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Original Research Article

Prospective Clinical Study to Assess the Prevalence of Vitamin D Deficiency in Orthopedic Patients

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Abstract

Aim: To determine the prevalence of vitamin D deficiency in orthopaedic patients. **Methods:** The prospective clinical study was conducted in the Department of Orthopaedics, All India Institute of Medical Science, Patna, Bihar, India for 1 year. The serum 25-OH-D levels of every patient consecutively admitted to the Orthopaedic Department (in total 950 patients) was measured after admission. Patients from the following orthopaedic sections were included in the study: elbow/shoulder, hip, knee, foot/ankle, spine and bone tumour. Measurement of serum 25-0H-D was standardized, the hospital laboratory used the ARCHITECT 25-OH Vitamin D assay. **Results:** A total of 950 patients participated in this study, of which 500(52.63%) were women, 450(47.37%) men. Ages ranged from 11 to 88 years, with a mean age of 57.5 years. The body region-specific patient census was as follows: 222 patients (25.5% of all patients) were scheduled to undergo back surgery (spondylodesis or kyphoplasty). 202 (21.26%) presented for knee surgery, 147 (15.47%) foot and ankle, 142 (14.95) hip, 137 (14.42%) shoulder and elbow. 100 (10.53%) patients were scheduled to undergo cancer associated surgery of different body regions. The serum 25-OH-D levels for all participants were normally distributed, with a mean of ng/ml. Lowest measured level was <8.5 ng/ml, highest measured level was 77.9 ng/ml. Statistical analyses failed to disclose any relationship between vitamin D level and body region scheduled to undergo surgery. All tested patient subgroups showed low vitamin D levels. Multivariate analyses showed no significant correlation between medication history and hypo- vitaminosis D. **Conclusion:** Our data suggests a possible way to improve the outcome after orthopaedic surgery by supplementing vitamin D. Nevertheless, heightened awareness is necessary, especially as vitamin D deficiency is preventable.

Keywords: Vitamin D, Osteoporosis, Deficiency.

Introduction

Vitamin D has been traditionally known as the anti-ricketic factor or the sunshine vitamin. It plays a crucial role in calcium homeostasis and appropriate serum calcium concentrations are essential for many functions, including proper mineralization of the bone, muscle contraction and transmission of nerve impulses[1]. Chronic vitamin D deficiency leads to osteoporosis, osteomalacia, muscle weakness, osteoarthritis, nonspecific backache, gout, ankylosing spondylitis, generalized body ache, increased risk of falls, etc[2]. Vitamin D deficiency does indeed constitute an epidemic in many populations across the world and has been reported in healthy population across all age groups and both genders[3]. In India also, more than 90% of apparently healthy Indians have subnormal 25(OH)D levels[4]. Reports documenting incidences of vitamin D deficiency in the orthopaedic patients as compared to apparently healthy population are sparse in literature. Data revealing the prevalence of vitamin D sufficiency and insufficiency may be of value to orthopaedic surgeon when treating their patients to prevent potential negative consequences in the operative and postoperative settings, to maintain good physical function and to preserve independence in daily life.

Material and methods

The prospective clinical study was conducted in the Department of Orthopaedics, All India Institute of Medical Science, Patna, Bihar, India for 1 year.

In the year 2020 the serum 25-OH-D levels of every patient consecutively admitted to the Orthopaedic Department (in total 950 patients) was measured after admission. Patients from the following orthopaedic sections were included in the study: elbow/shoulder, hip, knee, foot/ankle, spine and bone tumour. Measurement of serum 25-0H-D was standardized, the hospital laboratory used the ARCHITECT 25-OH Vitamin D assay. Laboratory results were collected by means of a retrospective chart review. Patient demographic variables and background data were collected by means of a chart review of patient records. As yet there is no universally accepted classification of vitamin D levels. We defined sufficient vitamin D status as a serum 25-OH-D level of above 30 ng/ml. Vitamin D inadequacy was defined as a serum 25-OH-D level of under 30 ng/ml and was further divided into vita- min D insufficiency (20 to 30 ng/ml) and vitamin D deficiency (under 20 ng/ml) as described previously[5,6].

All patients with valid 25-OH-D measurement were included in the statistical analysis. The distribution of 25- OH-D and the percentages of patients with insufficient (20 to 30 ng/ml) and deficient (under 20 ng/ml) 25-OH-D level were determined for each individual service.

Serum Vitamin D levels and rates of insufficiency and deficiency were compared between the different cohorts using two-tailed tests. The level of significance was set at $p \leq 0$, 05. To determine if there is a correlation between the different pain medications the patients received and hypovitaminosis D multivariate analysis, using the vitamin D level as a continuous variable, was performed. The medication had at least to be taken for the last 3 months before measurement of serum vitamin D level. All collected medications (proton pump inhibitors, acetylsalicylic acid, metamizole, diclofenac, isobutyl-propanoicphenolic acid, N-acetyl-p-aminophenol, indomethacin) were included. The level of significance was set at $p \leq 0.05$.

Results

A total of 950 patients participated in this study, of which 500(52.63%) were women, 450 (47.37%) men. Ages ranged from 11 to 88 years, with a mean age of 57.5 years.

The body region-specific patient census was as follows: 222 patients (25.5% of all patients) were scheduled to undergo back surgery

(spondylodesis or kyphoplasty). 202 (21.26%) presented for knee surgery, 147 (15.47%) foot and ankle, 142 (14.95) hip, 137 (14.42%) shoulder and elbow. 100 (10.53%) patients were scheduled to undergo cancer associated surgery of different body regions. The serum 25-OH-D levels for all participants were normally distributed, with a mean of ng/ml. Lowest measured level was <8.5 ng/ml, highest measured level was 77.9 ng/ml. Statistical analyses failed to disclose any relationship between vitamin D level and body region scheduled to undergo surgery. All tested patient subgroups showed low vitamin D levels. Multivariate analyses showed no significant correlation between medication history and hypo- vitaminosis D (Table 3).

Table 1. Gender and age distribution of patients

Gender	Number of patients =950	%
Male	500	52.63
Female	450	47.37
Age (mean)	57.5 years	

Table 2: Type of surgery

Type of surgery	Number of patients	%
Spondylodesis Or Kyphoplasty	222	23.37
Knee Surgery	202	21.26
Foot And Ankle	147	15.47
Hip	142	14.95
Shoulder and Elbow.	137	14.42
Undergo Cancer Associated Surgery	100	10.53

Table 3: Multivariate Analyses of potential risk factors for vitamin D insufficiency and deficiency in relation with drug consumption

	Mean Vitamin D Level (ng/ml)	Significance (P)	95% Confidence Interval
Proton pump inhibitors (n = 595)	15.9 (+/-10.36)	0.263	8.99 to 24.28
Acetylsalicylic acid (n = 126)	17.9 (+/-10.3)	0.875	11.1 to 23
Metamizole (n = 299)	17.5 (+/-8.7)	0.088	10.33 to 22.88
Diclofenac (n = 271)	18.4 (+/-11.9)	0.896	11.06 to 25.1
Iso-butyl-propanoic-phenolic acid (n = 65)	19.2 (+/-11.7)	0.362	11.04 to 22.9
N-acetyl-p-aminophenol (n = 278)	18.3 (+/-11.3)	0.896	11.22 to 23.1
Indomethacin (n = 402)	16.6 (+/-12.3)	0.477	5.99 to 24.89

Discussion

25-OH-D levels were low in every subgroup, with an overall high prevalence of severe vitamin D deficiency, irrespective of the body region scheduled to undergo surgery. None of the tested subgroups reached a sufficient mean level of serum 25-OH-D. Our findings indicate a high prevalence of low vitamin D levels and widespread vitamin D insufficiency in orthopaedic patients. These results are consistent with those of similar studies investigating the prevalence of vitamin D deficiency in trauma patients and other

population subgroups. Schilling demonstrated a prevalence of hypovitaminosis D in nearly 90% of all tested patients in a geriatric department[7]. Bee et al showed in their study of patients undergoing fracture repair a high rate of vitamin D insufficiency in winter (71%) as well as in summertime (62%)[8].

Extremely low vitamin D levels have been associated with osteomalacia and impaired muscle function[9]. Lips suggested vitamin D deficiency to play a role in the development of osteoporosis due to the induction of a secondary hyperparathyroidism, mobilizing calcium from the bone[10]. In 3270 elderly French women living in nursing homes, the daily supplementation of vitamin D and calcium reduced the number of hip fractures by 23% and normalized bone turnover markers by 28% after 3 years[11]. LeBoff et al documented a more than 50% prevalence of vitamin D deficiency among postmenopausal women with acute hip fracture[12]. Several studies confirmed this high rate of vitamin D deficiency among hip fracture patients[13]. Our results confirm a high prevalence of hypovitaminosis D in orthopaedic patients scheduled to undergo surgery of the hip. Furthermore, we showed that hypo-vitaminosis D is not correlated with orthopaedic problems in specific body regions. Hypovitaminosis D is seen in orthopaedic patients no matter which anatomic region is scheduled to undergo surgery.

Vitamin D deficiency has been shown to be associated with skeletal muscle myopathy (presenting as a proximal muscle weakness) in subjects of various ages, and body sway in osteoporotic and fall-prone subjects[14,15]. Improvement of serum 25- OH-D level to sufficient levels reversed the myopathy in tested patients[16]. In 242 community-dwelling seniors receiving calcium and vitamin D supplementation, Pfeifer et al showed a significant decrease in the number of subjects with first falls. Significant improvements in quadriceps strength of 8%, a decrease in body sway of 28%, and a decrease in time needed to perform the “Time up and go” test of 11% were observed compared to patients without vitamin D supplementation. Combined calcium and vitamin D supplementation proved superior to calcium alone in reducing the number of falls and improving muscle function in community-dwelling older individuals[15].

Good muscle function and healthy bones, as well as analgesia, are essential for fast rehabilitation and positive outcome after orthopaedic surgery. Musculoskeletal pain is one of the most common reasons for consultation of orthopaedic primary care or for negative outcome after orthopaedic surgery. Although vitamin D-related pain is not well understood, several studies have shown associations between vitamin D status and pain[17,18]. Hirani showed in his study that symptoms of moderate/severe pain were associated with poor vitamin D status. Nationwide 2070 British adults were asked for their current symptoms of pain and their 25-OH- D level was taken. Findings from this study were consistent with former studies in which increased symptoms of pain were seen in severe vitamin D deficiency state. Another British study showed that patients with chronic widespread pain had a moderately increased odd of low serum vitamin D[18,19]. In a Thai study of 6 men and 3 women who had failed back surgery syndrome after lumbar surgery, all patients had deficient serum vitamin D levels. Vitamin D was given to improve serum levels. Six months after vitamin D supplementation the mean serum level improved significantly, as did the mean pain score and the mean JOA (Japanese Orthopaedic Association) score. The authors concluded that vitamin D may be used as an adjuvant treatment for patients with failed back surgery syndrome[19].

Conclusion

The present study concluded that the deficiency of vitamin D in their patients. Given

the possible negative effects of hypovitaminosis D, our data suggests a possible way to improve the outcome after orthopaedic surgery by supplementing vitamin D. Nevertheless, heightened awareness is necessary, especially as vitamin D deficiency is preventable.

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