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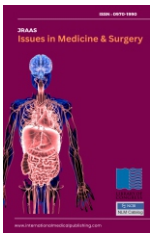

Research Article

Section: Geriatrics

Prevalence of Hypoalbuminemia Among Older Adults Admitted with Intertrochanteric Fracture & Its Impact on Clinical Outcome

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HIGHLIGHTS

- High prevalence of hypoalbuminemia
- Significant functional outcome impairment
- Prolonged hospital stays observed
- No significant mortality association
- Poor correlation with MNA scores

Key Words:
Hypoalbuminemia
Intertrochanteric fracture
Elderly
Nutritional status
Clinical outcome

ABSTRACT

Introduction: Intertrochanteric fractures in older adults are associated with high morbidity and mortality. Nutritional status, particularly serum albumin level, is an important indicator of both nutritional reserve and overall systemic health. **Aim & Objectives:** To determine the prevalence of hypoalbuminemia among elderly patients with intertrochanteric fractures and to evaluate its association with clinical outcomes. **Materials & Methods:** A hospital-based cross-sectional observational study was conducted on 120 patients aged ≥60 years with radiologically confirmed intertrochanteric fractures. Serum albumin levels were measured within 24 hours of admission. Hypoalbuminemia was defined as serum albumin ≤3.5 g/dL. Nutritional status was assessed using the Mini Nutritional Assessment (MNA) score. Clinical outcomes included functional recovery, in-hospital mortality, and duration of hospital stay. **Results:** Hypoalbuminemia was observed in 73.3% of patients. It showed a significant association with poor functional outcomes and prolonged hospital stay ($p < 0.05$). However, no significant association was found between hypoalbuminemia and mortality. Additionally, MNA scores did not show a significant correlation with serum albumin levels. **Conclusion:** Hypoalbuminemia is highly prevalent among elderly patients with intertrochanteric fractures and serves as an important predictor of poor functional recovery and increased hospital stay. Early identification and nutritional intervention may help improve clinical outcomes in this high-risk population.

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INTRODUCTION

Intertrochanteric fractures constitute a major cause of morbidity and mortality among older adults and represent a growing public health challenge worldwide. These fractures commonly occur following low-energy trauma such as falls and are frequently associated with prolonged hospitalization, loss of independence, and increased mortality. With increasing life expectancy and demographic transition toward an aging population, the global incidence of hip fractures is projected to rise substantially over the coming decades, placing significant strain on healthcare systems, particularly in low- and middle-income countries. The global incidence of hip fractures is projected to rise from approximately 2.6 million in 2025 to over 6.25 million by 2050 [1-3]. Despite improvements in surgical techniques and perioperative management, outcomes following intertrochanteric fractures in the elderly remain suboptimal.

Multiple factors influence recovery and prognosis after hip fracture surgery, including age, comorbid illnesses, cognitive status, fracture type, and perioperative complications. However, predictors of functional recovery and long-term outcomes remain incompletely understood [4]. In recent years, increasing attention has been directed toward the role of nutritional status as a potentially modifiable determinant of postoperative outcomes in geriatric fracture patients. Malnutrition is highly prevalent in older adults and is often under recognized in hospitalized patients, particularly those presenting with acute trauma [5].

Serum albumin is a widely available and inexpensive biochemical marker that reflects both nutritional reserve and systemic inflammatory status [6,7]. Hypoalbuminemia has been associated with impaired wound healing, reduced immune competence, increased susceptibility to infections, and delayed recovery following surgical interventions. In the context of geriatric hip fractures, several studies have demonstrated that low serum albumin levels at admission are independently associated with prolonged hospital stay, increased postoperative complications, poor functional outcomes, and higher mortality rates. As a result, serum albumin has been increasingly recognized as a valuable prognostic marker in elderly patients undergoing surgery for hip fractures [8,9].

Although various tools, such as the Mini Nutritional Assessment (MNA) are used to evaluate nutritional status in older adults, biochemical parameters like serum albumin may identify patients at risk even when clinical nutritional assessments appear normal. Previous studies have reported discrepancies between nutritional screening tools and serum albumin levels, suggesting that hypoalbuminemia may reflect acute illness, inflammatory response, or catabolic stress rather than nutritional deficiency alone [4,10]. Prevalence of hypoalbuminemia among elderly patients with intertrochanteric fractures and its association with clinical outcomes **(Figure 1)**. This highlights the importance of incorporating laboratory markers into the routine assessment of elderly fracture patients. Despite growing international evidence

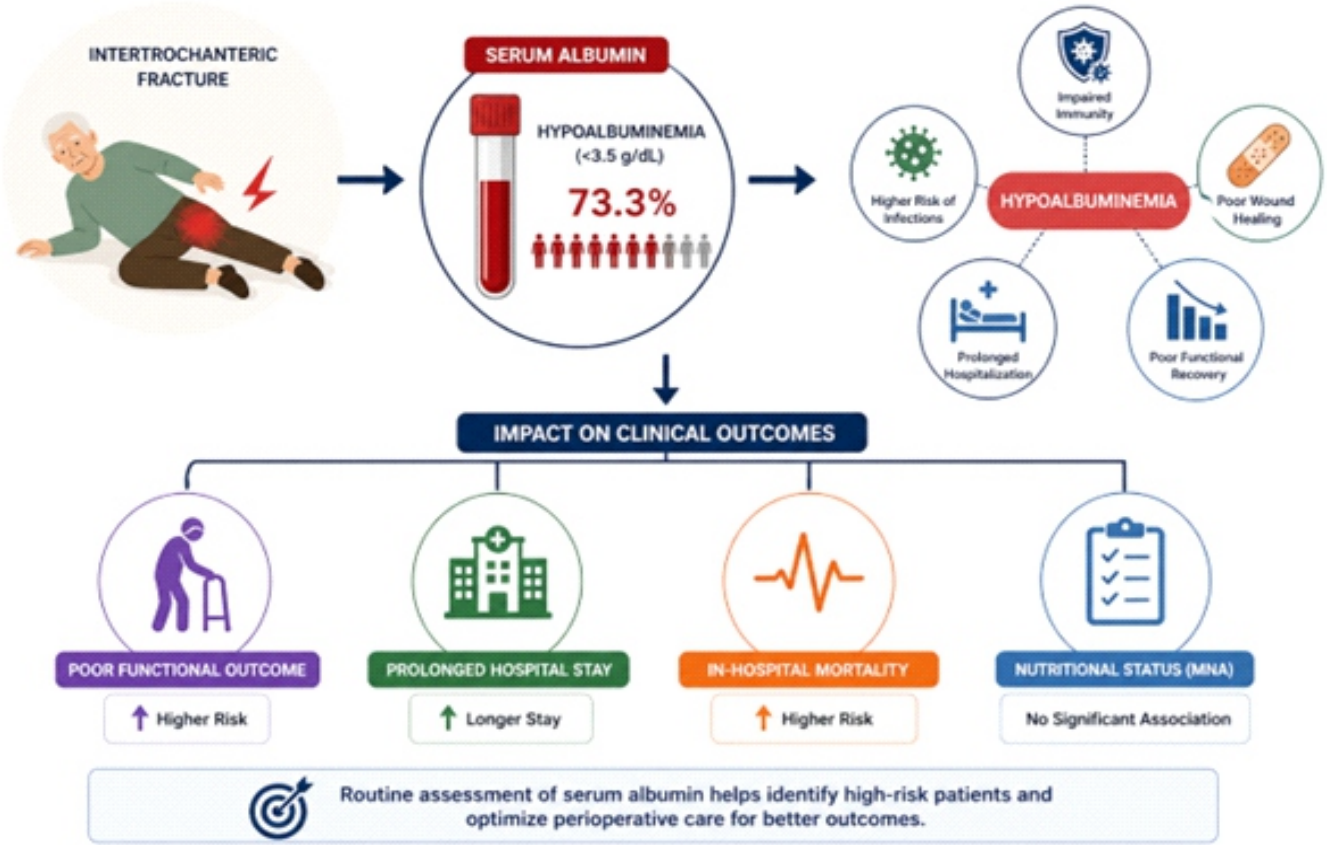

Figure 1: Prevalence of hypoalbuminemia in elderly patients with intertrochanteric fractures and its impact on clinical outcomes. ***Adapted from BioRender.com***

supporting the prognostic value of hypoalbuminemia, there is a relative paucity of data from India regarding its prevalence and impact on outcomes among older adults with intertrochanteric fractures. Understanding the burden of hypoalbuminemia and its association with clinical outcomes in this population is essential for early risk stratification, optimization of peri-operative care, and implementation of targeted nutritional interventions aimed at improving recovery and functional outcomes.

MATERIALS & METHODS

This hospital-based cross-sectional observational study was conducted in the Department of Geriatrics at MGM Medical College, Navi Mumbai. The study included patients aged ≥60 years with radiologically confirmed intertrochanteric fractures who were medically stable for surgical management. Patients with pathological fractures, polytrauma, or those unwilling to provide informed consent were excluded. A total of 120 patients were enrolled.

Following informed consent, a detailed clinical evaluation was performed, including demographic profile, comorbidities, and nutritional assessment using the Mini Nutritional Assessment (MNA) tool. Baseline laboratory investigations, including complete blood count, serum total albumin, renal function tests, and liver function tests, were obtained within 24 hours of admission. Hypoalbuminemia was defined as serum albumin ≤3.5 g/dL. Data were analyzed using appropriate statistical methods. Associations between categorical variables were assessed using the chi-square test, while continuous variables were compared using the independent t-test. A p-value <0.05 was considered statistically significant.

RESULTS

Sociodemographic and Nutritional Status of Patients

The study population predominantly comprised advanced age groups, reflecting the higher susceptibility of older adults to hip fractures. Patients aged 80–89 years constituted the largest proportion of the study cohort (40 patients, 33.3%), followed by those aged 70–79 years (30 patients, 25.0%). Individuals aged 60–69 years accounted for 22.5% (27 patients), while the oldest age group (≥90 years) represented 19.2% (23 patients) (**Table 1**). These findings highlight that nearly three-quarters of the patients were aged 70 years or older, emphasizing the increased fracture risk with advancing age.

With respect to sex distribution, females formed the majority of the study population, accounting for 56.7% (68 patients), whereas males constituted 43.3% (52 patients). This female predominance is consistent with existing literature and may be attributed to factors such as postmenopausal osteoporosis, longer life expectancy in women, and a higher propensity for falls in older age.

Assessment of nutritional status using the Mini Nutritional Assessment (MNA) revealed a high burden of nutritional impairment among the participants. Only 31 patients (25.8%) were classified as having a normal nutritional status. A substantial proportion of patients were either at risk of malnutrition (35 patients, 29.2%) or were already malnourished at the time of admission (54 patients, 45.0%). Collectively, nearly three-quarters of the study population (74.2%) demonstrated compromised nutritional status, underscoring the vulnerability of elderly patients with intertrochanteric fractures to malnutrition.

Prevalence of Hypoalbuminemia among Older Adults with Intertrochanteric Fracture (N=120)

Of the 120 patients included in the study, 88 patients (73%) were found to have hypoalbuminemia at the time of admission, while 32 patients (27%) had normal serum albumin levels. This finding highlights a high burden of hypoalbuminemia in the study population, indicating that nearly three out of four elderly patients with intertrochanteric fractures presented with low serum albumin levels **(Figure 2)**.

Association between Albumin and MNA (N=120)

The association between serum albumin levels and nutritional status was assessed using the Mini Nutritional Assessment (MNA). Of the total study population, 88 patients had hypoalbuminemia, while 32 had normal serum albumin levels at the time of admission. Among patients classified as having a normal nutritional status by MNA (n=31), a high proportion, 25 patients (80.6%) were found to have hypoalbuminemia, whereas only 6 patients (19.4%) had normal albumin levels. Similarly, in the group identified as being at risk of malnutrition (n=35), 28 patients (80.0%) exhibited hypoalbuminemia, and 7 patients (20.0%) had normal albumin levels. In contrast, among patients categorized as malnourished (n=54), hypoalbuminemia was present in 35 patients (64.8%), while 19 patients (35.2%) had normal serum albumin levels.

Although hypoalbuminemia was most prevalent among patients with normal and at-risk MNA scores, a comparatively lower proportion was observed in the malnourished group **(Figure 3)**. Chi-square test revealed no significant association between MNA categories and the presence of hypoalbuminemia ($\chi^2 = 3.64$, df = 2, p = 0.161). This indicates that serum albumin levels did not significantly correlate with nutritional status as assessed by the MNA tool in this study population **(Table 2)**.

Association between Albumin Level and Clinical Outcome (N=120)

Clinical outcomes assessed included functional outcome and in-hospital mortality, stratified according to the presence or absence of hypoalbuminemia. Concerning functional outcomes, among patients who achieved a good functional outcome (n=58), the majority, 50 patients (86.2%) had hypoalbuminemia, while only 8 patients (13.8%) had normal serum albumin

levels. Conversely, among patients with poor functional outcomes (n=62), hypoalbuminemia was present in 38 patients (61.3%), whereas 24 patients (38.7%) had normal albumin levels. Statistical analysis revealed a significant association between hypoalbuminemia and functional outcome ($\chi^2 = 9.56$, df = 2, p = 0.002), indicating that patients with hypoalbuminemia were significantly more likely to experience poor functional recovery following intertrochanteric fracture **(Figure 4)**.

Regarding mortality, 16 patients died during the hospital stay. Among these patients, hypoalbuminemia was present in 9 patients (56.3%), while 7 patients (43.7%) had normal serum albumin levels. In contrast, among survivors (n=104), a higher proportion-79 patients (76.0%) had hypoalbuminemia compared to 25 patients (24.0%) with normal albumin levels. However, the association between serum albumin levels and mortality was not statistically significant ($\chi^2 = 2.75$, df = 2, p = 0.096) **(Table 3)**.

Association between Albumin Level and Duration of Hospital Stay (N=120)

The mean duration of hospitalization was compared between patients with and without hypoalbuminemia. Patients with hypoalbuminemia (n=88) had a significantly longer mean hospital stay of 17.6 ± 6.3 days compared to 14.5 ± 6.1 days among patients with normal serum albumin levels (n=32). Statistical analysis using the independent t-test demonstrated that this difference was statistically significant (t = −2.38, df = 118, p = 0.018) **(Table 4).**

Table 1: Sociodemographic and nutritional status of patients (N=120)

Characteristics		Frequency (%)
Age (in years)	60-69	27 (22.5)
	70-79	30 (25.0)
	80-89	40 (33.3)
	≥90	23 (19.2)
Sex	Male	52 (43.3)
	Female	68 (56.7)
MNA status	Normal	31 (25.8)
	At risk	35 (29.2)
	Malnourished	54 (45.0)

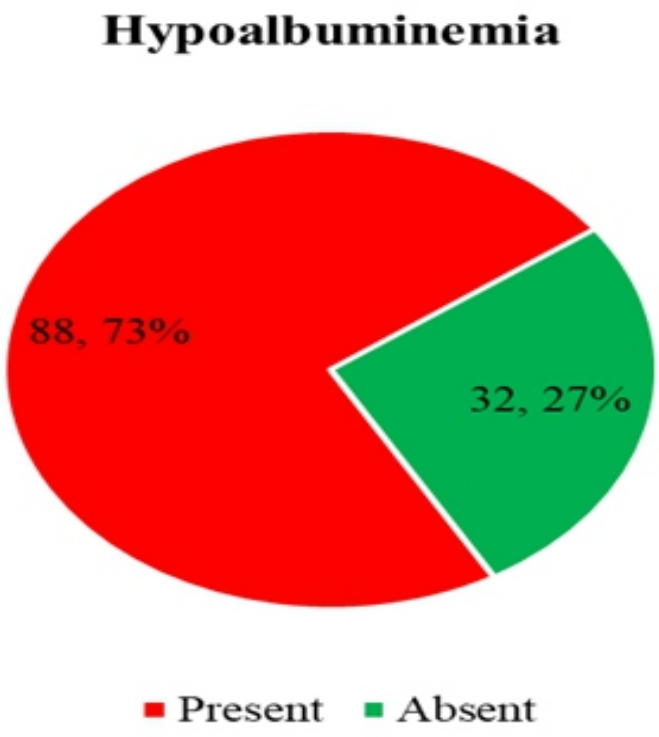

Figure 2: Prevalence of hypoalbuminemia among older adults with intertrochanteric fracture (N=120)

Table 2: Association between albumin and MNA (N=120)

MNA status	Hypoalbuminemia		Chi-square (p-value)
	Present (n=88)	Absent (n=32)	
Normal (n=31)	25 (80.6%)	6 (19.4%)	3.64 D(f)=2 (0.161)
At risk (n=35)	28 (80.0%)	7 (20.0%)	
Malnourished (n=54)	35 (64.8%)	19 (35.2%)	

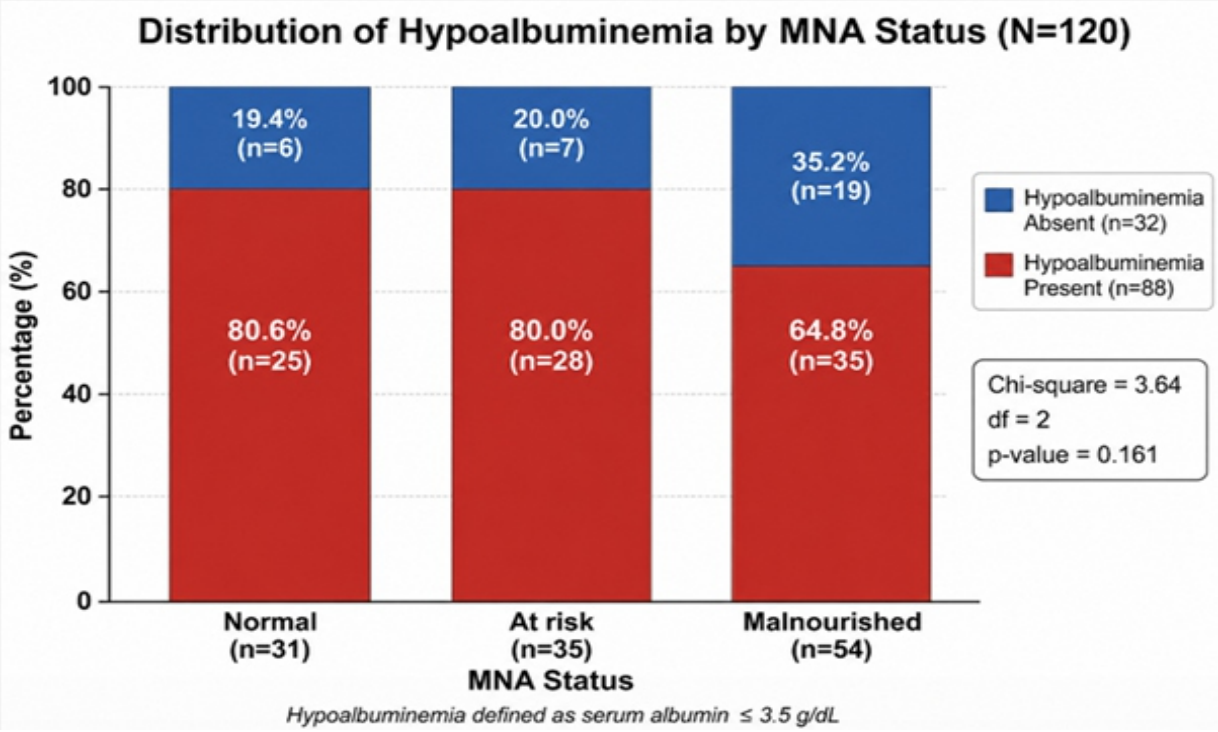

Figure 3: Distribution of hypoalbuminemia across Mini Nutritional Assessment (MNA) categories among elderly patients with intertrochanteric fracture (N=120).

Table 3: Association between albumin level and clinical outcome (N=120)

Clinical outcome		Hypoalbuminemia		Chi-square (p-value)
		Present (n=88)	Absent (n=32)	
Functional outcome	Good (n=58)	50 (86.2%)	8 (13.8%)	9.56 D(f)=2
	Poor (n=62)	38 (61.3%)	24 (38.7%)	**(0.002*)**
Mortality	Yes (n=16)	9 (56.3%)	7 (43.7%)	2.75 D(f)=2
	No (n=104)	79 (76.0%)	25 (24.0%)	(0.096)

*** Statistically significant**

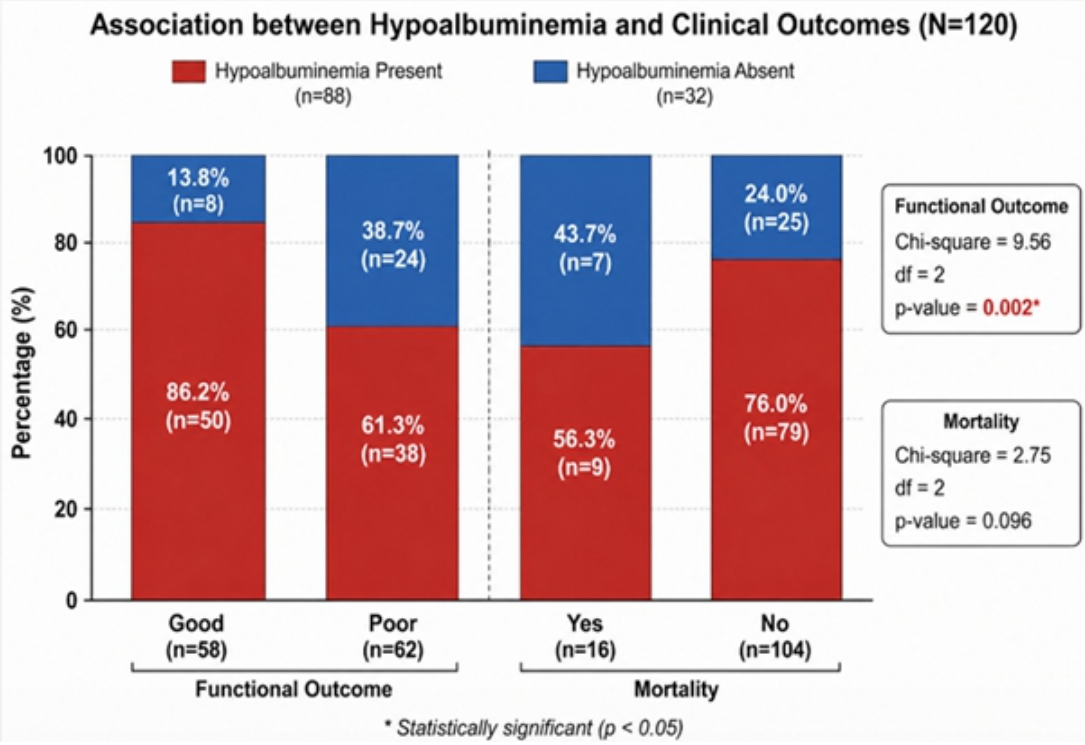

Figure 4: Association between hypoalbuminemia and clinical outcomes among elderly patients with intertrochanteric fracture (N=120).

Table 4: Association between albumin level and duration of hospital stay (N=120)

Hypoalbuminemia	Duration of hospital stay (days)	T-test (p-value)
Present (n=88)	17.6 ± 6.3	-2.38
Absent (n=32)	14.5 ± 6.1	D(f)=118 **(0.018*)**

*** Statistically significant**

DISCUSSION

The present study highlights a high burden of hypoalbuminemia among elderly patients admitted with intertrochanteric fractures and demonstrates its significant association with adverse clinical outcomes. The findings underscore the importance of serum albumin as a prognostic marker in geriatric fracture care. In this study, hypoalbuminemia was observed in 73% of patients at the time of admission. This prevalence is comparable to earlier reports from both Indian and international settings. Brock et al. reported hypoalbuminemia in 87% of hospitalized elderly patients, while Garwe et al. documented a prevalence of 65% among geriatric trauma patients [8,9]. The high prevalence observed in the present study reflects the combined effects of advanced age, acute physiological stress, inflammatory response to trauma, and pre-existing nutritional deficiencies commonly seen in elderly populations [7,11,12]

The sociodemographic profile of the study population revealed a predominance of patients aged ≥70 years and a higher proportion of females, which is consistent with existing epidemiological data on hip fractures [1]. Furthermore, sarcopenia in older adults may further contribute to hypoalbuminemia, as age-related loss of muscle mass is strongly linked to poor nutritional reserves and adverse outcomes following hip fractures. Age-related decline in physiological reserve, higher prevalence of osteoporosis in women, and increased risk of falls may contribute to both fracture occurrence and poorer post-operative recovery in this group [13,14].

Assessment of nutritional status using the Mini Nutritional Assessment revealed that nearly three-quarters of patients were either malnourished or at risk of malnutrition. However, no significant association was found between MNA categories and serum albumin levels. Similar discrepancies between clinical nutritional assessment tools and biochemical markers have been reported previously [8,15]. Trauma induced cytokine release increased vascular permeability, and reduced hepatic albumin synthesis are known contributors to low serum albumin levels in acute illness [16]. This finding suggests that hypoalbuminemia may reflect acute inflammatory & catabolic states induced by trauma rather than nutritional deficiency alone, reinforcing the limitations of relying solely on screening tools such as MNA in acute care settings.

A key finding of this study is the significant association between hypoalbuminemia and poor functional outcomes following intertrochanteric fracture. Patients with low serum

albumin levels were significantly more likely to experience poor functional recovery. This observation aligns with findings by Bohl et al., who demonstrated that hypoalbuminemia independently predicted poorer postoperative outcomes and reduced survival following geriatric hip fracture surgery [7]. Similar associations have also been reported in other international studies, emphasizing the role of albumin as a predictor of postoperative recovery [4,17]. Although mortality was higher among patients with hypoalbuminemia in the present study, the association did not reach statistical significance. This finding is consistent with some studies that have reported a trend toward higher mortality without statistical significance, possibly due to limited sample size or short follow-up duration [9].

The present study also demonstrated that patients with hypoalbuminemia had a significantly longer duration of hospital stay. Prolonged hospitalization associated with low serum albumin levels has been well documented and may be attributed to delayed wound healing, increased risk of postoperative complications, and reduced functional reserve [7,18,19,20]. This finding further emphasizes the economic and healthcare burden associated with hypoalbuminemia in geriatric fracture patients.

Overall, the findings of this study support existing evidence that hypoalbuminemia is a strong and independent predictor of poor functional outcomes and prolonged hospitalization in elderly patients with intertrochanteric fractures. Routine assessment of serum albumin at admission may facilitate early risk stratification and enable timely nutritional and medical interventions aimed at improving postoperative recovery.

CONCLUSION

Hypoalbuminemia is highly prevalent among elderly patients admitted with intertrochanteric fractures, highlighting its frequent occurrence in this vulnerable population. Hypoalbuminemia was found to be significantly associated with poor functional outcomes and prolonged hospital stay, underscoring its role as an important prognostic indicator in geriatric fracture care. Although mortality was higher among patients with low serum albumin levels, the association did not reach statistical significance in the present study.

The lack of a significant association between serum albumin levels and MNA scores suggests that hypoalbuminemia may reflect acute inflammatory and catabolic responses to trauma rather than nutritional deficiency alone. These findings emphasize the limitations of relying solely on clinical nutritional screening tools and support the inclusion of biochemical markers in routine assessment. Early identification of hypoalbuminemia at hospital admission may facilitate risk stratification and enable timely nutritional and medical interventions, potentially improving functional recovery and reducing hospital stay. Routine assessment of serum albumin should therefore be considered an integral component of the initial evaluation and management of elderly patients with intertrochanteric fractures.

CLINICAL SIGNIFICANCE

The clinical significance of this study lies in its potential to bridge the gap between research findings and practical healthcare applications. It emphasizes the importance of translating scientific observations into meaningful improvements in patient care, diagnosis, and treatment outcomes. By highlighting real-world relevance, the study contributes to evidence-based medical practice and supports informed clinical decision making. Ultimately, the findings aim to enhance patient quality of life, optimize therapeutic strategies, and promote better disease management in clinical settings.

ABBREVIATIONS

MNA: Mini Nutritional Assessment
S. Albumin / Alb: Serum Albumin
IF fracture: Intertrochanteric Fracture
LOS: Length of Stay
OPD: Outpatient Department

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AUTHOR CONTRIBUTIONS

All authors significantly contributed to the study conception and design, data acquisition, or data analysis and interpretation. They participated in drafting the manuscript or critically revising it for important intellectual content, consented to its submission to the current journal, provided final approval for the version to be published, and accepted responsibility for all aspects of the work. Additionally, all authors meet the authorship criteria outlined by the International Committee of Medical Journal Editors (ICMJE) guidelines.

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CONFLICT OF INTEREST

Authors declared that there is no conflict of interest.

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None

ETHICAL APPROVAL & CONSENT TO PARTICIPATE

All necessary consent & approval was obtained by authors.

CONSENT FOR PUBLICATION

All necessary consent for publication was obtained by authors.

DATA AVAILABILITY

All data generated and analyzed are included within this research article. The datasets utilized and/or analyzed in this study can be obtained from the corresponding author upon a re-asonable request.

USE OF ARTIFICIAL INTELLIGENCE (AI) & LARGE LANGUAGE MODEL (LLM)

The authors confirm that no AI & LLM tools were used in thewriting or editing of the manuscript, and no images were altered or manipulated using AI & LLM.

AUTHOR'S NOTE

This article serves as an important educational tool for the scientific community, offering insights that may inspire future research diretions. However, they should not be relied upon independently when making treatment decisions or developing public health policies.

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