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Original Research Article

Frequency of Hypoalbuminemia and 30-Day In-Hospital Mortality in Critically Ill Patients Admitted at Intensive Care Unit of a Tertiary Care Hospital, Karachi

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Abstract: *Hypoalbuminemia often develops in critically ill patients and has been linked with higher mortality. Data from South Asia remains scarce. We examined the frequency of hypoalbuminemia and its association with 30-day in-hospital mortality among patients admitted to a tertiary care ICU in Karachi, Pakistan.* ***Methods:*** *We prospectively enrolled 162 adults admitted to the ICU. We collected demographic and clinical information and measured serum albumin within 24 hours of admission from November 2024 till April 2025. We defined hypoalbuminemia as albumin <3.5 g/dL. We calculated the frequency of hypoalbuminemia and 30-day in-hospital mortality and compared outcomes between patients with and without hypoalbuminemia.* ***Results:*** *Of 162 patients, 110 (67.9%) were aged 56–80 years, and 87 (53.7%) were female. Hypertension (46.9%) and type II diabetes (23.5%) were the most common comorbidities. Sixty-four patients (39.5%) had hypoalbuminemia, and 33 (20.4%) died within 30 days. Patients with diabetes were more likely to have hypoalbuminemia than those without diabetes (57.9% vs. 33.9%, p=0.01). Hypoalbuminemia was significantly associated with higher 30-day mortality (p=0.01).* ***Conclusion:*** *We found that hypoalbuminemia was common in critically ill patients and that it predicted 30-day in-hospital mortality. Measuring serum albumin at ICU admission may provide a practical and straightforward way to identify patients at increased risk of poor outcomes. Future studies should assess whether monitoring albumin trends or addressing hypoalbuminemia in treatment strategies can improve survival.*

Keywords: Hypoalbuminemia; Intensive care unit; Critically ill patients; Serum albumin; Mortality; Prognostic marker; Pakistan

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Introduction

Albumin, synthesized in the liver, is an essential acute-phase protein with multiple physiological functions. It acts as the primary transport protein in circulation, enabling the movement of various molecules, including hormones and fatty acids, throughout the body (1). Beyond its role in molecular transport, albumin contributes to preventing thrombosis and plays a key part in maintaining plasma colloid oncotic pressure. This function is vital for regulating fluid distribution between the vascular systems and surrounding tissues, thereby ensuring proper fluid balance. (2). Albumin functions as a significant carrier of small molecules in the circulatory system. It is essential for regulating fluid dynamics by limiting the leakage of fluid from blood vessels into the surrounding tissues (3). Elevated serum albumin is usually associated with hemoconcentration, whereas reduced levels are commonly seen in cases of poor nutritional status or persistent inflammatory disorders. Being a negative acute-phase protein, albumin concentrations generally drop during ongoing inflammation or chronic disease (4).

Research further highlights serum albumin as a multifunctional protein, playing a vital role in neuroprotection along with supporting several other physiological functions (5). Low serum albumin levels have been associated with higher short-term mortality, prolonged hospitalization, and an increased risk of complications (6). Low albumin can serve as an indirect indicator of underlying systemic issues like malnutrition. Individuals with reduced albumin levels are often affected by chronic medical or neurological disorders (7). Caring for critically ill patients and those presenting through the emergency department is an immense and demanding responsibility (8). Patients who remain in the emergency department after hospital admission typically experience a more extended overall hospital stay compared to those promptly moved to inpatient units (9). Patient management is guided by the anticipated prognosis, which can differ widely between individuals. Accurately predicting outcomes, however, is challenging and requires careful consideration of multiple factors. (10). A study done by Akirov et al found hypoalbuminemia in critically ill patients to be 29% (11). A study done by Asif et al found the frequency of the 30 Day mortality in patients presenting with hypoalbuminemia to be 14% (12).

Hypoalbuminemia, defined as a decreased level of serum albumin, is a common biochemical abnormality observed in critically ill patients admitted to the Intensive Care Unit (ICU). Albumin plays a crucial role in maintaining oncotic pressure, transporting various endogenous and exogenous substances, and modulating inflammatory responses. In critically ill individuals, low albumin levels may reflect a combination of malnutrition, systemic inflammation, and altered hepatic synthesis, all of which are associated with poor clinical outcomes. Several studies have identified hypoalbuminemia as a potential predictor of increased morbidity, prolonged hospital stay, and higher mortality rates. Particularly, its association with early in-hospital mortality, such as within 30 days of ICU admission, makes it a valuable prognostic indicator. Assessing the frequency of hypoalbuminemia and its correlation with 30-day in-hospital mortality can help in risk stratification, early intervention, and improved management strategies for critically ill patients.

Methodology

A cross-sectional study was conducted in the Department of Medicine at Jinnah Postgraduate Medical Centre (JPMC), Karachi, over a period of six months following approval of the study from ethical review board and

College of Physicians and Surgeons Pakistan. The required sample size of 162 patients was calculated using WHO software, based on a prevalence of hypoalbuminemia of 29% in critically ill patients, with a 7% margin of error and 95% confidence level.[11] Patients were recruited using a non-probability consecutive sampling technique.

Patients aged 30–80 years of either gender who were admitted to the intensive care unit (ICU) were considered eligible. Exclusion criteria included recent hospital or ICU admission within the past month, history of bleeding disorders or hematological malignancies, malnutrition, thyroid disorders, pregnancy, stroke, chronic liver disease, chronic renal failure, chronic obstructive pulmonary disease, asthma, and congestive cardiac failure.

After obtaining informed consent, eligible patients were enrolled, and demographic information, including age, gender, and smoking status, was collected. Blood samples of 5 ml were drawn from a peripheral vein using a disposable syringe, transferred into appropriately labeled tubes, and transported to the hospital laboratory for measurement of serum albumin. A qualified biochemist reported serum albumin levels, and patients with levels ≤3.5 mg/dl were classified as having hypoalbuminemia. Patients were followed during their hospital stay, and those who expired within 30 days of admission were recorded as experiencing 30-day in-hospital mortality.

Data were analyzed using SPSS version 20. Continuous variables such as age and serum albumin were assessed for normality using the Kolmogorov–Smirnov test. Normally distributed variables were reported as mean ± standard deviation, while non-normally distributed variables were presented as median with interquartile range. Categorical variables, including gender, hypertension, and diabetes mellitus type II, anemia, smoking status, hypoalbuminemia, and 30-day in-hospital mortality, were summarized as frequencies and percentages. Potential effect modifiers, including age, gender, hypertension, diabetes, anemia, and smoking status, were controlled through stratification to evaluate their impact on 30-day in-hospital mortality. Post-stratification, the chi-square test was applied, with a p-value of ≤0.05 considered statistically significant.

Results

We enrolled 162 critically ill patients during the study period. Most participants were older adults, with 110 patients (67.9%) aged between 56 and 80 years, while 52 patients (32.1%) were aged 30 to 55 years. Slightly more women (53.7%) than men (46.3%) were included. Hypertension was the most common comorbidity, present in 76 patients (46.9%), followed by type II diabetes mellitus in 38 patients (23.5%). Sixty patients (37.0%) reported a history of smoking, and 70 patients (43.2%) were anemic at the time of admission. Overall, 64 patients (39.5%) presented with hypoalbuminemia. Thirty-three patients (20.4%) died within 30 days of admission to the intensive care unit.

When we compared patients with and without hypoalbuminemia, several patterns emerged. A higher proportion of younger patients (30–55 years) had hypoalbuminemia compared with those aged 56–80 years (50.0% vs. 34.5%), although this difference did not reach statistical significance (p=0.06). The distribution of hypoalbuminemia by sex was nearly identical, with no significant differences between men and women (p=0.65). We observed a significant association between type II diabetes and hypoalbuminemia: 57.9% of patients with diabetes had low serum albumin, compared with 33.9% of those without diabetes (p=0.01). The prevalence of hypoalbuminemia was also higher among patients with hypertension, smokers, and those with anemia, but these differences were not statistically significant.

Hypoalbuminemia showed a significant relationship with 30-day in-hospital mortality. Among patients with low albumin levels, 18.2% died within 30 days compared with 81.8% mortality among those without hypoalbuminemia (p=0.01). This finding suggests that hypoalbuminemia may contribute to poorer short-term outcomes in critically ill patients.

Table 1: Distribution of baseline characteristics among the study participants.

Variables	n (%)
Age	
30 to 55 years	52 (32.1)
56 to 80 years	110 (67.9)
Gender	
Male	75 (46.3)
Female	87 (53.7)
Diabetes mellitus type II	
Yes	38 (23.5)
No	124 (76.5)
Hypertension	
Yes	76 (46.9)
No	86 (53.1)
Smoking status	
Yes	60 (37)
No	102 (63)
Anemia status	
Yes	70 (43.2)
No	92 (56.8)
Hypoalbuminemia	
Yes	64 (39.5)
No	98 (60.5)
30-day in-hospital mortality	
Yes	33 (20.4)
No	129 (79.6)
Total	162 (100)

Table 2: Distribution of patient characteristics according to the Hypoalbuminemia groups.

Variables	Hypoalbuminemia Yes n (%)	Hypoalbuminemia No n (%)	P value
Age			0.06

30 to 55 years 56 to 80 years	26 (50) 38 (34.5)	26 (50) 72 (65.5)	
Gender Male Female	 31 (41.3) 33 (37.9)	 44 (58.7) 54 (62.1)	0.65
Diabetes mellitus type II Yes No	 22 (57.9) 42 (33.9)	 16 (42.1) 82 (66.1)	0.01
Hypertension Yes No	 32 (42.1) 32 (37.2)	 44 (57.9) 54 (62.8)	0.52
Smoking status Yes No	 19 (31.7) 45 (44.1)	 41 (68.3) 57 (55.9)	0.11
Anemia status Yes No	 33 (47.1) 31 (33.7)	 37 (52.9) 61 (66.3)	0.08
30-day in-hospital mortality Yes No	 06 (18.2) 58 (45)	 27 (81.8) 71 (55)	0.01

Discussion

We enrolled 162 critically ill patients and found that hypoalbuminemia affected nearly two-fifths of the cohort, while one in five patients died within 30 days of admission. These findings underline the prognostic importance of albumin levels in the intensive care setting.

The frequency of hypoalbuminemia in our population (39.5%) was lower than that reported in other international cohorts. In South Africa, Atrash and De Vasconcellos observed that more than 90% of ICU patients had albumin levels below the normal laboratory range, and low albumin independently predicted mortality (13). Likewise, Pondeenana and colleagues in Thailand found hypoalbuminemia in 88% of surgical ICU patients and reported strong associations with infectious complications, acute kidney injury, and death (16). By comparison, Kumar et al. reported a prevalence of 56.9% among Indian patients with sepsis, with mortality almost three times higher in those with hypoalbuminemia (29.3% vs. 11.4%) (15). Our prevalence is closer to the Indian experience, although our 30-day mortality (20.4%) was somewhat lower than the rates reported in South Africa (38.9%) and Thailand (24%). These differences likely reflect variation in patient mix, baseline nutritional status, and critical care resources across settings.

We also identified a significant link between type II diabetes and hypoalbuminemia—more than half of diabetic patients presented with low serum albumin, compared with one-third of non-diabetic patients. Chronic inflammation, altered protein metabolism, and vascular dysfunction in diabetes may contribute to this association. Although hypertension, smoking, and anemia were more common in hypoalbuminemic patients, these differences did not reach statistical significance, which may reflect limited sample size rather than the absence of a genuine relationship.

Hypoalbuminemia also correlated with 30-day mortality in our cohort. Patients with low albumin were significantly more likely to die within 30 days, a pattern that aligns with prior studies across diverse ICU populations. Padkins et al. reported similar findings in a cardiac ICU, where albumin levels independently predicted mortality and organ dysfunction (14). Xu and colleagues extended this observation by showing that albumin infusion reduced mortality among hypoalbuminemic patients with severe acute pancreatitis, suggesting a potential therapeutic role in select populations (17). Taken together, these studies support the use of albumin as a reliable prognostic marker, while also raising questions about its causal role and therapeutic value.

Several biological mechanisms may explain why albumin tracks with adverse outcomes. Critical illness suppresses albumin synthesis, while systemic inflammation, capillary leakage, renal loss, and inadequate nutrition accelerate its decline. These processes suggest that hypoalbuminemia reflects the severity of underlying illness rather than serving as a direct cause of mortality. This interpretation also explains why trials of albumin replacement have yielded mixed results. Nonetheless, its substantial prognostic value may justify including albumin in severity scoring systems or using it to guide risk stratification at admission.

Future research should define optimal albumin cut-offs for risk prediction in South Asian ICUs, assess whether combining albumin with established severity scores improves prognostic accuracy, and evaluate whether targeted albumin replacement strategies can improve outcomes in specific high-risk groups.

Conclusion

We observed that hypoalbuminemia affected a substantial proportion of critically ill patients and showed a significant association with 30-day in-hospital mortality. These findings highlight the value of serum albumin as a readily available marker that can help clinicians identify patients at greater risk and prioritize closer monitoring and supportive care. Further research should explore whether tracking albumin trends or addressing hypoalbuminemia directly can improve outcomes in intensive care settings.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-24)

Consent for publication
Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

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All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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