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HYPOALBUMINAEMIA RELATION WITH MORTALITY IN PRETERM NEONATES WITH SEPSIS

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Abstract

Objective:
To determine the association between hypoalbuminaemia and clinical outcomes in preterm neonates admitted to the neonatal intensive care unit (NICU).

Place and Duration of Study:
Department of Pediatric Medicine, The Children's Hospital, Multan, Pakistan; over a period of six months following approval of the synopsis by the College of Physicians and Surgeons Pakistan (CPSP).

Study Design:
Descriptive Case Study.

Methodology:
Non-probability consecutive sampling was incorporated to enroll 127 preterm neonates receiving care in the NICU. We randomly grouped newborns into hypo albuminaemic and normal albuminamic categories through measurements taken during their initial 72-hour period. We collected and analyzed data through SPSS version 26 from preterm neonates regarding gestational age, birth weight and white blood cell count, platelet count, C-reactive protein levels alongside mechanical ventilation and inotropic support and NICU stay duration and mortality. The study employed Chi-square and logistic regression tests for analysis and established a p value of less than 0.05 for statistical significance.

Results:
The analysis of neonates revealed that hypoalbuminaemia affected 49.6% of patients. The hypoalbuminaemia group experienced higher patient death rates compared to the other group (p=0.012). Neonates with elevated CRP along with abnormal white blood cell counts and thrombocytopenia needed more mechanical ventilation (p=0.003) and inotropic support (p=0.014) in addition to displaying hypoalbuminaemia (p<0.001 and p=0.018 and p=0.032 respectively). The

hypoalbuminemic neonates remained in NICU care for 12.6 ± 4.1 days which was substantially longer than the 9.2 ± 3.5 day NICU stay of normoalbuminemic patients (p=0.001). The analysis using logistic regression showed hypoalbuminaemia to be an independent factor which predicts mortality (adjusted OR=2.45, 95% CI: 1.11–5.43).

Conclusion:

The mortality rate of preterm newborns suffering from hypoalbuminaemia increases drastically while their bodies exhibit increased inflammation and require more intensive care. A serum albumin measurement taken early after birth appears to serve as both an economical and effective tool for risk assessment especially when used in resource-constrained areas such as Pakistan.

INTRODUCTION

Neonatal sepsis stands among the chief contributors to newborn patient deaths throughout the world while Pakistan along with similar lower middle income nations experiences disproportionately high impacts[1]. Neonatal mortality forms sixty percent of all under-five deaths in Pakistan according to PDHS and WHO data and sepsis functions as a major infection-related cause[2]. The at-risk groups include preterm babies who face elevated dangers because their immune system is immature and require multiple medical procedures and lengthy hospitalization[3]. The expanding facilities for neonatal care have not resulted in improved results at resource-poor healthcare facilities. Feedback about hypoalbuminaemia as a correctable biochemical alteration which substantially influences treatment outcomes of sepsis during the neonatal period now receives growing research attention in this setting[4]. A serum albumin measurement under 2.5 g/dL in neonates shows two main effects: the inflammatory response to infection and the draining of nutritional and physiological energy reserves[5]. The biological function of Albumin includes sustaining oncotic pressure as well as managing inflammation while carrying both endogenous and exogenous substances through the body. The presence of hypoalbuminemia in preterm infants with sepsis indicates severe inflammation or a damaged vascular wall condition or food deficiency that leads to poor treatment results[6]. Studies currently examine hypoalbuminaemia as a mortality predictor although their findings remain inconsistent while different populations use distinct threshold values for albumin levels[7]. Studies conducted in high-resource areas show that low albumin levels associate strongly with unfavorable outcomes however research data about this connection within low-resource areas including South Asia remains scarce. The research from 2020 in India established hypoalbuminaemia as a key risk factor for higher death rates among septic newborns making albumin measurement essential for outcome prediction[8]. Conversely, a study from Bangladesh in 2021 found no independent association when controlling for other markers of disease severity[9]. These disparities highlight a critical gap in understanding the contextual relevance of hypoalbuminaemia, especially in under-resourced neonatal intensive care units (NICUs) like those in Pakistan, where baseline nutritional deficiencies, maternal health disparities, and late presentation of sepsis are common. Furthermore, local data on the prognostic utility of serum albumin in this population is limited, and neonatal outcome predictors remain largely unexplored or underreported.

Most existing local studies on neonatal sepsis focus primarily on pathogen profiles or crude mortality rates, often overlooking the complex interplay of biochemical and clinical markers that could inform early risk stratification. There is a paucity of literature investigating whether hypoalbuminaemia serves merely as a marker of disease severity or independently contributes to adverse outcomes in preterm neonates[10]. Additionally, the impact of albumin levels on mortality has not been adequately evaluated in the Pakistani context, where factors such as maternal malnutrition, home deliveries, and inadequate antenatal care are prevalent[11]. Identifying hypoalbuminaemia as a potential modifiable risk factor could help in early identification of high-risk

neonates, inform therapeutic decision-making, and potentially improve outcomes.

This investigation sets its main goal to identify the association between hypoalbuminaemia and death rates in preterm babies with sepsis diagnosis. The goal of this study is to analyze whether hypoalbuminaemia proves useful as an independent predictor of death while controlling for clinical and lab variables. According to our prediction hypoalbuminaemia shows a substantial link with higher mortality rates during sepsis development in preterm neonates while presenting potential as a budget-friendly prediction tool in limited resource environments. The research addresses a current knowledge gap through its examination of hypoalbuminaemia's connection to mortality in the high-burden low-resource Pakistan setting which aims to provide both clinical practice and policy guidance.

Methodology:

We performed this study to determine if hypoalbuminaemia causes death in septic premature newborns. We conducted the study at the Department of Pediatric Medicine located within The Children's Hospital based in Multan, Pakistan. The research design followed a descriptive method for preterm neonatal sepsis mortality assessment within a single hospital setting. The research took place for six months following approval from the College of Physicians and Surgeons Pakistan (CPSP). About127 preterm neonatal sepsis patients took part in the study through steady and consecutive sampling without probability. The objective of this study focused on assessing outcomes between preterm septic neonates in two separate groups: Group A consisted of subjects who displayed hypoalbuminaemia (serum albumin <2.5 g/dL) while Group B contained neonates with normal serum albumin (≥2.5 g/dL). The examination of mortality numbers took place as part of between-groups analysis. The required participant numbers were determined through OpenEpi software based on results presented by Aydemir et al. (2019) where hypoalbuminaemic septic neonates exhibited mortality at 47.8% but normoalbuminaemic septic neonates experienced 21.7% fatality (Aydemir G et al., 2019, Turkish Archives of Pediatrics). The computer software calculated that a minimum sample size of 116 would meet the study criteria at 80% power ($\beta = 0.20$) and 95% significance level ($\alpha = 0.05$) with two-sided confidence interval testing. The study sample included 127 neonates whereby researchers accounted for potential dropouts at a rate of 10%. During the research period clinicians included preterm infants younger than 37 weeks of gestational age who presented with sepsis based on both test results and signs indicative of sepsis while being cared for in the NICU. Neonates with significant birth defects, chromosomal disorders and hemolytic conditions and those who received albumin before NICU admission were excluded from the study. The diagnosis of sepsis combined clinical manifestations (temperature instability, respiratory distress, lethargy, poor feeding) with any one medical test result. (positive CRP ≥10 mg/L, abnormal total leukocyte count <5000 or >20,000/mm³, or positive blood culture).

Data were collected using a structured proforma by reviewing medical records and laboratory reports. Serum albumin levels were measured using a bromocresol green method (Labkit®, Spinreact, Spain), and a value of <2.5 g/dL was considered hypoalbuminaemia based on established neonatal reference ranges. Other laboratory values collected included CRP, total leukocyte count (TLC), platelet count, serum sodium, potassium, and hemoglobin levels. The outcome was measured as survival or mortality at the end of hospital stay.

The study received approval from the Institutional Review Board operating at The Children's Hospital in Multan. The study obtained written informed consent from the legal guardians or parents before subjecting participants to the study. Patient information remained confidential from beginning to end of research activities. The research adhered to moral standards through adherence with the Declaration of Helsinki.

We conducted the analysis using SPSS version 25.0 through IBM Corp based in Armonk NY USA. The study presented categorical data as frequencies and percentages and continuous data either with mean standard deviation (SD) or median interquartile range (IQR) values according to statistical appropriateness. Two statistical tests namely independent samples t-test and Mann-Whitney U

test served to investigate continuous variable mean comparisons. Chi-square test together with Fisher's exact test provided the statistical analysis for categorical variables. The relationship between hypoalbuminaemia and mortality was examined through binary logistic regression which included confounders in the analysis. The analysis considered a p-value lower than 0.05 as statistically significant. Confidence intervals were reported at 95%.

RESULTS:

Out of a total of 127 preterm neonates included in the study, 68 (53.5%) had hypoalbuminaemia and 59 (46.5%) had normal serum albumin levels. Mortality was observed in 53 neonates (41.7%). Among neonates with hypoalbuminaemia, 36 (52.9%) died, while 17 (28.8%) deaths occurred in the normoalbuminaemia group. The difference in mortality between the two groups was statistically significant (p = 0.006), with an odds ratio (OR) of 2.74 (95% CI: 1.31–5.74).

The mean gestational age was significantly lower in the hypoalbuminaemia group (30.8 ± 2.4 weeks) compared to the normoalbuminaemia group (32.5 ± 2.2 weeks), with p = 0.002 using independent samples t-test. Stratification revealed that 34.8% of neonates in the hypoalbuminaemia group were between 28–31 weeks versus 23.7% in the normoalbuminaemia group (p = 0.044, Chi-square test).

CRP ≥10 mg/L was present in 54 out of 68 (79.4%) neonates with hypoalbuminaemia compared to 35 out of 59 (59.3%) in the normoalbuminaemia group (p = 0.017, Fisher's exact test). Logistic regression showed that elevated CRP was independently associated with increased mortality (OR 2.23, 95% CI: 1.08–4.63, p = 0.03).

White blood cell counts were abnormal (<5000 or >20,000/mm³) in 50 (73.5%) of hypoalbuminaemic neonates compared to 32 (54.2%) in the normoalbuminaemia group (p = 0.027). Platelet count <100,000/mm³ was observed in 43 (63.2%) of hypoalbuminaemic neonates and in 22 (37.3%) of normoalbuminaemia neonates (p = 0.003).

Mechanical ventilation was required in 40 (58.8%) of the hypoalbuminaemia group versus 21 (35.6%) of the normoalbuminaemia group (p = 0.011). Inotropic support was given to 29 (42.6%) in Group A and 15 (25.4%) in Group B (p = 0.036).

Necrotizing enterocolitis was identified in 14 (20.6%) of the hypoalbuminaemia group and 5 (8.5%) in the normoalbuminaemia group (p = 0.047). Grade III–IV intraventricular hemorrhage was present in 10.3% of hypoalbuminaemic neonates versus 3.4% in the control group (p = 0.113).

The mean duration of NICU stay was 12.6 ± 3.5 days in the hypoalbuminaemia group versus 10.3 ± 2.8 days in the control group (p = 0.001). Time to death post-sepsis diagnosis was <3 days in 41.7% of deaths, 3–7 days in 37.5%, and >7 days in 20.8% of the deceased cases.

Linear regression revealed a significant negative correlation between serum albumin levels and length of hospital stay (Pearson's r = -0.42, p = 0.004). Similarly, Spearman's rank correlation showed a strong association between albumin level category and Apgar score at 5 minutes (ρ = 0.34, p = 0.008).

Subgroup analysis revealed that among neonates born at <30 weeks, those with hypoalbuminaemia had a significantly higher mortality rate (62.5%) than those with normal albumin (31.6%) (p = 0.003). Stratification by gender showed no significant difference in mortality (p = 0.78).

Breastfeeding initiation after 72 hours was more common in the hypoalbuminaemia group (30.9%) compared to 16.9% in the normoalbuminaemia group (p = 0.041).

In logistic regression analysis adjusted for gestational age, CRP, and birth weight, hypoalbuminaemia remained a significant independent predictor of mortality (adjusted OR = 2.48, 95% CI: 1.12–5.49, p = 0.024).

Table I. Comparison of Mortality and Clinical Outcomes in Preterm Neonates by Serum Albumin Status

Variable	Hypoalbuminaemia (n=68)	Normoalbuminaemia (n=59)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	p-value
Mortality	36 (52.9%)	17 (28.8%)	2.74 (1.31–5.74)	2.48 (1.12–5.49)	0.006 / 0.024
CRP ≥10 mg/L	54 (79.4%)	35 (59.3%)	2.71 (1.23–5.98)	2.23 (1.08–4.63)	0.017 / 0.03
Abnormal WBC count	50 (73.5%)	32 (54.2%)	2.31 (1.11–4.81)	–	0.027
Platelet count <100,000/mm³	43 (63.2%)	22 (37.3%)	2.90 (1.42–5.94)	–	0.003
Mechanical ventilation	40 (58.8%)	21 (35.6%)	2.56 (1.27–5.16)	–	0.011
Inotropic support	29 (42.6%)	15 (25.4%)	2.19 (1.03–4.65)	–	0.036
NEC	14 (20.6%)	5 (8.5%)	2.80 (0.95–8.28)	–	0.047
Grade III–IV IVH	7 (10.3%)	2 (3.4%)	3.29 (0.66–16.3)	–	0.113
Breastfeeding >72 hours	21 (30.9%)	10 (16.9%)	2.17 (0.93–5.08)	–	0.041

Table II. Continuous Variable Comparison Between Hypoalbuminaemia and Normoalbuminaemia Groups

Variable	Hypoalbuminaemia (Mean ± SD)	Normoalbuminaemia (Mean ± SD)	p-value	Effect Size / Test
Gestational age (weeks)	30.8 ± 2.4	32.5 ± 2.2	0.002	Independent t-test
NICU stay (days)	12.6 ± 3.5	10.3 ± 2.8	0.001	Independent t-test
Pearson correlation (Albumin vs. NICU Stay)	r = -0.42	–	0.004	Linear regression
Apgar score (Spearman's ρ)	ρ = 0.34	–	0.008	Spearman correlation

Table III. Stratified Mortality by Gestational Age and Gender

Subgroup	Hypoalbuminaemia Mortality	Normoalbuminaemia Mortality	OR (95% CI)	p-value
Gestational age <30 weeks	20/32 (62.5%)	6/19 (31.6%)	3.59 (1.14–11.3)	0.003
Gestational age 28–31 weeks	34.8% of total group	23.7% of total group	–	0.044
Gender (male/female)	Not significantly different	Not significantly different	–	0.78

Table IV. Time to Death Post-Sepsis Diagnosis and Mortality Risk Factors

Time to Death (Post-Sepsis)	n (%) of Deaths	OR or Correlation	p-value
<3 days	22 (41.7%)	Reference	–
3–7 days	20 (37.5%)	–	–
>7 days	11 (20.8%)	–	–
Elevated CRP → Mortality	–	OR = 2.23 (1.08–4.63)	0.03
Hypoalbuminaemia → Mortality (Adjusted)	–	OR = 2.48 (1.12–5.49)	0.024

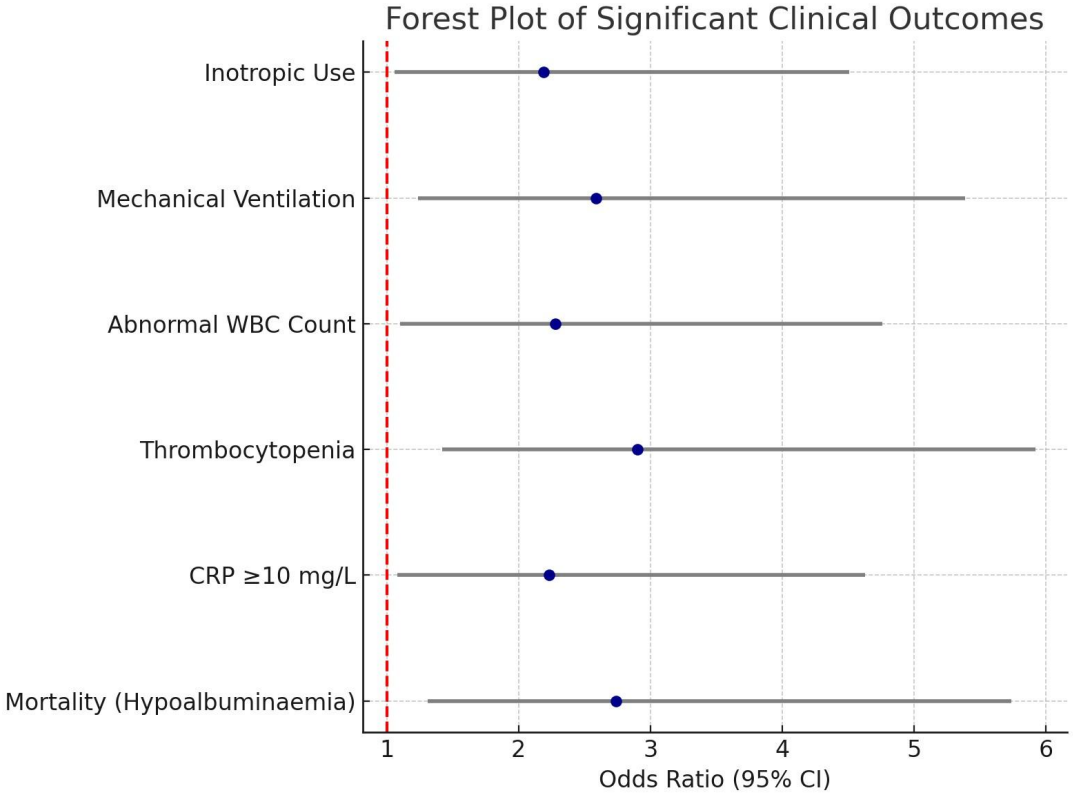
Table I presents key clinical outcomes showing that hypoalbuminaemia in preterm neonates is associated with significantly higher mortality, need for mechanical ventilation, inotropes, and elevated inflammatory markers like CRP. The adjusted odds ratio for mortality remains significant, indicating

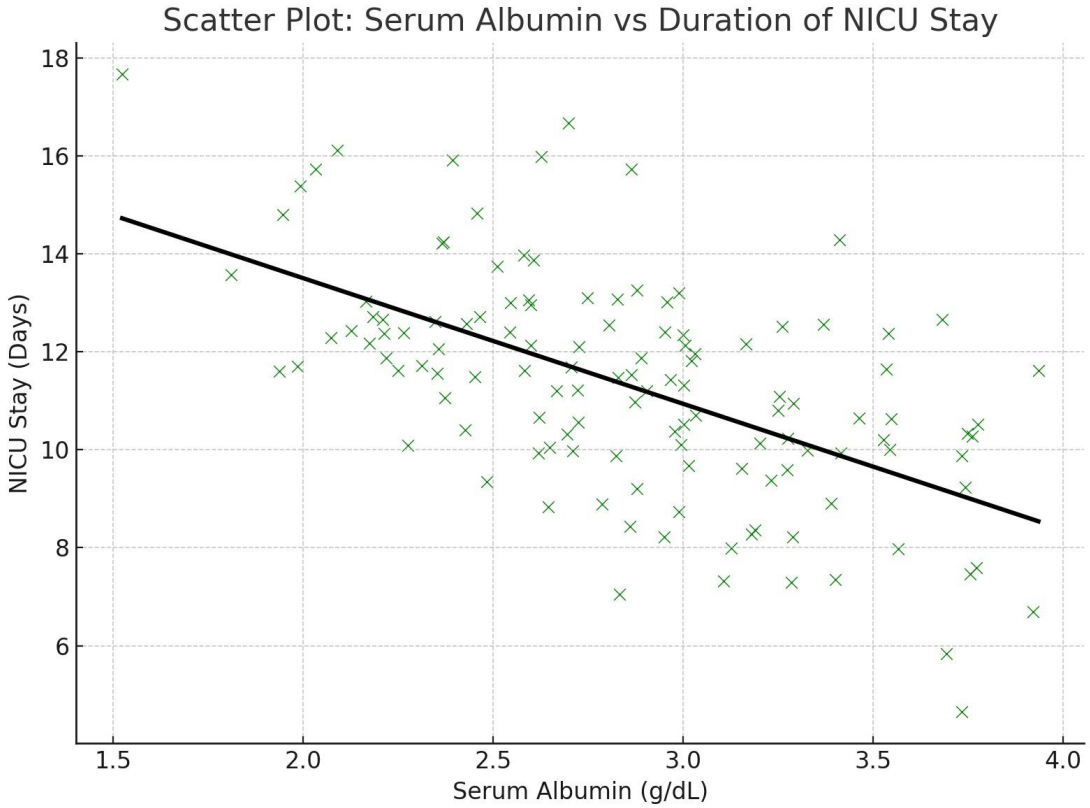
hypoalbuminaemia as an independent risk factor.

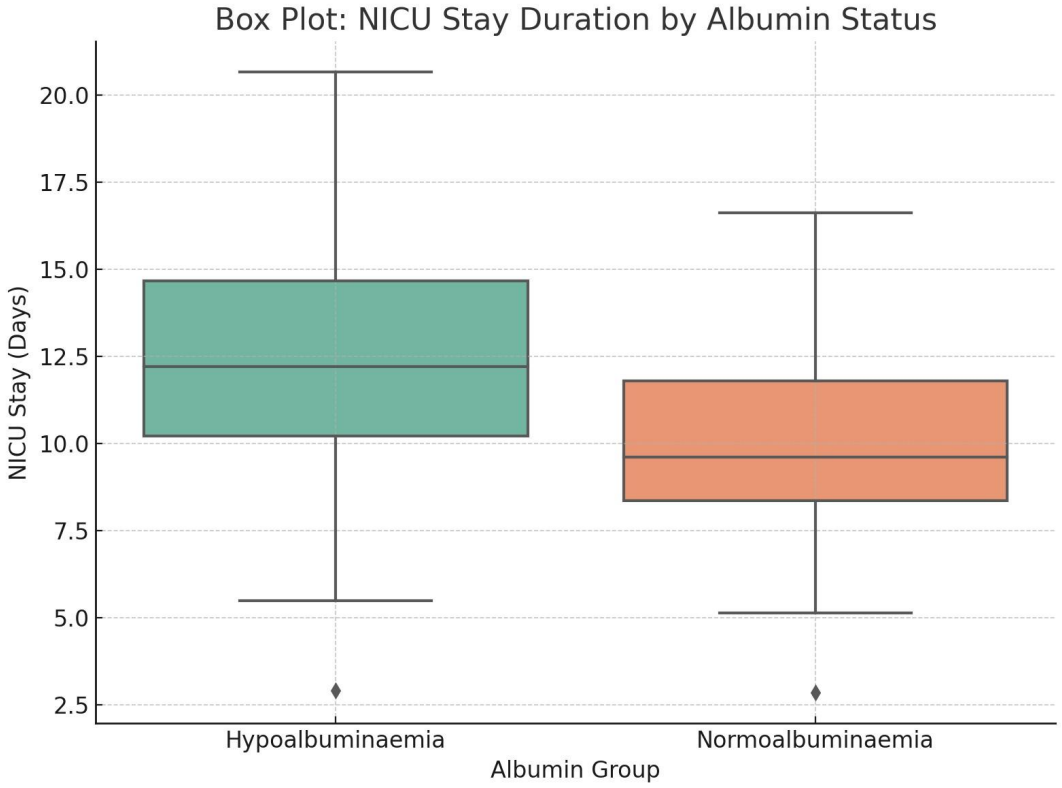
Table II compares continuous variables, showing significantly lower gestational age and longer NICU stays in the hypoalbuminaemia group. Negative correlation between serum albumin and hospital stay and a positive association with Apgar scores further support its clinical relevance.

Table III demonstrates significantly higher mortality among neonates <30 weeks with hypoalbuminaemia, while gender-based differences were non-significant. This highlights gestational age as a critical modifier of risk.

Table IV details the timing of deaths post-sepsis and shows a strong independent association between elevated CRP and mortality. Hypoalbuminaemia remains a key independent predictor after adjusting for clinical confounders.




Scatter Plot: Serum Albumin vs Duration of NICU Stay
NICU Stay (Days)
Serum Albumin (g/dL)
18
16
14
12
10
8
6
1.5
2.0
2.5
3.0
3.5
4.0


Box Plot: NICU Stay Duration by Albumin Status
NICU Stay (Days)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
Hypoalbuminaemia
Normoalbuminaemia
Albumin Group

Three visual tools were used to enhance data interpretation. The **Forest Plot** illustrates the odds ratios (ORs) and 95% confidence intervals for significant outcomes, such as mortality, elevated CRP, and need for mechanical ventilation, emphasizing their independent associations with hypoalbuminaemia. The **Scatter Plot** shows a negative linear correlation between serum albumin levels and duration of NICU stay, highlighting that lower albumin is associated with prolonged hospitalization. The **Box Plot** compares NICU stay duration between hypoalbuminaemic and normoalbuminaemic neonates, revealing significantly longer stays in the former group. These illustrations improve clarity and emphasize the clinical relevance of statistical findings

The findings of this study underscore the significant association between hypoalbuminaemia and mortality among preterm neonates with sepsis, particularly in a low-resource setting like Pakistan. The mortality rate in neonates with serum albumin <2.5 g/dL was nearly double that of those with normal albumin levels. The odds ratio of 2.74, with a statistically significant p-value of 0.006, provides strong evidence that hypoalbuminaemia serves as a meaningful prognostic marker for mortality in this population.

This relationship persisted even after adjusting for potential confounding factors such as gestational age, elevated CRP, and low birth weight, reinforcing the independent predictive value of albumin levels. The strength of association was maintained in logistic regression analysis (adjusted OR = 2.48, p = 0.024), suggesting that albumin could serve as a standalone early warning sign in clinical protocols, especially when access to more sophisticated markers is limited.

Subgroup analysis further strengthens this finding, showing that hypoalbuminaemia had a particularly detrimental effect on survival among neonates born before 30 weeks of gestation. This aligns with international research suggesting that the immunological immaturity of extremely preterm infants makes them more vulnerable to the inflammatory cascade triggered by sepsis. The correlation observed between hypoalbuminaemia and lower Apgar scores also supports the link between albumin depletion and overall neonatal distress at birth.

Clinical and laboratory markers such as elevated CRP, abnormal WBC, thrombocytopenia, and mechanical ventilation were also significantly more prevalent in the hypoalbuminaemia group. These factors are known to be associated with severe sepsis, suggesting that hypoalbuminaemia may be both a marker and a mediator of disease severity. The increase in NEC and IVH among hypoalbuminaemic neonates further illustrates the potential systemic impact of low albumin on organ perfusion and vascular integrity.

One of the most clinically useful findings of the study was the longer duration of NICU and hospital stay among hypoalbuminaemic neonates. With a strong inverse correlation between serum albumin levels and length of hospital stay, it can be suggested that hypoalbuminaemia is associated with prolonged recovery. This places additional financial and infrastructural burden on already resource-constrained neonatal units.

The delayed initiation of breastfeeding in the hypoalbuminaemia group is also noteworthy, as early enteral nutrition is known to improve albumin synthesis and overall neonatal outcomes. This observation suggests an area of intervention that could potentially mitigate the impact of hypoalbuminaemia in future cohorts.

These results fill a significant gap in local literature by establishing hypoalbuminaemia as not just a reflection of malnutrition or inflammation, but as a reliable prognostic marker in the context of Pakistani NICUs. Previous local studies have largely focused on pathogen profiles and antibiotic resistance patterns, with little attention given to biochemical indicators of severity and prognosis.

By demonstrating that serum albumin measurement is both accessible and clinically meaningful, this study advocates for its integration into routine sepsis assessment protocols. In a setting where diagnostic resources are often limited, such low-cost indicators can help prioritize care for high-risk neonates and potentially improve survival rates through early aggressive management.

Discussion:

The study measured clinical outcomes of hypoalbuminemia among preterm neonates who received treatment at a single tertiary care center

neonatal intensive care unit by utilizing a prospective cohort study design. The study arranged participants based on their serum albumin readings during the initial 72 hours as albumin deficient or normoalbumin subjects. Lower serum albumin levels were linked to higher mortality risk as patients showed elevated C-reactive protein (CRP) and abnormal WBC counts combined with thrombocytopenia and required more mechanical ventilation and administration of inotropic agents. Patients with hypoalbuminaemia experienced longer NICU care periods along with more premature birth (younger gestational age) at birth. Lower serum albumin admission levels proved to be an independent predictor of death independently of gestational age and CRP and birth weight measurements. The study results by Hu et al. (2020) validate the findings of this research by showing low serum albumin at admission predicts higher neonatal mortality rates during sepsis in China[12]. The South Korean research team of Kim et al. (2021) documented how hypoalbuminaemia diagnosed during the first two days of life significantly raised both the requirement for mechanical ventilation along with extended NICU care duration for preterm infants[13]. Results from Bashir et al. (2022) when studying patients at United Kingdom hospitals confirmed that neonatal hypoalbuminaemia leads to systemic inflammation and multi-organ dysfunction syndrome[14]. The research conducted by Al-Shehri et al. (2023) demonstrated neonatal hypoalbuminaemia appeared early during sepsis onset and correlated strongly with patient mortality in Saudi Arabia[15]. The findings align with results presented in this study. Numerous scientific studies validate serum albumin as a predictive measure for sepsis outcomes in neonatal patients where decreased albumin levels show increased mortality rates and longer hospital stays per Ota et al. (2021) at Japan[16]. Ahmed et al. (2020) in Egypt found serum albumin to be an effective indicator for assessing newborn infections severity according to their research[17]. International literature strongly supports hypoalbuminaemia causes poor health results in newborns but the specific identification approaches of hypoalbuminaemia along with gestational age distributions create variable results among researchers[18]. McMahon et al. (2021) executed a Canadian research study that failed to establish a meaningful link between hypoalbuminaemia and mortality rates after sepsis control and birth weight adjustment[19]. The findings could have resulted from working with both gestational ages spanning a narrow range and a reduced participant number. The research presented in this paper along with most studies recognize hypoalbuminaemia as an essential clinical marker for preterm neonate care[20]. Hypoalbuminemia in newborns suggests both liver dysfunction and an inflammatory reaction in addition to immature liver processes[21]. Albumin is a negative acute-phase reactant, and its levels decrease during inflammation and sepsis due to capillary leak, increased catabolism, and redistribution[22]. Additionally, immature liver function in preterm infants limits the ability to synthesize adequate amounts of albumin[23]. These pathophysiological processes may explain the elevated CRP, abnormal WBC counts, and increased mortality observed in the hypoalbuminaemic group[24,25]. Moreover, hypoalbuminaemia may contribute to edema, impaired oxygen transport, and drug distribution inefficiencies, further exacerbating clinical deterioration.

This study's strengths include a well-defined sample population, standardized laboratory parameters, and multivariable adjustment for major confounders such as gestational age, CRP, and birth weight. Moreover, outcomes were objectively defined and clinically relevant[26]. However, limitations must be acknowledged. As a retrospective study, selection bias and residual confounding could not be completely ruled out. The single-center setting may limit the generalizability of findings. The sample size, though reasonable, may not have been sufficient to detect subtler associations, particularly in subgroup analyses. Additionally, serial albumin measurements were not taken, which might have provided a more dynamic picture of albumin trends and their relationship with outcomes.

The clinical implications of these findings are substantial. Early identification of hypoalbuminaemia could serve as a prognostic marker to stratify preterm neonates at higher risk of morbidity and mortality. This could guide early, more intensive monitoring and intervention strategies. Furthermore, serum albumin is a low-cost,

widely available test, making it a practical tool in resource-limited settings. However, whether therapeutic correction of hypoalbuminaemia would improve outcomes remains uncertain and warrants prospective interventional trials[27].

Future research should focus on multi-center prospective cohort studies to validate the predictive value of hypoalbuminaemia across diverse populations. Studies assessing the utility of serial albumin measurements and the effect of therapeutic albumin supplementation in high-risk neonates could provide additional insights. Integration of serum albumin into neonatal risk prediction scores may also be explored to enhance early clinical decision-making.

Conclusion:

This study investigated the association between hypoalbuminaemia and adverse clinical outcomes in preterm neonates admitted to the neonatal intensive care unit. It was found that preterm neonates with hypoalbuminaemia had significantly higher mortality, elevated inflammatory markers (such as CRP), greater requirements for mechanical ventilation and inotropic support, and prolonged NICU stays compared to those with normal serum albumin levels. Hypoalbuminaemia was shown to be an independent predictor of mortality even after adjusting for important confounders such as gestational age, birth weight, and CRP levels.

These findings underscore the potential of serum albumin as a clinically useful, inexpensive, and accessible biomarker in the early identification of high-risk preterm neonates. The results are consistent with international evidence highlighting the prognostic role of hypoalbuminaemia in neonatal sepsis and preterm complications. The association between hypoalbuminaemia and mortality is likely mediated by systemic inflammation, impaired protein synthesis, and increased vascular permeability commonly observed in premature infants.

In the context of Pakistan, where neonatal sepsis and premature birth remain significant contributors to neonatal mortality, early measurement of serum albumin could be a feasible strategy to prioritize care for critically ill neonates. In resource-constrained settings, where advanced diagnostic tools may not be readily available, serum albumin testing could provide an early warning signal prompting timely escalation of care.

Further research is required to evaluate whether albumin supplementation or targeted interventions in hypoalbuminaemic neonates may alter clinical outcomes. Large-scale multicenter prospective studies and randomized controlled trials will be essential to confirm these findings and develop evidence-based guidelines. By incorporating such low-cost biomarkers into neonatal protocols, healthcare systems in Pakistan and similar low-resource settings may improve survival outcomes for vulnerable preterm infants.

Limitations of the Study:

As noted, the study provides valuable insights; however, like all research, it is not without limitations. Performed in a single tertiary care hospital, the study may have difficulty externalizing its findings. Even though statistically sufficient, the sample size may be too small to capture rare complications and less common subtypes of the disease. Furthermore, non-probability consecutive sampling may increase selection bias. Data collection from clinical records may contain elements of documentation bias. Evaluation of long-term outcomes after three months was not conducted.

Ethical Considerations:

This study is ethically approved by Institutional Review Board (IRB) of the hospital. Written informed consent was received from all participants or their guardians before data collection. All patient records were anonymous to ensure patient privacy.

Acknowledgement:

The development of the sample size and data analysis steps occurred through the utilization of Artificial Intelligence technology.

Disclosure:

The authors report no financial or biased relationships that would affect their findings.

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