

Prevalence of Vitamin D Deficiency in Patients with Osteoporotic Hip Fractures: A Cross-Sectional Study

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ABSTRACT

Background: Vitamin D plays a crucial role in calcium metabolism and bone health, and its deficiency is highly prevalent among elderly individuals. It is strongly associated with osteoporosis and fragility fractures, particularly hip fractures. This study aims to determine the prevalence of vitamin D deficiency in patients presenting with osteoporotic hip fractures and to evaluate the associated demographic and clinical factors.

Methods: This cross-sectional study was conducted over 1 year at a tertiary care hospital in India. A total of 120 patients aged ≥ 50 years with osteoporotic hip fractures were included. Serum 25-hydroxyvitamin D levels were measured using standard immunoassay methods. Patients were categorized as vitamin D deficient, insufficient, or sufficient. Data on age, gender, and fracture type were collected and analyzed using appropriate statistical tests.

Results: The prevalence of vitamin D deficiency was 68.3%. Deficiency was more common among females (65%) and elderly patients, particularly those aged 70 or older (53.4%). Intertrochanteric fractures were the most common type (58.3%). A statistically significant association was observed between advancing age and vitamin D deficiency ($p < 0.05$).

Conclusion: Vitamin D deficiency is highly prevalent among patients with osteoporotic hip fractures, especially in elderly and female populations. Routine screening and timely supplementation may help reduce fracture risk, improve clinical outcomes, and decrease the overall burden of osteoporosis-related complications.

Key-words: Vitamin D deficiency, Osteoporosis, Hip fracture, Fragility fracture, Cross-sectional study, Intertrochanteric fractures

INTRODUCTION

Vitamin D is an essential fat-soluble vitamin responsible for maintaining calcium homeostasis, bone mineralization, and neuromuscular function. Vitamin D Deficiency leads to decreased bone mineral density and increased susceptibility to fractures, particularly among elderly populations^[1].

Osteoporotic hip fractures represent a major public health concern due to their association with high morbidity, mortality, and increased healthcare burden^[2]. Several studies have demonstrated a high prevalence of vitamin D deficiency among patients with hip fractures, ranging from 55% to more than 80%^[3,4].

In addition to its role in bone health, vitamin D deficiency has been linked to muscle weakness, impaired balance, and an increased risk of falls, thereby further contributing to fracture risk^[5]. Aging, reduced sunlight exposure, poor nutritional status, and associated comorbidities are important contributing factors to hypovitaminosis D^[6]. In countries such as India, vitamin D deficiency remains highly prevalent despite adequate sunlight exposure, reflecting the influence of lifestyle and dietary factors^[7]. A 2020 study reported a high

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prevalence of vitamin D deficiency among patients with hip fractures, underscoring the need for early identification and timely intervention [8].

Furthermore, recent consensus statements have highlighted the importance of routine assessment and appropriate vitamin D supplementation to maintain optimal bone health and prevent fragility fractures [4]. Despite growing evidence globally, data from Indian populations remain limited. Therefore, the present study was undertaken to assess the prevalence of vitamin D deficiency in patients with osteoporotic hip fractures and to evaluate associated demographic and clinical factors.

MATERIALS AND METHODS

Study Design and Setting- A hospital-based cross-sectional study was conducted over 12 months in the Department of Orthopedics at a tertiary care center in India. The study included patients admitted with osteoporotic hip fractures, and a total of 120 patients were enrolled as the study population.

Inclusion Criteria

- ✓ Patients aged ≥ 50 years
- ✓ Diagnosed with osteoporotic hip fracture
- ✓ Patients who gave informed consent

Exclusion Criteria

- ✓ Fractures due to high-energy trauma
- ✓ Pathological fractures (e.g., malignancy, metabolic bone disorders)
- ✓ Patients on steroid therapy, endocrine disorders, or malabsorption disorders
- ✓ Patients with chronic kidney or liver disease
- ✓ Patients already receiving vitamin D supplementation

Data Collection- Data were collected using a predesigned and structured proforma. Written informed consent was taken from all the participants before the study. Demographic details such as age and gender were recorded. Clinical information, including the type of hip fracture, was documented. Blood samples were collected at the time of admission under aseptic conditions, and serum 25-hydroxyvitamin D levels were measured using standard Chemiluminescent Immunoassay (CLIA) /Immunoassays methods. Based on the obtained values, patients were categorized into vitamin D-deficient, insufficient, and sufficient groups.

Vitamin D Classification [9]

- Deficiency: <20 ng/mL
- Insufficiency: $20-30$ ng/mL
- Sufficiency: >30 ng/mL

Statistical Analysis- All collected data were entered into Microsoft Excel and analyzed using SPSS software (version 25). Continuous variables were expressed as mean \pm standard deviation, while categorical variables were presented as frequencies and percentages. The association between categorical variables was assessed using the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

Ethical Consideration- The study was conducted after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants before their inclusion in the study.

RESULTS

A total of 120 patients with osteoporotic hip fractures were included in the study. The demographic and clinical characteristics, along with vitamin D status, are presented below. The majority of patients (53.4%) were aged 70 years or older, indicating a higher fracture prevalence in the elderly population (Table 1).

Table 1: Age-wise Distribution of Patients with Osteoporotic Hip Fractures (n=120)

Age Group	Number (n=120)	Percentage (%)
50–60 years	22	18.3%
61–70 years	34	28.3%
>70 years	64	53.4%

Female patients constituted a higher proportion (65%), suggesting increased vulnerability to osteoporotic fractures among women (Table 2).

Table 2: Gender Distribution of Study Participants (n=120)

Gender	Number	Percentage (%)
Male	42	35%
Female	78	65%

A significant majority of patients (n=82, 68.3%) were found to be vitamin D deficient, as illustrated in Fig. 1. The figure clearly demonstrates that the proportion of deficient individuals is substantially higher compared to

those with insufficient and sufficient vitamin D levels, highlighting the widespread prevalence of hypovitaminosis D among patients presenting with osteoporotic hip fractures.

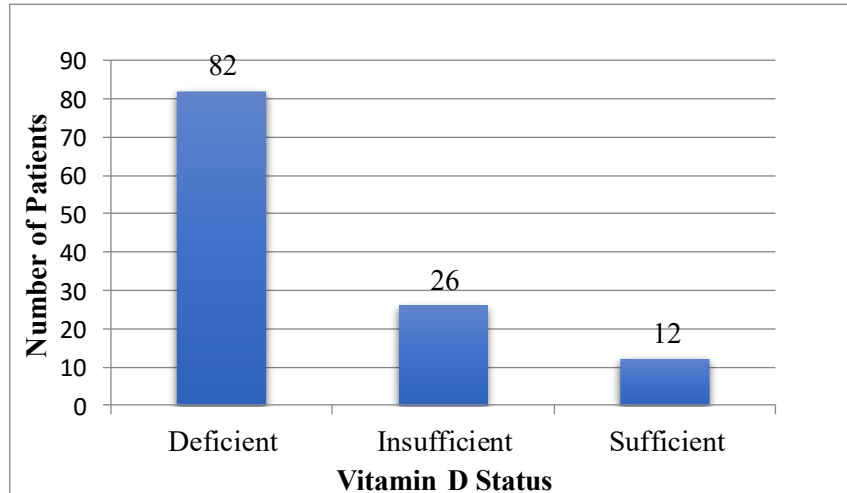


Fig. 1: Distribution of Serum Vitamin D Levels Among Study Participants (n=120)

Intertrochanteric fractures were more common (58.3%) compared to neck of femur fractures (Table 3).

Table 3: Distribution of Types of Osteoporotic Hip Fractures (n=120)

Fracture Type	Number	Percentage (%)
Intertrochanteric	70	58.3%
Neck of femur	50	41.7%

Vitamin D deficiency increased with age, and the association was statistically significant ($p < 0.05$) (Table 4).

Table 4: Association between Age Groups and Vitamin D Deficiency

Age Group	Deficient (%)	Not Deficient (Insufficient + Sufficient)	p-value
50–60 years	12 (14.6%)	10 (26.3%)	0.03
61–70 years	23 (28.1%)	12 (31.6%)	
>70 years	48 (58.5%)	16 (42.1%)	
Total	82 (100%)	38 (100%)	

DISCUSSION

The present study demonstrated a high prevalence (68.3%) of vitamin D deficiency among patients with osteoporotic hip fractures, which is consistent with previous studies reporting similar findings^[10,11].

This high prevalence underscores the significant burden of hypovitaminosis D in patients presenting with fragility fractures. In the present study, vitamin D deficiency was found to increase with advancing age, with the highest prevalence observed in patients aged 70 years or older.



This finding aligns with earlier studies that have identified aging as a major risk factor due to reduced cutaneous vitamin D synthesis and decreased outdoor activity [12]. The statistically significant association between age and vitamin D deficiency further strengthens this observation. Female patients constituted a higher proportion of the study population, which is consistent with previous reports indicating a higher risk of osteoporotic fractures among women, particularly in the postmenopausal period due to hormonal changes affecting bone metabolism [13]. Intertrochanteric fractures were more common than fractures of the neck of the femur in this study, which is comparable to findings in other studies [14]. This may be attributed to greater trabecular bone involvement, which is more susceptible to metabolic changes associated with vitamin D deficiency. The present study demonstrates that the majority of patients are vitamin D deficient, highlighting the importance of routine screening in high-risk populations, such as the elderly. Previous studies have also emphasised that vitamin D deficiency is associated with increased risk of falls, impaired muscle strength, and adverse clinical outcomes in elderly individuals [15, 16]. These factors collectively contribute to increased fracture susceptibility and a poorer prognosis. Recent clinical practice guidelines further recommend adequate vitamin D supplementation to prevent fractures and improve bone health outcomes, particularly in elderly and high-risk individuals [14].

LIMITATIONS

Its cross-sectional design prevents causal inference. The absence of a control group limits comparison with the general population. Potential confounders such as diet, sunlight exposure, and comorbidities were not assessed. Additionally, vitamin D was measured only once, and selection bias may be present due to exclusion criteria.

CONCLUSIONS

The present study demonstrates a high prevalence of vitamin D deficiency (68.3%) among patients with osteoporotic hip fractures, highlighting its significant role as a modifiable risk factor in this population. The deficiency was more pronounced in elderly individuals, particularly those aged 70 or older. It was more common among females, reflecting increased vulnerability due to

age-related changes and postmenopausal bone loss. A statistically significant association between advancing age and vitamin D deficiency further emphasizes its clinical importance. The findings suggest that inadequate vitamin D levels may contribute not only to reduced bone mineral density but also to increased susceptibility to falls and fragility fractures. Therefore, routine screening for vitamin D levels in high-risk individuals, especially older adults, is strongly recommended. Early identification and appropriate supplementation may help reduce fracture incidence, improve functional outcomes, and decrease the overall healthcare burden associated with osteoporotic hip fractures.

CONTRIBUTION OF AUTHORS

Research concept- Navdeep Singh Charan, Harshwardhan Dawar

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REFERENCES

- [1] Holick MF. The vitamin D deficiency pandemic: approaches for diagnosis, treatment and prevention. *Rev Endocr Metab Disord.*, 2017; 18(2): 153–65. doi: 10.1007/s11154-017-9424-1.
- [2] Kanis JA, Norton N, Harvey NC, Jacobson T, Johansson H, et al. SCOPE 2021: a new scorecard for osteoporosis in Europe. *Arch Osteoporos.*, 2021; 16(1): 82. doi: 10.1007/s11657-020-00871-9.
- [3] Bouillon R, Marocchi C, Carmeliet G, et al. Skeletal and extraskeletal actions of vitamin D: current evidence and outstanding questions. *Endocr Rev.*, 2019; 40: 1109–51. doi: 10.1210/er.2018-00126.
- [4] Giustina A, Bilezikian JP, Adler RA, Banfi G, Bikle DD, et al. Consensus statement on vitamin D status assessment and supplementation: whys, whens, and

- hows. *Endocr Rev.*, 2024; 45(5): 625–54. doi: 10.1210/edrv/bnae009.
- [5] Weaver CM, Alexander DD, Boushey CJ, Dawson-Hughes B, Lappe JM, et al. Calcium plus vitamin D supplementation and risk of fractures: an updated meta-analysis from the National Osteoporosis Foundation. *Osteoporos Int.*, 2016; 27(1): 367–76. doi: 10.1007/s00198-015-3386-5.
- [6] Gaksch M, Jorde R, Grimnes G, Joakimsen R, Schirmer H, Wilsgaard T, et al. Vitamin D and mortality: individual participant data meta-analysis. *PLoS One*, 2017; 12(2): e0170791. doi: 10.1371/journal.pone.0170791.
- [7] Aparna P, Muthathal S, Nongkynrih B, et al. Vitamin D deficiency in India. *J Family Med Prim Care*, 2018; 7(2): 324–30. doi: 10.4103/jfmpc.jfmpc_78_18.
- [8] Awal W, Bindra R, Price N, Sadler A, et al. Vitamin D deficiency in proximal femur fracture patients of South-East Queensland. *Australas J Ageing*, 2020; 39(3): e271–e77. doi: 10.1111/ajag.12791.
- [9] Holick MF, Binkley NC, Bischoff-Ferrari HA, et al. Evaluation, treatment, and prevention of vitamin D deficiency: an Endocrine Society clinical practice guideline. *J Clin Endocrinol Metab.*, 2011; 96(7):1911–30.
- [10] Phusunti S, Suthutvoravut U, Nanuntta A, Chotiyarnwong P. The prevalence of hypovitaminosis D in patients with fragility hip fracture at a single institution in Thailand. *J Med Assoc Thai.*, 2016; 99(11): 1233–38.
- [11] Kim HS, Jang G, Park JW, Lee YK, Koo KH. Vitamin D deficiency and sarcopenia in hip fracture patients. *J Bone Metab.*, 2021; 28(1): 79–83. doi: 10.11005/jbm.2021.28.1.79.
- [12] Wang Q, Yu D, Wang J, Lin S. Association between vitamin D deficiency and fragility fractures in elderly patients: a cross-sectional study. *Ann Palliat Med.*, 2020; 9(4): 1660–65. doi: 10.21037/apm-19-610.
- [13] Torres-Lopez R, Obradors N, Elosua R, Azagra-Ledesma R, Zwart M. Efficacy of vitamin D supplementation on the risk of falls among community-dwelling older adults: a systematic review and meta-analysis. *J Clin Med.*, 2025; 14(17):6117. doi: 10.3390/jcm14176117.
- [14] Demay MB, Pittas AG, Bikle DD, Diab DL, Kiely ME, et al. Vitamin D for the prevention of disease: an Endocrine Society clinical practice guideline. *J Clin Endocrinol Metab.*, 2024; 109(8): 1907–47. doi:10.1210/clinem/dgae290.
- [15] Bayram JM, Kanesan H, Clement ND. Vitamin D deficiency in hip fracture patients is associated with an increased mortality risk. *Eur J Orthop Surg Traumatol.*, 2024; 35(1): 33. doi: 10.1007/s00590-024-04162-8.
- [16] Dadra A, Aggarwal S, Kumar P, Kumar V, Dibar DP, et al. High prevalence of vitamin D deficiency and osteoporosis in patients with fragility fractures of hip: a pilot study. *J Clin Orthop Trauma*, 2019; 10(6): 1097–100. doi: 10.1016/j.jcot.2019.03.012.

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