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TO DETERMINE THE IMPACT OF ANEMIA ON CLINICAL OUTCOMES WITH SEVERE PNEUMONIA IN CRITICALLY ILL PATIENTS

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ABSTRACT
Introduction: The major cause of morbidity and mortality which requires admission to intensive care unit (ICU), is severe pneumonia. It leads to septic shock and significantly long term stay in ICU. Anemia is often associated with it and is a known predictor of increased mortality and morbidity.
Objective To assess the association between anemia and clinical outcomes in patients admitted to ICU with severe pneumonia.
Place and Duration: The study was conducted at ICU of Shifa International Hospital, Islamabad over 6 months from 11 December,2025 to 09 June,2026.
Methodology: 86 patients with severe pneumonia were included in this cross-sectional research. Based on their hemoglobin status, they were divided into two groups: anemia and non-anemia (43 in each group). Data on demographics, comorbidities, hemoglobin level and clinical outcomes such as mortality, mechanical ventilation (MV), renal replacement therapy (RRT), and ICU stay were collected on a pre-formed questionnaire. SPSS version 23 was used for data analysis.
Results: The median age was this cohort was 65 years with female predominance (54.7%). The anaemia group had significantly higher rates of Mechanical Ventilation (51.2% vs 18.6%, p=.002), prolonged ICU stay >7 days (32.6% vs 2.3%, p<.001), and Renal Replacement Therapy (18.6% vs 0%, p=.003). The anemia group's ICU stay was substantially longer (median 5 vs. 3 days, p<.001). On multivariate analysis, anemia independently predicted prolonged ICU stay (aOR=16.81, 95% CI 2.03–139.0, p=.009) and mechanical ventilation need (aOR=5.35, 95% CI 1.81–15.87, p=.003). Mortality was non-significant between groups (20.9% vs 11.6%, p=.243).
Conclusion: Length of ICU stay and need for MV was significantly associated with anemia in patients with severe pneumonia. While mortality was not significant in both groups.

KEYWORDS: Anemia, severe pneumonia, outcomes, ICU.

INTRODUCTION

The major cause of morbidity and mortality which requires admission to ICU, is severe pneumonia. It leads to septic shock and significantly long term stay in ICU (1). In these patient multiple factors lead to adverse outcomes but anemia is the known predictor of increase mortality and morbidity (2). It is often associated with severe pneumonia and those with anemia the rate of admission goes up to 63.31% (3).

The pathophysiology of anemia in pneumonia patients lies in the severe inflammatory response of body in the form of increase production hepcidin which is a hormone which causes decrease in iron absorption and its utilization (4). Also, in these critically ill patients with pneumonia the oral intake is low and have malabsorption as well, which leads to decrease in iron, vitamin B12 and folate reserves in the body, which are the main components of red blood cell production (5). During severe pneumonia, body needs higher metabolic rate and oxygen supply. Due to anemia insufficient oxygen supply leads to tissue hypoxia which is the critical factor in the development of multiorgan failure (6,7). Many studies have reported that anemia in these patients is linked to a prolonged need for mechanical ventilation and difficulties with weaning from the ventilator. The presence of anemia is associated with extended stay in the ICU (8, 20).

A study conducted by Rajabtu W et al., in severe pneumonia patients admitted to ICU and reported that anemia was present in 34 (31%) patients, while 76 (69%) were non-anemic. Mortality was 15 (44.1%) in anemic vs. 12 (15.8%) in non-anemic patients. Median hospital stay was 16 days in anemic vs. 13 days in non-anemic patients (9).

Objective:

To assess clinical outcomes association with Anemia in patients admitted to ICU with severe pneumonia.

MATERIAL AND METHODS

Following ethical approval from the Institutional Review Board and Ethics Committee of Shifa International Hospitals Ltd. (IRB No. 404-25; approval dated 5 November 2025) and approval of the research title by the CPSP Research Evaluation Unit (Ref. No. CPSP/REU/CCM-2024-043-208; dated 11 December 2025), this study was conducted in the Intensive Care Unit of Shifa International Hospital, Islamabad, Pakistan, from 11 December 2025 to 9 June 2026. Written informed consent was obtained from the patients' attendants or legal guardians before enrolment.

86 patients (43 in each group) were included. Sampling technique was be non-probability consecutive and informed written consents were taken from patients/ attendants.

Patients ≥18 years admitted to ICU with severe pneumonia as per operational definition which was pneumonia requiring ICU admission, confirmed by chest radiograph/HRCT showing new infiltrates, and fulfilling IDSA/ATS criteria. Patients with ≥1 major criterion (mechanical ventilation or septic shock) or ≥3 minor criteria (e.g., tachypnea ≥30/min, PaO_2/FiO_2 ≤250, multilobar infiltrates, confusion, leukopenia, thrombocytopenia, hypothermia, hypotension, etc.).

Patients with haematological malignancies or chronic anemia disorders (e.g., thalassemia, aplastic anemia), Patients with active bleeding or recent transfusions prior to admission.

Apart form demographic variables, venous blood samples were taken and sent to hospital laboratory for checking haemoglobin level. Based on haemoglobin levels patients were grouped into anemia or non-anemia patients. We followed the patients till discharge for clinical outcomes (mortality, duration of ventilation, days of stay in ICU and need for RRT). All data was noted in the pre formed questionnaire.

Based on anaemia status (Yes/No), we applied Chi square or fishers exact test for categorical variables and independent t-test / Mann–Whitney U test for continuous variables to compare it with the clinical outcomes (mortality, duration of ventilation and length of ICU stay). To control for potential confounders (age, gender, and comorbidities), multivariate logistic regression analysis was applied to determine the independent association of anemia with mortality, duration of ventilation and prolonged ICU stay. A p-value ≤0.05 was considered statistically significant.

RESULTS

The median age of our cohort was 65 years (IQR 59–70) and the majority were female (54.7%). The two groups were well matched for age and gender (p=.054 and p=.829, respectively). All patients in the anemia group had comorbidities compared to 83.7% in the Normal HB group (p=.006).

Table 1. Baseline Characteristics (N=86)

Variable	Categories	n or Median	% or IQR
Demographics			
Age (years)		65	IQR 59–70
Gender	Female	47	54.7%
	Male	39	45.3%
Comorbidities			
Any Comorbidity		79	91.9%
Laboratory & Clinical			
Haemoglobin (g/dL)		12.0	IQR 10.0–13.3

Variable	Categories	n or Median	% or IQR
Creatinine (mg/dL)		1.4	IQR 0.9–2.5
Positive Cultures		41	47.7%
Vasopressors		25	29.1%
Outcomes			
Mechanical Ventilation		30	34.9%
ICU Stay (days)		4	IQR 2–6
Prolonged ICU >7 days		15	17.4%
Renal Replacement		8	9.3%
Mortality		14	16.3%

Table 2. Baseline Characteristics by Anemia Status

Variable	Overall (n=86)	Anaemia (n=43)	Normal HB (n=43)	p-value
Demographics — n (%) or Median (IQR)				
Age (years) — Median (IQR)	65 (59–70)	65 (59–70)	65 (57–70)	.054
Gender — Female	47 (54.7%)	23 (53.5%)	24 (55.8%)	.829
Comorbidities — n (%)				
Any Comorbidity	79 (91.9%)	43 (100%)	36 (83.7%)	**.006**
Laboratory — Median (IQR)				
Haemoglobin (g/dL)	12.0 (10.0–13.3)	10.0 (8.9–11.0)	13.0 (12.5–14.1)	**<.001**
Creatinine (mg/dL)	1.4 (0.9–2.5)	1.7 (1.0–3.1)	1.1 (0.8–1.9)	—
Microbiology — n (%)				
Vasopressors	25 (29.1%)	15 (34.9%)	10 (23.3%)	.235
Positive Cultures	41 (47.7%)	29 (67.4%)	12 (27.9%)	**<.001**

Chi Square or Mann-Whitney U tests were used

Table 3. Clinical Outcomes by Anaemia Status

Outcome	Anaemia n (%) (n=43)	Normal HB n (%) (n=43)	p-value
Mechanical Ventilation	22 (51.2%)	8 (18.6%)	**.002**
Renal Replacement Therapy	8 (18.6%)	0 (0%)	**.003**

Outcome	Anaemia n (%) (n=43)	Normal HB n (%) (n=43)	p-value
Mortality	9 (20.9%)	5 (11.6%)	.243
Prolonged ICU Stay (>7 days)	14 (32.6%)	1 (2.3%)	**<.001**

Regarding clinical outcomes (Table 3), the Anemia group had significantly higher rates of mechanical ventilation (51.2% vs 18.6%, p=.002), prolonged ICU stay >7 days (32.6% vs 2.3%, p<.001), renal replacement therapy (18.6% vs 0%, p=.003). Mortality was higher in the Anaemia group (20.9% vs 11.6%) but did not reach statistical significance (p=.243).

Table 4. Multivariate Binary Logistic Regression — Independent Predictors of Clinical Outcomes

Variable	B	SE	Wald	p	aOR	95% CI
Model 1: Prolonged ICU Stay >7 days — Dependent variable (n=82)						
Age Category	1.585	1.229	1.664	.197	4.881	0.44–54.04
Gender	0.800	0.673	1.413	.235	2.226	0.60–8.30
Anemia Status (ref: Normal HB)	**2.822**	**1.078**	**6.855**	**.009**	**16.81**	**2.03–139.0**
Constant	−4.072	1.109	13.485	**<.001**	—	—
Model 2: Mechanical Ventilation — Dependent variable (n=82)						
Age Category	−1.658	1.271	1.702	.192	0.190	0.02–2.28
Gender	−0.084	0.509	0.027	.869	0.919	0.34–2.49
Comorbidities	−0.996	0.982	1.029	.310	0.369	0.05–2.53
Anemia Status (ref: Normal HB)	**−1.678**	**0.555**	**9.133**	**.003**	**5.35†**	**1.81–15.87†**
Constant	1.718	0.520	10.920	**.001**	—	—

aOR = adjusted Odds Ratio. Reference: Normal HB group, Female, Age 41–80 years. Comorbidities excluded from Model 1 due to complete separation (100% of anaemia patients had comorbidities). † aOR for MV is inverted from SPSS output (corrected: 1÷0.187=5.35; 95% CI 1.81–15.87). Bold = p ≤ .05.

Based on the multivariate logistic regression summarized in Table 4, anemia was an independent predictor of prolonged ICU stay and mechanical ventilation.

DISCUSSION

The median age of our cohort was 65 years with a female predominance (54.7%), which is consistent with findings reported by Rajabtu I et al., who observed a similar demographic profile in ICU patients with severe pneumonia (9). While Marziano Y et al., reported the mean age of 77 years (IQR 22.2) and predominance of male gender (10).

Aleast one comorbidity was present in anemia group compared to 83.7% in the normal HB group (p=.006), which is supported by Rajabtu et al., Tao Z et al., and Romero SK et al., who demonstrated that comorbid conditions are significantly more prevalent among anaemic critically ill patients (9,11,12,19).

Positive cultures were significantly more frequent in the anaemia group (67.4% vs 27.9%, p<.001), consistent with Marziano et al., and Abuga KM el al., who reported that anemia impairs immune function and increases susceptibility to secondary infections in pneumonia patients (10,13).
Need for MV was higher in anemia group with statistical significane of p= 0.002 in our study, corroborating the findings of Jati SA et al., who identified anemia as a major contributor to respiratory failure and ventilator dependence in ICU patients (14).
On multivariate analysis, anemia was an independent predictor of mechanical ventilation (aOR=5.35, 95% CI 1.81–15.87, p=.003), which aligns with Jati SA et al., and Theodora E et al., who similarly found anemia to independently increase the odds of requiring ventilatory support after adjusting for confounders (14,15).
Prolonged ICU stay (>7 days) was observed in 32.6% of anemia patients versus only 2.3% in the normal HB group (p<.001), and anemia remained an independent predictor on regression (aOR=16.81, p=.009), consistent with Song X et al., and Reade MC who reported significantly longer ICU stays in anemic pneumonia patients (16,17).
Renal replacement therapy was required exclusively in the anemia group (18.6% vs 0%, p=.003), which is supported by Han SS et al., who proposed that tissue hypoxia secondary to anemia accelerates acute kidney injury in critically ill patients (18).
Lin IH et al., and Abd Al Kader MM et al., reported both in their study about the positive association of mortality in patients with anemia in ICU setting (19,20). In contrast to the findings of Rajabtu et al., who reported a significant association between anemia and in-hospital mortality, our study did not demonstrate a statistically significant difference in mortality between the two groups (20.9% vs 11.6%, p=.243)(9).
The pathophysiological basis for these findings is well established, as Jandu VS et al. demonstrated that elevated hepcidin levels in severe infection impair iron utilisation and erythropoiesis, thereby worsening anemia and its downstream consequences in the context of critical illness (4).

CONCLUSION

Length of ICU stay and need for MV was significantly associated with anemia in patients with severe pneumonia. While mortality was not significant in both groups.

Conflict of Interest:
The authors declare no conflict of interest.

Disclosure:
The authors have nothing to disclose.

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Patient Consent:
Written consents were taken at start of study and kept safe for further record.

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