

## Prevalence and severity of Vitamin D deficiency in patients presenting with fractures following trivial trauma in a teaching hospital of rural India

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### Abstract

**Introduction:** Vitamin D insufficiency, even in its milder form, is associated with an increased risk of fracture through negative calcium balance. Clinical studies have indicated that intervention with vitamin D supplementation reduced the incidence of falling in elderly subjects. Vitamin D insufficiency is common worldwide irrespective of latitude of countries.

**Objective:** In current study we intended to find prevalence and severity of vitamin D deficiency in patients, who presented with various type of fractures sustained following trivial trauma.

**Results:** One hundred and four patients who suffered low velocity trauma, presented with various fractures were studied. Fractures around the hip were commonest (39.42 %), followed by Colle's (24.03%) and vertebral fractures (17.30 %). Serum vitamin D levels of the patients showed 65.38% were having deficient levels, whereas 18.26 % were having insufficient levels.

**Conclusion:** Our study indicates very high incidence of vitamin D deficiency among patients who suffered fractures following trivial trauma. The high incidence of fractures in elderly population with vitamin D deficiency probably is partly because of altered bone mass and strength, and partly because of poor muscular control because of pain and muscle weakness.

**Keywords:** Vitamin D, Trivial trauma, Fractures, Insufficiency fractures, hypovitaminosis D

### 1.Introduction

Vitamin D is very important for the maintenance of calcium and phosphorus homeostasis. It enhances the intestinal absorption of calcium and phosphorus [1,2] promotes bone mineralization and, prevents rickets in children and osteomalacia in adults. Low levels of vitamin D result in inadequate intestinal absorption of calcium, leading to compensatory increase of parathyroid hormone (PTH) production. Calcium levels are restored, in part, by a PTH-mediated increase in bone calcium reabsorption. Vitamin D insufficiency can lead to softness, thinning and brittleness of bones. Initial symptoms of vitamin D insufficiency usually are diffuse muscle and bone pains, fatigue, muscular weakness and gait disturbances. Muscle tissue has vitamin D receptors [3], which could account for the association between vitamin D insufficiency and proximal muscle weakness.[4] Diffuse bone and muscle pain, is poorly responsive to NSAIDs and opioids. [5]

Vitamin D insufficiency, even in its milder form, is associated with increased risk of fracture through negative calcium balance.[1,2] Clinical studies have indicated that intervention with vitamin D supplementation reduced the incidence of falling in elderly subjects.[6] Clinically important fractures, such as hip and wrist fractures are

triggered by falling. Thus, vitamin D insufficiency would render the elderly subjects more prone to fracture through its effects both on the skeleton and muscle. There is increased risk of falls and fractures in older adults.[7]

Two major sources of vitamin D are sunlight and dietary sources. Vitamin D insufficiency is associated with limited exposure to sunlight, inadequate dietary intake of vitamin D, increased skin pigmentation, problems with kidney and liver functions in converting vitamin D to its active form [8] as well as lack of vitamin D supplementation. Vitamin D insufficiency is common worldwide irrespective of latitude of countries. It ranges from far north-west in the European countries, to many countries in the Middle East, Africa and Asia. Its prevalence is astoundingly high in the sunny Mediterranean countries than in certain northern countries such as Norway. Vitamin D insufficiency is prevalent in South Asian countries as well as other neighboring countries such as Turkey, China, Japan and Thailand despite the abundant sunlight. [9-15]

In current study we intended to find prevalence and severity of vitamin D deficiency in patients, who presented with various type of fractures sustained following trivial trauma.

## 2. Materials and Methods

The present study was conducted in the post graduate department of Orthopedics in a teaching institution of north India between March 2012 and February 2015. The study was approved by the board of studies and the protocol was approved by the local institutional review committee. Informed consent was obtained from all subjects involved in the study.

### 2.1 Inclusion criteria

All the adults who presented with various fractures due to low velocity/ trivial trauma during activities of daily living.

### 2.2 Exclusion Criteria

- 1) All fractures due to high velocity trauma like RTA and fall from height.
- 2) Patients with deranged renal function due to renal parenchymal disease.
- 3) Patients with abnormal thyroid function.
- 4) Patients with significant liver disease.
- 5) Patients with history of cancer.
- 6) Patients on regular therapy with a phosphate binding antacid, estrogen replacement therapy within the previous 9 -12 months, therapy with any other drug that affect skeleton like steroids, anti convulsants and anticoagulants.

One hundred and four patients who presented with various types of fractures following trivial trauma were studied. In this study a detailed history and physical examination was carried out for every subject who entered the study to rule out various conditions as per exclusion criteria. Investigations were carried out to assess hematological parameters and ESR, serum calcium, serum phosphorus, serum vitamin D, serum TSH, serum alkaline phosphatase, serum PTH, lipid profile, creatinine and fasting sugar. Routine radiographs as required were done. Serum 25-hydroxy vitamin D was estimated using chemiluminescent immunoassay and other biochemical parameters using spectrophotometric analysis.

We defined vitamin D deficiency using Holick classification [8]:-

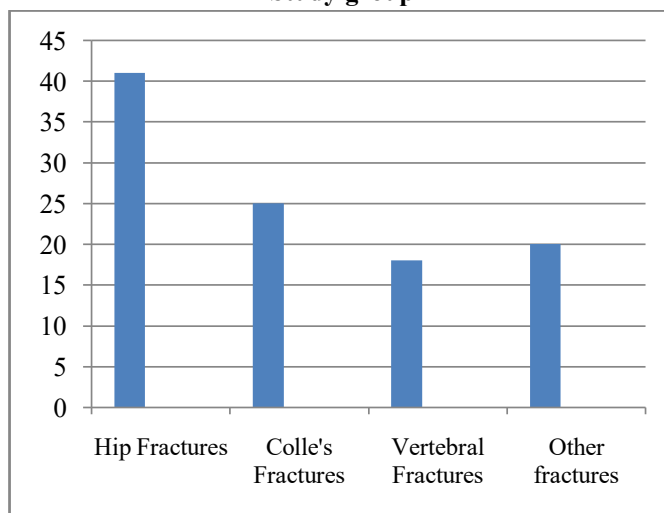
- (a) Vitamin D deficiency is considered when there is a vitamin D level  $\leq 20$  ng/mL,
- (b) Vitamin D insufficiency is defined as vitamin D level 21 to 29 ng/mL, and
- (c) Normal vitamin D levels are defined as  $\geq 30$  ng/mL.

## 3. Results

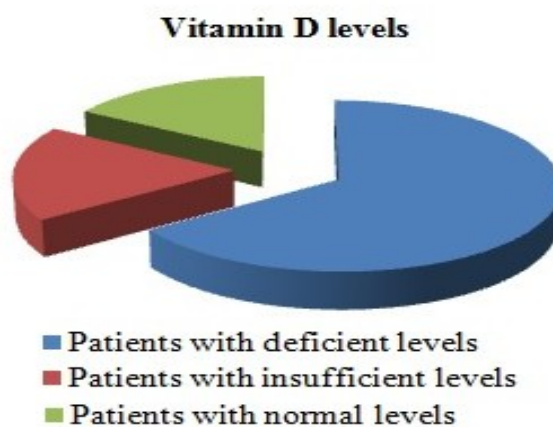
One hundred and four patients who suffered low velocity trauma, presented with various fractures (Table 1) were studied. Fractures around the hip were commonest (39.42 %), followed by Colle's (24.03%) and vertebral fractures (17.30 %). Fig 1 Age ranged from 42 to 95 years, with average age of 66.31 years. Sixty nine patients were female and rest male. Serum vitamin D levels (Table 2/ Fig. 2) of the patients showed 65.38% were having deficient levels, whereas 18.26 % were having insufficient levels. Only IJBR (2016) 7(07)

16.34 % had normal levels of Vitamin D. Patients with low level of vitamin D usually were restricted to indoor activities and patients with normal level of vitamin D were associated with usually outdoor activities like farming etc. Ninety One patients were living a sedentary life style with no or little weight bearing and muscle building exercise. Serum phosphorus was in normal range in all patients. Serum PTH was done randomly in fifty six patients and was found to be within normal range. Serum alkaline phosphatase done in all patients and 54 patients had raised levels. Total serum protein level was low in 32 patients. Serum creatinine was slightly raised in 15 patients due to dehydration and improved on proper hydration and repeat testing. Patients were treated with adequate dosage of Vitamin D in addition to treatment fracture specific treatment. In all the patients treated operatively or non operatively fracture united at 3 to 6 months of treatment and majority of the patients were walking full weight bearing by that time except for five patients with osteoporotic collapse of multiple vertebrae who were able to manage to sit with brace application and had marked improvement in pain but were not able to walk.

**Figure 1: Bar Diagram showing Incidence of fractures in Study group**



**Figure 2: Vitamin D level among the patients.**



**Table 1: Incidence of various injuries in study group**

S. No	Fracture	Total Number
1.	Intertrochanteric femur	20
2.	Colle's	25
3	Vertebrae ( single/ multiple)	18
4.	Neck of femur	17
5.	Subtrochanter femur	4
6.	Neck of humerus	4
7.	Bimalleolar	4
8.	Both bone forearm	2
9.	Isolated ulna	2
10.	Calcaneus	2
11.	Shaft of femur	2
12	Supracondylar femur	2
13	Distal humerus	2

**Table 2: Level of Vitamin D among Patients**

S. No	Vit. D levels(ng/ml)	No.of patients	% age
1.	Normal (> 30)	17	16.34
2.	Insufficiency (21-29)	19	18.26
3.	Deficiency (< 20)	68	65.38

#### 4. Discussion

In our study we found high prevalence of vitamin D deficiency / insufficiency approximately 83.64 %. Most affected patients were female patients (66.34 %). Most of the female patients were postmenopausal and had vitamin D levels < 20ng/ml. In postmenopausal women, bone density is lower in those who have serum vitamin D concentrations of 15 ng per milliliter or less.(23/16) Fractures around hip were highest in number (39.42 %), followed by Colle's (24.03 %) and vertebral (17.30 %) fractures. In some studies of elderly housebound people one quarter to one half were vitamin D-deficient.[17-20] It is unclear why the prevalence of vitamin D deficiency was so high. Genetic factors exert a strong and perhaps predominant influence on peak bone mass, but physiological, environmental, and modifiable lifestyle factors can also play a significant role. Among these are adequate nutrition and body weight, exposure to sex hormones at puberty, and physical activity [21]. Low levels of ultraviolet-light exposure and vitamin D intake are probably important factors.

Vitamin D is required for optimal calcium absorption and thus is also important for bone health. The importance of vitamin D deficiency is related primarily to bone integrity. Because vitamin D is required for calcium homeostasis, secondary hyperparathyroidism may develop in patients with vitamin D deficiency. With increasing severity of hypovitaminosis D and secondary hyperparathyroidism, patients progress from states of increased bone turnover and decreased bone mass to states of impaired, and ultimately absent, mineralization with generalized osteomalacia.[22] Decreased calcium leads to increased parathyroid secretion which causes increased bone resorption [23]. Indeed, in patients who are vitamin D deficient, no more than 15 % of dietary calcium is absorbed, whereas in persons who are not

vitamin D deficient 30 – 80% of dietary calcium is absorbed [24]. There is strong evidence that physical activity early in life contributes to higher peak bone mass [25]. Some evidence indicates that resistance and high impact exercise are likely the most beneficial. In our study we found that vitamin D deficiency (< 20 ng/ml) is quite common in India (65.38%) as has been reported by various other studies Arya *et al* (2004) reported an incidence of 66.3% using 15 ng/ml as the cut-off point [26]. Using 20 ng/ml they reported an incidence of more than 78 %. All the fractures treated by various methods united indicating that if adequate vitamin D supplementation in addition to proper immobilization is given, fractures unite though it may take a little longer for them to unite. In the present study, we were not able to assess the effect on reduction in fracture risk due to short period of study. Many patients with osteoporotic fractures have low serum vitamin D concentrations.[27,28] Because treatment with vitamin D and calcium increases bone mass and substantially reduces the risk of fractures [29-31], the diagnosis of vitamin D deficiency warrants attention.

In addition to its effect on the skeleton, hypovitaminosis D may affect other organ systems adversely, resulting in muscle weakness and pain [32], progression of osteoarthritis, [32,33] or impaired macrophage activation.[34] Our study indicates very high incidence of vitamin D deficiency among patients who suffered fractures following trivial trauma. The high incidence of fractures in elderly population with vitamin D deficiency probably is partly because of altered bone mass and strength, and partly because of poor muscular control because of pain and muscle weakness. Our results are restricted to a specific set of patients presenting to a tertiary care referral centre which may not be representative of general community. An adequately powered community based study analyzing bone turn over markers in addition is expected to provide better answer to the research question. Because elevated values of both resorption and formation markers do indicate increased risk for bone loss and fractures, their measurement may become useful in determining the need for therapy, particularly if they can be made more accurate and less expensive. In conclusion, we found a high prevalence of hypovitaminosis D in our study and prevention of vitamin D deficiency by appropriate diet, activity, sunlight exposure appears to be the primary prerequisite in reducing the incidence of such fractures in relatively elderly population.

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