

A Study on Prevalence of Vitamin - D3 Deficiency in Elderly Patients Coming With Proximal Femur Fracture in a Tertiary Care Hospital

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Abstract: ***Introduction:** Vitamin D deficiency is rampant in elderly populations and house bound patients. Deficiency of vitamin D3 causes mineralisation defects, proximal muscles weakness which leads to proximal femur fracture and fractures at other sites. **Materials and Methods:** 92 cases of proximal femur fractures satisfying inclusion and exclusion criteria were evaluated for serum vit - D3 levels, between 1st June 2021 to 31st May 2022 at Silchar Medical College & hospital, Silchar, Assam. Vitamin D levels between 21 ng/ml and 29 ng/ml are considered insufficient, while those below 20 ng/ml are considered deficient. **Result:** In Intertrochanteric femur fracture out of 36 patients, 26 (72.2%) have VitD3 deficiency; 3 (8.3%) have VitD3 insufficiency & 7 (19.5%) have normal VitD3 value. In Neck femur fracture out of 27 patients, 19 (70.4%) have VitD3 deficiency; 3 (11.1%) have VitD3 insufficiency & 5 (18.5%) have normal VitD3 value. In Subtrochanteric femur fracture out of 4 patients, 3 (75%) have VitD3 deficiency; & 1 (25%) have normal VitD3 value. **Conclusion:** Vitamin D deficiency and insufficiency are high in elderly patients with low - energy hip fractures with female preponderance and only 18.5 % of patients shows normal blood vitamin D levels (among female only 1.96% shows normal level).*

Keywords: Vitamin - D Deficiency, Mineralisation, Proximal Femur Fracture, Intertrochanteric Femur Fracture, Neck Femur Fracture, Subtrochanteric Femur Fracture

1. Introduction

Vitamin D belongs to the group of fat soluble vitamins. The human body obtains vitamin D either through endogenous production in the skin aided by exposure to UV radiation or through intestinal absorption of exogenous vitamin D present in foods and supplements.¹ Sunlight exposure is the main source of vitamin D in humans and is subject to regional and seasonal fluctuations.² The etiopathogenesis and progression of chronic painful conditions like rheumatoid arthritis, osteoporosis, osteoarthritis, lower back pain, arthralgia and soft tissue rheumatism are linked to vitamin D deficiency.²

The majority of vitamin D obtained by diet or cutaneous production is transformed to 25 (OH) D, and very little of it is converted to calcitriol (1, 25 (OH) 2D), which is the physiologically active form of vitamin D. Therefore, the optimum method for estimating vitamin D levels in the human body is through measurement of 25 (OH) D levels.³ Vitamin D levels between 21 ng/ml and 29ng/ml are considered insufficient, while those below 20 ng/ml are considered deficient.⁴

In a particular situation, vitamin D levels may be insufficient as a result of 1) inadequate sun exposure and dietary vitamin - D deficiency 2) Inadequate synthesis of vitamin D from the skin or inability to absorb vitamin D from the intestines 3) The liver and kidneys are unable to convert vitamin D into its active and useful forms.⁵ Vitamin - D deficiency results in secondary hyperparathyroidism, accelerated bone

turnover and loss, mineralization abnormalities, hip fractures, and fractures at other sites.⁵⁻⁶

Elderly people are more likely to fall and fracture their hips and other bones due to proximal muscle weakness that is known to result from vitamin D deficiency. This can negatively affect mobility and functional capacity and increase the risk of hip and other fractures. As a cost - effective method to avoid hip and other elderly fractures, prevention of such occurrences is possible by proper sunshine exposure, food fortification, and vitamin D supplementation for at - risk populations.⁷⁻⁸

Aim and Objectives

Aim: A study of prevalence of Vit. D deficiency in elderly patient coming with proximal femur fracture.

Objective: To study the prevalence of Vit. D deficiency in elderly patient coming with proximal femur fractures. Evaluation of association of Vit. D level with types of proximal femoral fractures in elderly patients

2. Materials And Methods

This study was carried out in the **Department of Orthopaedics**, Silchar Medical College and Hospital, Silchar, Assam. The study was designed as a Hospital - based cross - sectional study.

The study was done for One year period, from 1st June 2021 to 31st May 2022. After obtaining Ethical clearance was taken from Institutional Ethics Committee (H), Silchar Medical College and Hospital, Silchar, Assam, All the patients attending Orthopaedics OPD of Medical College & Hospital with the following criteria were included in our study. 92 cases were studied.

Inclusion Criteria:

- Patient age above 65 years.
- Patient with neck of femur fracture.
- Patient with intertrochanteric femur fracture.
- Patient with subtrochanteric femur fracture.

Exclusion Criteria:

- Patient refusing informed consent.
- Patient below 65 years of age.
- All open proximal femur fracture.
- Patient with shaft of femur fracture.
- Patient with distal femur fracture.
- Patients on Vitamin D3 supplement for the last 3 months.
- Medical or surgical disorders affecting vitamin D metabolism (gastric surgery, chronic liver disease, renal failure, intestinal malabsorption, systemic infection, cancer, etc).

Technique and Protocol

- A basic proforma inclusive of demographic information, age, sex, education, occupation was recorded.
- Proximal femoral fracture was diagnosed by radiological plain X - rays. Digital radiograph of pelvis with both hips (antero - posterior view) and lateral view of involved side was taken & type of fracture, comminution and severity was assessed independently by a radiologist.
- Blood samples were drawn between 9am and 10am to prevent any circadian variation and Serum Vit - D3 (25 - hydroxy - vitD) level was assessed.
- Serum 25 (OH) Vit - D level of all patient were measured by electrochemiluminescence immunoassay (ECLIA).

Operational definitions:

Values of vitamin D (25 (OH) D) greater than 30ng/ml are considered normal, levels between 20 ng/ml to 29.9 ng/ml

are regarded as insufficient / hypovitaminosis, and levels below 20ng/ml are regarded as deficient.4

Singh - Index⁹:

Degree of osteoporosis was estimated by using Singh's index (a classification system for bone density of the femoral neck based on the visibility of the trabecular types) in view of feasibility, cost effectiveness and ease of assessment based on the readily available radiographs of pelvis, taken for the purpose of fracture care. Singh's index grade 1, 2, 3 were considered as osteoporotic and grade 4, 5, 6 were considered as non - osteoporotic (fig - 12).9

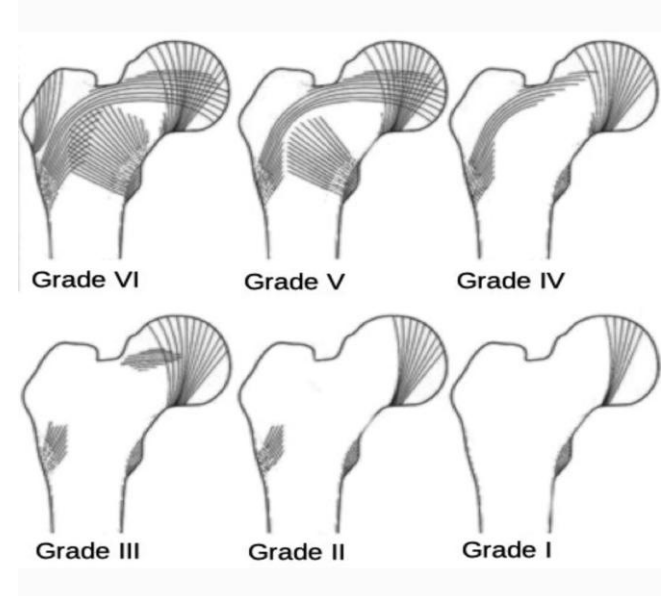


Figure 1

3. Results and Observations

Distribution of patients according to vitamin D3 level and Mode of Injury:

Table 1: VitD3 level in patients according to mode of injury

Mode of Injury	Vitamin D3 level			
	<10	10 - 19.9	20 - 29.9	>30
Low Energy Trauma	28	20	6	13
High Energy Trauma	0	5	1	19

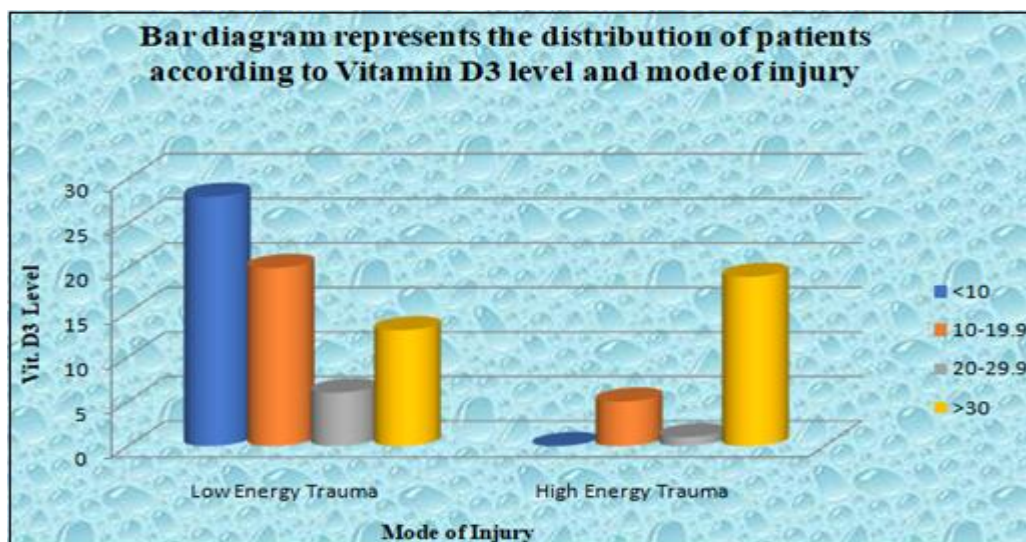


Figure 2

In low energy trauma out of 67 patients 48 (72.5%) have Serum VitD3 deficiency; 6 (9%) patients have VitD3 insufficiency & 13 (18.5%) have normal VitD3 level.

In high energy trauma out of 25 patients 5 (20%) have Serum VitD3 deficiency; 1 (4%) patients have VitD3 insufficiency & 19 (76%) have normal VitD3 level.

Distribution of patients according to vitamin D3 level and fracture type in Low energy trauma:

Table 2: Serum VitD3 levels according to fracture type

Serum vitD3	IT	NOF	ST	Total
<10	14	13	1	28
10 - 19.9	12	6	2	20
20 - 29.9	3	3	0	6
>30	7	5	1	13
	Total=36	Total=27	Total=4	67

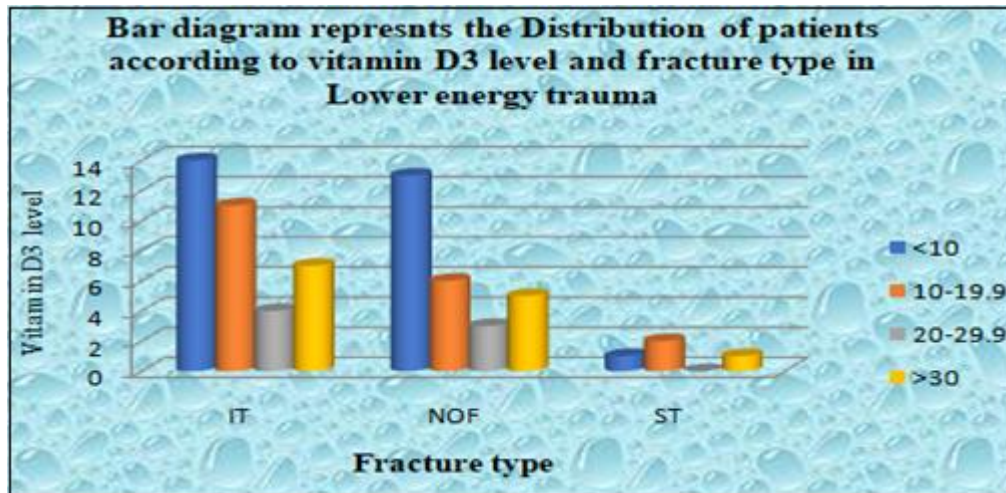


Figure 3

In Intertrochanteric femur fracture out of 36 patients, 26 (72.2%) have VitD3 deficiency; 3 (8.3%) have VitD3 insufficiency & 7 (19.5%) have normal VitD3 value.

In Neck femur fracture out of 27 patients, 19 (70.4%) have VitD3 deficiency; 3 (11.1%) have VitD3 insufficiency & 5 (18.5%) have normal VitD3 value.

In Subtrochanteric femur fracture out of 4 patients, 3 (75%) have VitD3 deficiency; & 1 (25%) have normal VitD3 value.

Distribution of patients according to Fracture Comminution and Vitamin D3 level in Low Energy Trauma:

Table 3: VitD3 level according to fracture site comminution

Fracture Comminution	Vitamin D3 level		Total
	Vit D3<30	Vit D3>30	
Comminution	24	2	26
Non - Comminution	30	11	41

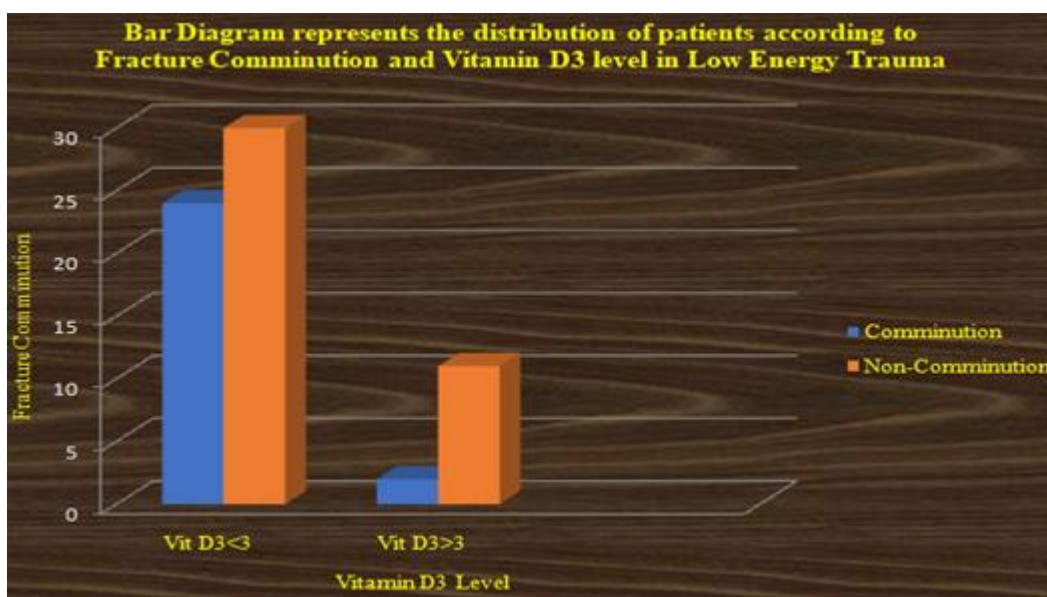


Figure 4

Among 26 patients with fracture site comminution, 24 patients (92.3%) have VitD deficiency or insufficiency & 2 patients (7.7%) have normal VitD level.

Among 41 patients without fracture site comminution, 30 patients (73.2%) have VitD deficiency or insufficiency & 11 patients (26.8%) have normal VitD level.

Distribution of patients according to Singh index and Vitamin D3 level in Low Energy Trauma:

Table 4: VitD3 levels according to Singh Index

Singh index	Vitamin D3 level		Total
	<30	>30	
1	5	0	5
2	23	1	24
3	25	7	32
>3	1	5	6

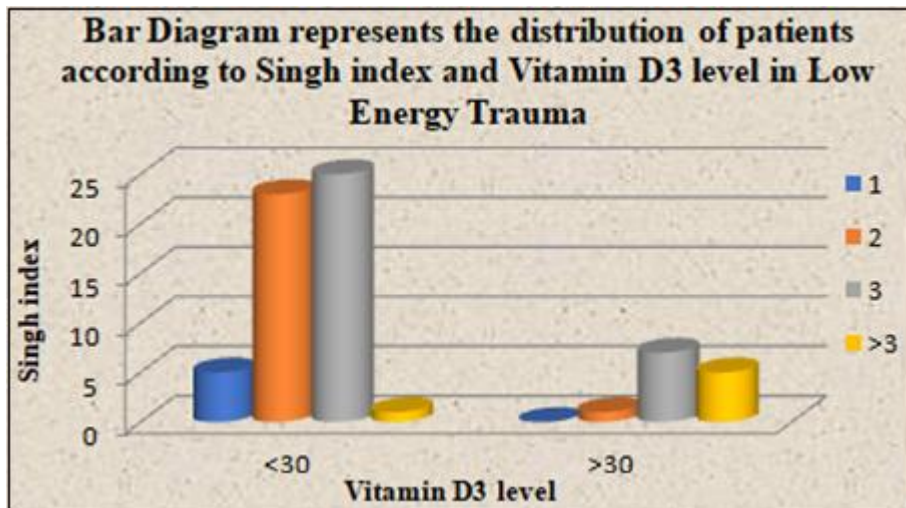


Figure 5

All patients (100%) with Singh - Index 1 have VitD Insufficiency or Deficiency.

Out of 24 patients with Singh - Index 2, 23 patients (95.83%) have VitD3 insufficiency or deficiency & 1 patient (4.17%) have normal VitD3 level.

Out of 32 patients with Singh - Index 3, 25 patients (78.2%) have VitD3 insufficiency or deficiency & 7 patients (21.8%) have normal VitD3 level.

Out of 6 patients with Singh - Index more than 3, 1 patient (16.67%) have VitD3 insufficiency or deficiency & 5 patients (83.33%) have normal VitD3 level.

4. Discussion

Hip fractures are a major cause of morbidity and mortality in the elderly and are associated with chronic pain, disability and an increasing degree of dependence. These injuries are costly to treat and have a significant physical and social impact. Approximately 50 million people in India are either osteoporotic or osteopenic.¹⁰ Most of the hip fractures in the elderly can be related to osteoporosis with a consequent increase in bone fragility.¹¹ The frequency of fractures of the proximal femur increases with age and are more common in women than men.

Low vitamin D levels are linked to poor calcium absorption in the serum, which causes loss of bone mass.¹² Adults with osteomalacia experience impaired mineralization of the organic bone matrix. Due to vitamin D's role in regulating bone mineralization, a lack of it can cause an accumulation of undermineralized osteoid, which can cause fractures to soften, bend, and break more easily.¹³ The coexistence of osteomalacia with osteoporosis, which exacerbates bone fragility and increases the risk of hip fractures. In our study we considered p value <0.05 as statistically significant and p value >0.05 was considered statistically insignificant.

Age group

In the present study, most of patients (61.95%) were found for the age group (65 - 74 years), followed by 29.35% for the age group (75 - 84years) followed by 8.69% for the age group (>84years) with mean age of 73.48 years. On contrary in the study conducted by M. Lakkireddy et al. (2019)¹⁴ on the effect of increasing age on the risk of proximal femur fracture and found that the mean age at presentation was 62.7 years and maximum incidence was seen in the age group of 55-65 years and 61% of them being < 65 years.

Sex

In this study the total number of Female patients are 58 (63.05%) and total number of male patients are 34 (36.95%). More females are suffer from low energy trauma. On contrary in the study conducted by M. Lakkireddy et al. (2019)¹⁴ & there was also Female preponderance (63%) in study of hypovitaminosis D in patients with osteoporotic hip fracture.

Type of proximal hip fracture

This Study shows 59.7% patients with Intertrochanteric (extracapsular fracture) and subtrochanteric femur fracture (extracapsular fracture) & 40.3% patients have Neck of femur fracture (intracapsular fracture) in low energy trauma. Jaehwi Han et al. (2020)¹⁵ conducted a study on VitD levels in patients with low energy hip fractures and observed that

53.3% patients have extracapsular fracture and 46.7% patients have intracapsular hip fractures.

Serum Vit - D3

In present study of low energy trauma patients out of 67 patients 48 (72.5%) have Serum VitD3 deficiency; 6 (9%) patients have VitD3 insufficiency & 13 (18.5%) have normal VitD3 level. Khadgawat et al. (2010) ¹⁶Conducted a cross sectional study on Asian - Indian individuals with fragility hip fracture have a high rate of vitamin D deficiency. All patients except one (96.7%) had vit D deficiency.

Serum VitD3 and Type of proximal hip fracture:

In present study, in Intertrochanteric femur fracture out of 36 patients, 26 (72.2%) have VitD3 deficiency; 3 (8.3%) have VitD3 insufficiency & 7 (19.5%) have normal VitD3 value. In Neck femur fracture out of 27 patients, 19 (70.4%) have VitD3 deficiency; 3 (11.1%) have VitD3 insufficiency & 5 (18.5%) have normal VitD3 value. Jaehwi Han et al. (2020) ¹⁵ conducted a study on VitD levels in patients with low energy hip fractures and observed that in Intertrochanteric femur fracture 84% had VitD3 deficiency; 11% had VitD3 insufficiency & 5% had normal VitD3 value. In Neck femur fracture 88% had VitD3 deficiency; 8 had VitD3 insufficiency & 4% had normal VitD3 value.

Serum VitD3 and Sex:

This study shows Out of 51 female patients with low energy trauma, 46 (90.1%) have VitD3 deficiency; 4 (7.94%) have VitD3 insufficiency & 1 (1.96%) have normal VitD3 level. Out of 16 male patients with low energy trauma, 2 (12.5%) have VitD3 deficiency; 2 (12.5%) have VitD3 insufficiency & 12 (75%) have normal VitD3 level. Jaehwi Han et al. (2020) ¹⁵ conducted a study on VitD levels in patients with low energy hip fractures and found that among female patients about 86% had VitD deficiency; 10% had VitD insufficiency & about 4% had normal VitD levels, and among male patients 63% had VitD deficiency; 14% had VitD insufficiency and about 23% had normal VitD levels.

Serum VitD3 and fracture site comminution:

In present study Among 26 patients with fracture site comminution, 24 patients (92.3%) have VitD deficiency or insufficiency & 2 patients (7.7%) have normal VitD level. Among 41 patients without fracture site comminution, 30 patients (73.2%) have VitD deficiency or insufficiency & 11 patients (26.8%) have normal VitD level. M. Lakkireddy et al. (2019) ¹⁴conducted a study on hypovitaminosis D in patients with osteoporotic hip fractures and observed that 36% patients had fracture site comminution of which 75% had vitD deficiency; 12 had vitD insufficiency and 13% had normal vitD level and 64% patients doesn't had fracture site comminution of which 35% had vitD deficiency; 21 had vitD insufficiency and 44% had normal vitD level.

Serum VitD and Singh - Index:

In this study All 5 patients (100%) with Singh - Index 1 have VitD Insufficiency or Deficiency. Out of 24 patients with Singh - Index 2, 23 patients (95.83%) have VitD3 insufficiency or deficiency & 1 patient (4.17%) have normal VitD3 level. Out of 32 patients with Singh - Index 3, 25 patients (78.2%) have VitD3 insufficiency or deficiency & 7

patients (21.8%) have normal VitD3 level. Out of 6 patients with Singh - Index more than 3, 1 patient (16.67%) have VitD3insufficiency or deficiency& 5 patients (83.33%) have normal VitD3 level. M. Lakkireddy et al. (2019) ¹⁴conducted a study on hypovitaminosis D in patients with osteoporotic hip fractures and found that 92.5% patients with Singh index 1, 87.5% patients with Singh index 2, 70% patients with Singh index 3 and 23% patients with Singh index more than 3 had VitD deficiency or insufficiency.

5. Conclusion

Vitamin D deficiency and insufficiency are high in elderly patients with low - energy hip fractures with female preponderance and only 18.5 % of patients shows normal blood vitamin D levels (among female only 1.96% shows normal level).

Our study established a strong correlation between hypo - vitaminosis D, osteoporosis and fracture site comminution as coexisting co morbidities. Identifying and treating these patients early with vitamin D for osteomalacia and anti - osteoporotic regimens for osteoporosis will improve the bone, muscle and overall health thereby reducing falls and fractures. Efforts to maintain adequate levels of vitamin D in the blood through proper sun exposure and vitamin D supplements are needed in patients at risk of hip fractures.

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