



Frequency of Vitamin D Deficiency in Trauma Patients with Fracture

Article History:

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Abstract: Background: The role of vitamin D in maintaining bone health and fracture healing has gained increasing attention in orthopedic practice. Vitamin D deficiency is common among trauma patients and may adversely affect bone metabolism and recovery following fractures. Early identification of vitamin D deficiency may help improve patient outcomes and reduce complications associated with delayed healing. **Objectives:** To determine the frequency of vitamin D deficiency in trauma patients with fracture. **Study Design & Setting:** This descriptive cross-sectional study was conducted at the Department of Orthopaedic Surgery, PGMI Shaikh Zayed Hospital, Lahore from 2 July 2025 to 2 October 2025. **Methodology:** A total of 100 trauma patients with fracture aged 18–60 years of either gender were included through non-probability consecutive sampling over a period of six months. Patients with chronic renal failure, pregnancy, lactation, obesity (BMI >35 kg/m²), recent vitamin D supplementation, or use of drugs affecting vitamin D metabolism were excluded. Five milliliters of venous blood were collected for serum vitamin D estimation. Vitamin D deficiency was labelled when serum vitamin D level was <20 ng/ml. Data were analyzed using SPSS version 22.0. Stratification was performed for age, gender, residence, socioeconomic status, and BMI, and post-stratification chi-square test was applied. **Results:** The mean age of patients was 38.74 ± 11.26 years, while the mean BMI was 26.18 ± 4.12 kg/m². Vitamin D deficiency was observed in 42 (42.0%) patients. Significant associations were found between vitamin D deficiency and age (p=0.041), residence (p=0.027), and socioeconomic status (p=0.012). **Conclusion:** Vitamin D deficiency was frequently observed among trauma patients with fracture. Routine screening may help in early diagnosis and better orthopedic management.

Keywords: Fracture, Orthopaedic trauma, Trauma patients, Vitamin D, Vitamin D deficiency.

INTRODUCTION

Vitamin D plays an essential role in maintaining general health and has become an area of increasing interest in medical research. Vitamin D deficiency has been linked not only to various non-orthopedic conditions such as cancer, diabetes, and cardiovascular diseases, but also to adverse effects on musculoskeletal health.¹ In the past decades, a vast number of pre-clinical and clinical studies have reported the potential health-beneficial properties of vitamin D.²⁻⁵ While some studies have demonstrated positive effects of vitamin D on different systems of the human body⁶, others have failed to show favorable effects on overall health.⁷ Furthermore, numerous studies have reported the prevalence of vitamin D deficiency and insufficiency in healthy individuals as well as in different groups of patients suffering from various diseases.^{8,9}

Several studies have documented low vitamin D levels among orthopedic patients.^{10,12} In addition, insufficient vitamin D levels have also been reported in pediatric orthopedic patients.^{13,14} A large proportion of orthopedic patients undergoing surgical procedures have been found to be vitamin D insufficient. These include patients scheduled for foot and ankle, spine, knee, shoulder, and elbow surgeries, as well as patients undergoing hip, knee, and shoulder arthroplasty.^{15,16} Moreover, various orthopedic diseases have been associated with low vitamin D levels.¹⁷ Studies have demonstrated that patients with decreased articular cartilage thickness are more likely to have vitamin D insufficiency, suggesting that low vitamin D status may be a risk factor for the development of osteoarthritis. Orthopedic conditions associated with altered bone metabolism, such as bone marrow edema syndrome and osteochondritis dissecans, have also been linked with low vitamin D levels.¹² In a study conducted by Nault K et al., the frequency of vitamin D deficiency in trauma patients with fracture was reported to be 40%.¹⁸

The aim of this study is to determine the frequency of vitamin D deficiency in trauma patients with fracture. Although a few international studies are available, there is limited local published data on this subject, which necessitates the present study. If the results of this study reveal a significant frequency of vitamin D deficiency, it may support routine screening for vitamin D deficiency in trauma patients with fracture. Early identification and timely management of vitamin D deficiency may help improve patient outcomes and future orthopedic practice. The objective is to determine the frequency of vitamin D deficiency in trauma patients with fracture.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted at the Department of Orthopedic Surgery, PGMI Shaikh Zayed Hospital, Lahore after approval of the synopsis from CPSP from 2 July 2025 to 2 October 2025. The sample size was 100 patients, calculated with a 10% margin of error, 95% confidence level, and an expected frequency of vitamin D deficiency in trauma patients with fracture of 40%.¹⁸ Non-probability consecutive sampling technique was used. Patients aged 18–60 years of either gender who were admitted with minimal trauma fractures were included in the study. Falls from standing height and torsional injuries were considered low-energy trauma as per operational definition. Patients with vitamin D supplementation for more than two weeks during the preceding three months, patients with chronic renal failure (serum creatinine >1.2 mg/dl), patients with body mass index greater than 35 kg/m², pregnant and lactating females, and patients taking drugs affecting vitamin D metabolism such as anti-epileptic and anti-tuberculosis medications for more than one month during the preceding six months were excluded from the study.

After approval from the hospital ethical committee, 100 patients presenting to the Department of Orthopedic Surgery, PGMI Shaikh Zayed Hospital, Lahore were enrolled after fulfilling the inclusion and exclusion criteria. Informed written consent was taken from each patient. Demographic information including name, age, weight, and address was recorded on a specially designed proforma. Serum vitamin D levels were obtained from the hospital laboratory facility, which was provided free of cost to the patients. Vitamin D deficiency was labelled according to the operational definition. Confounding variables were controlled through exclusion criteria. Patients found to have vitamin D deficiency were managed according to departmental protocols. Trauma patients with fractures were defined as patients having minimal trauma fractures confirmed on X-ray anteroposterior or lateral view. Vitamin D deficiency was defined as serum vitamin D level <20 ng/ml. Approximately 5 ml of venous blood sample was obtained through venipuncture and sent to the laboratory for estimation of serum vitamin D level.

All data were entered and analyzed using SPSS version 22.0. Quantitative variables such as age and BMI were presented as mean $\pm$ standard deviation. Qualitative variables including gender, socioeconomic status, residence, and vitamin D deficiency were presented as frequency and percentages. Data were stratified for age, gender, BMI, socioeconomic status, and residence. Post-stratification chi-square test was applied, and a p-value ≤ 0.05 was considered statistically significant.

RESULTS

The mean age of the patients was 38.74 ± 11.26 years. Among 100 trauma patients with fracture, 34 (34.0%) patients were between 18–30 years, 41 (41.0%) were between 31–45 years, and 25 (25.0%) were between 46–60 years of age. There were 63 (63.0%) male and 37 (37.0%) female patients. Regarding residence, 58 (58.0%) patients belonged to rural areas while 42 (42.0%) belonged to urban areas. According to socioeconomic status, 39 (39.0%) patients belonged to the lower class, 46 (46.0%) to the middle class, and 15 (15.0%) to the upper class. The mean BMI of the patients was 26.18 ± 4.12 kg/m². Moreover, 36 (36.0%) patients had normal BMI, 43 (43.0%) were overweight, and 21 (21.0%) were obese, as given in Table 1.

Table 1: Baseline Characteristics of Trauma Patients with Fracture (n = 100)

Variable	Category	n (%)
Age Group (Years)	Mean±SD	38.74 ± 11.26
	18–30	34 (34.0)
	31–45	41 (41.0)
	46–60	25 (25.0)
Gender	Male	63 (63.0)
	Female	37 (37.0)
Residence	Rural	58 (58.0)
	Urban	42 (42.0)
Socioeconomic Status	Lower	39 (39.0)
	Middle	46 (46.0)
	Upper	15 (15.0)
BMI Category (kg/m ²)	Mean±SD	26.18 ± 4.12
	Normal (18.5–24.9)	36 (36.0)
	Overweight (25–29.9)	43 (43.0)
	Obese (30–34.9)	21 (21.0)

Vitamin D deficiency was present in 42 (42.0%) trauma patients with fracture, while 58 (58.0%) patients did not have vitamin D deficiency, as given in Table 2.

Table 2: Frequency of Vitamin D Deficiency in Trauma Patients with Fracture (n = 100)

Vitamin D Deficiency	n (%)
Yes	42 (42.0)
No	58 (58.0)

Stratification analysis showed that vitamin D deficiency was present in 10 (29.4%) patients aged 18–30 years, 18 (43.9%) patients aged 31–45 years, and 14 (56.0%) patients aged 46–60 years, with a statistically significant association ($p=0.041$). Among male patients, vitamin D deficiency was observed in 23 (36.5%) patients, whereas among females it was present in 19 (51.4%) patients, with no statistically significant association ($p=0.148$). Vitamin D deficiency was found in 30 (51.7%) rural patients and 12 (28.6%) urban patients, showing a statistically significant association ($p=0.027$). According to socioeconomic status, vitamin D deficiency was present in 24 (61.5%) lower class patients, 15 (32.6%) middle class patients, and 3 (20.0%) upper class patients, demonstrating a statistically significant association ($p=0.012$), as given in Table 3.

Table 3: Stratification of Vitamin D Deficiency with Respect to Age Group, Gender, Residence, and Socioeconomic Status (n = 100)

Variable	Category	Vitamin D Deficiency Present	Vitamin D Deficiency Absent	p-value
Age Group (Years)	18–30	10 (29.4)	24 (70.6)	0.041
	31–45	18 (43.9)	23 (56.1)	

	46–60	14 (56.0)	11 (44.0)	
Gender	Male	23 (36.5)	40 (63.5)	0.148
	Female	19 (51.4)	18 (48.6)	
Residence	Rural	30 (51.7)	28 (48.3)	0.027
	Urban	12 (28.6)	30 (71.4)	
Socioeconomic Status	Lower	24 (61.5)	15 (38.5)	0.012
	Middle	15 (32.6)	31 (67.4)	
	Upper	3 (20.0)	12 (80.0)	

Vitamin D deficiency was more common among patients belonging to the lower socioeconomic class, where 24 (61.5%) patients had vitamin D deficiency, compared to 15 (32.6%) patients from the middle class and 3 (20.0%) patients from the upper socioeconomic class. The association between socioeconomic status and vitamin D deficiency was statistically significant ($p=0.012$), as given in Table 4.

Table 4: Stratification of Vitamin D Deficiency with Respect to Socioeconomic Status (n = 100)

Socioeconomic Status	Vitamin D Deficiency Present	Vitamin D Deficiency Absent	p-value
Lower	24 (61.5%)	15 (38.5%)	0.012
Middle	15 (32.6%)	31 (67.4%)	
High	3 (20.0%)	12 (80.0%)	
Total	42 (42.0%)	58 (58.0%)	

DISCUSSION

Vitamin D plays a vital role in bone health, calcium metabolism, and fracture healing. Deficiency of vitamin D has become a common health problem worldwide and is frequently observed in orthopedic patients. Trauma patients with fracture may have an increased risk of vitamin D deficiency, which can negatively affect bone strength and recovery. Several international studies have reported a high prevalence of vitamin D deficiency among patients presenting with fractures. Early identification of vitamin D deficiency may help improve fracture healing and reduce complications. However, limited local data are available regarding the frequency of vitamin D deficiency in trauma patients with fracture.

Our findings are comparable with the study conducted by Nault K et al. (2020), who reported vitamin D deficiency in approximately 40% of trauma patients with fracture. The similarity between the two studies supports the observation that vitamin D deficiency is highly prevalent among orthopedic trauma patients. Nault K et al. further reported that low vitamin D levels were associated with delayed fracture healing and fracture nonunion, highlighting the clinical importance of early recognition and treatment of vitamin D deficiency in fracture patients. The slightly higher prevalence observed in our study (42.0% vs. 40%) may be attributed to geographical variation, nutritional differences, socioeconomic factors, and varying sunlight exposure among populations.¹⁸

Similarly, Moore DM et al. (2022) reported a prevalence of vitamin D deficiency of 38% among children with low-energy fractures caused by accidental trauma. Although their study population consisted of pediatric patients aged 1–16 years, their

results closely resemble our findings. The higher frequency in our adult population may be related to poor dietary habits, limited outdoor activity, and increasing prevalence of metabolic disorders among adults. Both studies emphasize the association between trauma fractures and low vitamin D status.

Lee YS et al. (2022) also demonstrated a high prevalence of vitamin D deficiency and insufficiency among children requiring fracture surgery. Their findings support the concept that vitamin D deficiency is common across different age groups of orthopedic patients. Although our study focused on adults aged 18–60 years, both studies collectively suggest that vitamin D deficiency is not limited to a specific age group and may significantly affect fracture patients requiring orthopedic management.¹⁹

Smith JT et al. (2014) evaluated 75 fracture patients and reported that 47% had insufficient vitamin D levels, while 13% had frank vitamin D deficiency (<20 ng/ml). Furthermore, they observed significantly lower vitamin D levels in fracture patients compared to ankle sprain patients ($P = 0.02$). The prevalence reported in their study differs slightly from our findings because they differentiated between insufficiency and deficiency separately. Nevertheless, both studies indicate that hypovitaminosis D is highly prevalent among patients presenting with orthopedic injuries. Their statistically significant findings further strengthen the relationship between fractures and low vitamin D levels.²⁰

Booth M et al. (2024) also reported a high prevalence of vitamin D deficiency among young orthopedic trauma patients and demonstrated an inverse relationship between vitamin D levels and bone mineral density. These findings correlate with our study and reinforce the importance of vitamin D in maintaining bone strength and integrity. Reduced bone mineral density due to vitamin D deficiency may

predispose patients to fractures even after minimal trauma.²¹

In the present study, stratification analysis showed statistically significant associations between vitamin D deficiency and age ($p=0.041$), residence ($p=0.027$), and socioeconomic status ($p=0.012$). Vitamin D deficiency was more common among older patients and those belonging to rural and lower socioeconomic groups. These findings may be explained by poor nutritional intake, reduced healthcare access, lack of awareness, and limited vitamin D supplementation among lower socioeconomic populations. Similar socioeconomic and lifestyle factors have also been implicated in previous international studies evaluating vitamin D deficiency among orthopedic patients. Overall, the findings of our study are in agreement with the existing literature demonstrating a high prevalence of vitamin D deficiency among trauma patients with fracture. The consistency between our results and previous studies highlights the need for routine screening and timely correction of vitamin D deficiency in orthopedic trauma patients to potentially improve fracture healing and reduce complications.

LIMITATIONS

The study was conducted at a single center, which may limit the generalizability of the results. In addition, the cross-sectional design did not allow assessment of long-term outcomes or causal relationships.

CONCLUSION

Vitamin D deficiency was found to be common among trauma patients with fracture. A significant association was observed between vitamin D deficiency and factors such as age, residence, and socioeconomic status. Routine screening for vitamin D deficiency in trauma patients may help in timely management and improved orthopedic outcomes.

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Conflict of Interest: No

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