deficiency on OA-related symptoms [7, 8]

Laslett LL *et al.* investigated whether serum vitamin D predicts change in knee and hip pain in older adults. Longitudinal population-based cohort study of randomly selected older adults aged 50-80 years; 50% were male. Serum 25-hydroxyvitamin D (25-OHD) was assessed at baseline by radioimmunoassay, and pain at baseline, 2.6 and/or 5 years using the Western Ontario and McMaster University Osteoarthritis Index (WOMAC) questionnaire. Mean total knee WOMAC score was 3.2. 4.2% of participants had moderate vitamin D deficiency at baseline. 25-OHD <25 nmol/l predicted change in knee pain over 5 years with a similar effect size for hip pain over 2.4 years. Results were consistent within pain subscales, and the association was independent of demographic, anthropometric and structural covariates. No association was present when 25-OHD was analysed as a continuous measure. They concluded that moderate vitamin D deficiency independently predicts incident, or worsening of, knee pain over 5 years and, possibly, hip pain over 2.4 years. Bassiouni H *et al.* compared serum 25 OH vitamin D (25 (OH) D) levels between medial femoro-tibial knee osteoarthritis (OA) patients and controls, and to detect structural progression in patients with mild to moderate knee osteoarthritis in relation to baseline 25(OH) D levels in a one year longitudinal prospective cohort study. Thirty eight patients with medial femoro-tibial knee OA according to the ACR criteria and no knee malalignment, and 20 age, sex and BMI-matched pain free controls were included in the vitamin D study. All included OA patients had radiographic Kellgren and Lawrence grades 2 or 3. Baseline serum levels of 25(OH) D, and the "Benefiting from ultraviolet index "(BFUI) score were determined; serum parathormone, total alkaline phosphatase, calcium and phosphorus were measured. In the OA progression study, OA patients were divided into 2 groups according to 25 (OH) D level using a cutoff of 10 ng/ml to identify their status. MRIs were done at baseline and repeated after 12 months with scoring system according to Boston Leeds osteoarthritis knee score (BLOKS). Of those, 21 had 25(OH) D levels <10 ng/ml, while 9 had levels >10 ng/ml. A significant progression of the medial meniscal grading from baseline to 1 year was seen in the patients with 25(OH)D levels <10 ng/ml as compared to the others. It was concluded that 25 (OH) D levels were significantly decreased in knee OA patients [9, 10]

Conclusion
Within the limitations of the study we conclude that, periodic screening of vitamin D levels in patients should be done and treated as needed, and thereby, reduce the risk of osteoarthritis and other complications.

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