ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Correlation of Vitamin D Deficiency with Incidence of Fragility Fractures in Elderly Patients.

Sanjay M Patil*.

Professor and HOD, Dr Rajendra Gode Medical College, Amravati, Maharashtra, India.

ABSTRACT

Fragility fractures in elderly patients are a major public health concern, often leading to significant morbidity, mortality, and financial burden. Vitamin D plays a crucial role in bone health, and its deficiency has been implicated as an important modifiable risk factor for such fractures. To study the correlation between vitamin D deficiency and the incidence of fragility fractures in elderly patients. This hospital-based observational study was conducted over a period of one year in the Department of Orthopaedics at a tertiary care hospital. A total of 50 patients aged 60 years and above presenting with fragility fractures were included. Serum 25-hydroxy vitamin D levels were measured and categorized as deficient (<20 ng/mL), insufficient (20–29 ng/mL), and sufficient (≥30 ng/mL). Data were analyzed using SPSS version 23, with Chi-square and Fisher's exact tests applied. Among 50 patients, 28 (56%) were female and 22 (44%) male. Hip fractures (40%) were most common, followed by vertebral (24%) and wrist fractures (20%). Vitamin D deficiency was present in 32 (64%) patients, insufficiency in 12 (24%), and sufficiency in only 6 (12%). A significant association was observed between vitamin D deficiency and increased incidence of fragility fractures. Vitamin D deficiency was highly prevalent among elderly patients with fragility fractures, particularly hip and vertebral fractures. Screening and correction of vitamin D deficiency may reduce fracture risk and improve geriatric bone health outcomes.

Keywords: Vitamin D deficiency, Fragility fractures, Elderly patients.

https://doi.org/10.33887/rjpbcs/2024.15.6.101

Corresponding author

INTRODUCTION

Fragility fractures are a major public health concern in elderly populations, leading to significant morbidity, mortality, and healthcare costs [1]. These fractures typically occur from minimal trauma, such as a fall from standing height, and are most often associated with underlying osteoporosis and impaired bone strength [2, 3]. Among the various factors contributing to skeletal fragility, vitamin D deficiency has emerged as a crucial modifiable risk factor. Vitamin D plays a vital role in calcium absorption, bone mineralization, and maintenance of musculoskeletal health. Deficiency of this micronutrient results in secondary hyperparathyroidism, bone demineralization, impaired muscle function, and increased susceptibility to falls—all of which collectively enhance fracture risk [4-6].

Globally, the prevalence of vitamin D deficiency among the elderly is alarmingly high, particularly in developing countries, despite abundant sunlight exposure. This paradox is explained by lifestyle changes, reduced outdoor activity, inadequate dietary intake, and age-related decline in cutaneous synthesis [7]. Multiple observational and interventional studies have demonstrated a strong correlation between low serum vitamin D levels and the incidence of fragility fractures, particularly hip and vertebral fractures, which are associated with poor functional outcomes [8, 9]. Understanding this association is essential for early detection, preventive strategies, and optimizing treatment in elderly patients, ultimately reducing the burden of fragility fractures.

METHODOLOGY

This hospital-based observational study was conducted over a period of one year in the Department of Orthopaedics at a tertiary care teaching hospital. A total of 50 elderly patients, aged 60 years and above, presenting with fragility fractures were enrolled after obtaining informed consent. Fragility fractures were defined as fractures resulting from minimal trauma, such as a fall from standing height or lesser force. Patients with high-energy trauma, pathological fractures due to malignancy, chronic renal disease, or those unwilling to participate were excluded. Ethical clearance for the study was obtained from the Institutional Ethics Committee prior to commencement.

Detailed demographic and clinical data, including age, gender, fracture type, site of injury, and history of falls, were collected using a structured proforma. Relevant clinical history regarding comorbidities, medication use, and prior fracture history was also recorded. Anthropometric measurements such as height, weight, and body mass index (BMI) were noted. Each participant underwent radiological investigations to confirm the diagnosis of fracture. Laboratory investigations included estimation of serum calcium, phosphate, alkaline phosphatase, and serum 25-hydroxy vitamin D levels, which were measured using chemiluminescent immunoassay techniques.

Vitamin D status was categorized based on standard guidelines, with deficiency defined as serum 25(OH)D levels less than 20 ng/mL, insufficiency as 20–29 ng/mL, and sufficiency as ≥30 ng/mL. Patients were stratified according to their vitamin D status, and the incidence of fragility fractures was correlated with these categories. The relationship between vitamin D deficiency and fracture incidence was analyzed with respect to age, sex, and fracture location (hip, vertebra, wrist, or others). This stratification allowed for subgroup comparisons and identification of high-risk patterns.

Data were entered into Microsoft Excel and analyzed using SPSS software version 23. Descriptive statistics were used to summarize demographic and clinical variables. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. The association between vitamin D deficiency and fragility fractures was assessed using the Chi-square test and Fisher's exact test wherever applicable. A p-value of less than 0.05 was considered statistically significant. This methodological framework enabled systematic evaluation of the correlation between vitamin D deficiency and fragility fractures in elderly patients.

ISSN: 0975-8585

RESULTS

Table 1: Demographic Profile of Study Participants (n = 50)

Parameter	Category	Number of Patients (%)
Age Group (years)	60–69	18 (36%)
	70–79	20 (40%)
	≥80	12 (24%)
Gender	Male	22 (44%)
	Female	28 (56%)
BMI Category	<18.5 (Underweight)	10 (20%)
	18.5–24.9 (Normal)	26 (52%)
	≥25 (Overweight/Obese)	14 (28%)

Table 2: Distribution of Fragility Fractures According to Site

Fracture Site	Number of Patients (%)
Hip	20 (40%)
Vertebral	12 (24%)
Wrist (Colles')	10 (20%)
Proximal humerus	5 (10%)
Others	3 (6%)
Total	**50 (100%)**

Table 3: Correlation of Vitamin D Status with Fragility Fractures

Vitamin D Status	No. of Patients (%)	Common Fracture Sites Observed
Deficient (<20 ng/mL)	32 (64%)	Hip (15), Vertebral (10), Wrist (5), Others (2)
Insufficient (20–29 ng/mL)	12 (24%)	Hip (4), Vertebral (2), Wrist (4), Proximal humerus (2)
Sufficient (≥30 ng/mL)	6 (12%)	Hip (1), Vertebral (0), Wrist (1), Proximal humerus (1), Others (3)
Total	**50 (100%)**	—

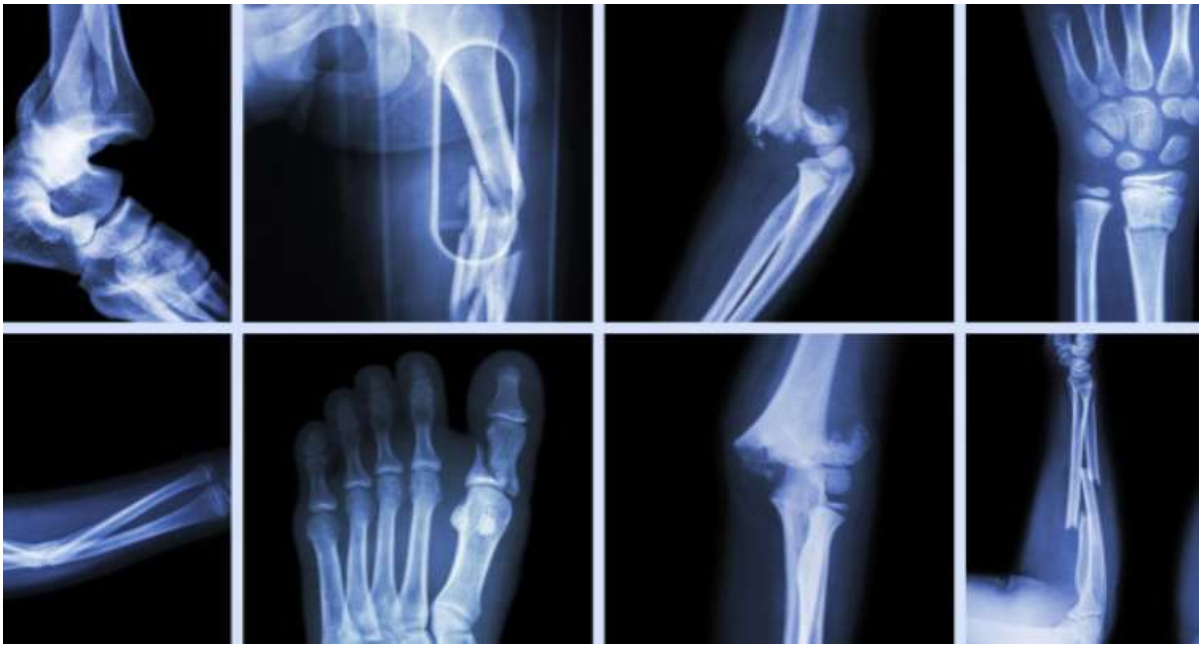

Figure: Fragility Fractures

DISCUSSION

The present study was conducted to evaluate the correlation of vitamin D deficiency with the incidence of fragility fractures in elderly patients. A total of 50 patients aged 60 years and above were included over a period of one year. The results highlighted several important demographic and clinical patterns, as well as a strong association between vitamin D deficiency and fragility fractures [8].

In terms of demographic profile, the majority of patients belonged to the age group of 70–79 years, accounting for 40% of cases, followed by 36% in the 60–69 age group and 24% in those aged 80 years and above. This finding is consistent with global epidemiological trends, where the risk of osteoporosis and fragility fractures rises with advancing age due to progressive decline in bone mineral density and muscle strength. Female predominance (56%) was noted, which is explained by postmenopausal hormonal changes leading to accelerated bone loss. Similar gender distribution patterns have been documented in earlier studies, indicating that elderly women remain more vulnerable to fragility fractures than their male counterparts.

Analysis of fracture distribution revealed that hip fractures (40%) were the most common, followed by vertebral fractures (24%) and wrist fractures (20%). This distribution reflects the typical sites of osteoporotic fragility fractures observed in elderly populations worldwide. Hip fractures, in particular, are considered the most serious due to their association with impaired mobility, prolonged hospitalization, and increased mortality. Vertebral fractures, though sometimes clinically silent, contribute significantly to chronic pain, deformity, and functional limitations. Wrist fractures were more frequent in younger elderly participants, likely related to fall-on-outstretched-hand mechanisms, whereas proximal humerus fractures and others were less common. These patterns emphasize the burden of osteoporosis-related fractures on both patients and healthcare systems [9-10].

A striking observation in this study was the high prevalence of vitamin D deficiency among patients with fragility fractures. Nearly two-thirds of the study population (64%) were vitamin D deficient, while 24% had insufficient levels, and only 12% were vitamin D sufficient. This indicates that the vast majority of patients sustaining fragility fractures had suboptimal vitamin D status. Hip and vertebral fractures were particularly more common in the vitamin D deficient group, reinforcing the role of vitamin D in maintaining bone strength and preventing fractures. These findings are in line with previous reports from both Western and Asian populations, where vitamin D deficiency has consistently been linked to increased fracture risk.

The pathophysiological basis for this association lies in the essential role of vitamin D in calcium absorption, bone mineralization, and neuromuscular function. Deficiency leads to secondary hyperparathyroidism, increased bone resorption, reduced bone density, and impaired muscle function, all of which synergistically increase the risk of falls and fractures. Moreover, elderly individuals are more prone to vitamin D deficiency due to limited sun exposure, reduced cutaneous synthesis, and inadequate dietary intake. The present study supports these mechanisms by demonstrating a significant clustering of fractures in patients with low vitamin D levels.

CONCLUSION

Overall, these findings highlight the need for early identification and correction of vitamin D deficiency in elderly populations as part of comprehensive strategies for fracture prevention. Routine screening, supplementation, and lifestyle modifications such as sunlight exposure and diet enrichment may reduce fracture risk substantially. Strengthening fall-prevention programs and integrating vitamin D assessment in geriatric care can further improve outcomes. Thus, this study underscores the critical role of vitamin D deficiency as a modifiable risk factor for fragility fractures in the elderly and emphasizes preventive and therapeutic interventions to reduce this burden.

REFERENCES

[1] Chapuy MC, Arlot M, Duboeuf F, Brun J, Crouzet B, Arnaud S, et al. Vitamin D3 and calcium to prevent hip fractures in elderly women. N Engl J Med. 1992;327(23):1637-42.

[2] Navarro Mdel C, Saavedra P, Jódar E, Gómez de Tejada MJ, Mirallave A, Sosa M. Osteoporosis and metabolic syndrome according to socio-economic status, contribution of PTH, vitamin D and

body weight: The Canarian Osteoporosis Poverty Study (COPS). Clin Endocrinol (Oxf). 2013 May;78(5):681-6.

[3] Chapuy MC, Pamphile R, Paris E, Kempf C, Schlichting M, Arnaud S, et al. Combined calcium and vitamin D3 supplementation in elderly women: confirmatory Decalyos II study. Osteoporos Int. 2002;13(3):257-64.

[4] Bischoff-Ferrari HA, Dawson-Hughes B, Staehelin HB, Orav JE, Stuck AE, Theiler R, et al. Prevention of nonvertebral fractures with oral vitamin D and dose dependency: a meta-analysis of randomized controlled trials. Arch Intern Med. 2009;169(6):551-61. =

[5] Lips P, Chapuy MC, Dawson-Hughes B, Pols HA, Holick MF. Vitamin D and its role in elderly bone health and fractures: insights from observational and interventional studies. J Bone Miner Res. 1996;11(11):1717-26.

[6] Wang Q, Yu D, Wang J, Lin S. Association between vitamin D deficiency and fragility fractures in Chinese elderly patients: a cross-sectional study. Ann Palliat Med. 2020;9(4):1660-5.

[7] Dadra A, Aggarwal S, Kumar P, Kumar V, Dibar DP, Bhadada SK. 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.

[8] Han J, Cho Y, Jee S, Jo S. Vitamin D Levels in Patients with Low-energy Hip Fractures. Hip Pelvis. 2020;32(4):192-8.

[9] Saini AK, Dawe EJC, Thompson SM, Rosson JW. Calcium and vitamin D supplementation in elderly patients suffering fragility fractures; an audit of current practice. Open Orthop J. 2017;11:1230-6.

[10] Zhao JG, Zeng XT, Wang J, Liu L. Association Between Calcium or Vitamin D Supplementation and Fracture Incidence in Community-Dwelling Older Adults: A Systematic Review and Meta-analysis. JAMA. 2017;318(24):2466-82.