

Determinants of Mortality in Mechanically Ventilated Preterm Neonates

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ABSTRACT

Background: Preterm neonates requiring mechanical ventilation are at high risk of mortality. Identification of clinical and laboratory determinants is essential for early risk stratification and improved outcomes.

Material and Methods: This prospective observational study included 50 mechanically ventilated preterm neonates admitted to a tertiary care neonatal intensive care unit. Detailed data on demographic, clinical, maternal, laboratory, and ventilatory parameters were collected. Outcomes were compared between survivors and non-survivors, and determinants of mortality were evaluated using univariate and multivariate logistic regression analysis.

Results: Out of 50 neonates, 30 (60.0%) survived and 20 (40.0%) died. Baseline characteristics, including gestational age and birth weight, were comparable between groups. APGAR score at 10 minutes was significantly lower among non-survivors ($p = 0.046$). Caesarean delivery was associated with higher survival, while singleton gestation was more common among non-survivors ($p = 0.032$ and $p = 0.022$, respectively). Platelet count was significantly lower in non-survivors ($p < 0.001$), and venous blood gas analysis showed lower pH ($p = 0.008$). Higher FiO_2 requirement at initiation of ventilation was observed in non-survivors ($p < 0.001$). On multivariate analysis, platelet count remained an independent predictor of mortality (adjusted OR 0.98, $p = 0.018$).

Conclusion: Mortality in mechanically ventilated preterm neonates is primarily associated with indicators of disease severity rather than baseline characteristics. Thrombocytopenia is an independent predictor of mortality, emphasizing the importance of early identification and targeted management.

Keywords: Preterm neonates; Mechanical ventilation; Neonatal mortality; Thrombocytopenia; FiO_2 ; Predictors of outcome

INTRODUCTION

Preterm birth, defined as delivery before 37 completed weeks of gestation, remains a major global health concern and contributes substantially to neonatal morbidity and mortality. Complications related to prematurity account for a significant proportion of neonatal deaths worldwide, particularly in low- and middle-income countries where access to advanced neonatal care is variable [1]. Despite advances in neonatal intensive care, preterm neonates continue to be at increased risk of respiratory failure due to structural and functional immaturity of the lungs, including surfactant deficiency, reduced lung compliance, and impaired respiratory drive [2].

Mechanical ventilation is a cornerstone intervention in the management of critically ill preterm neonates with respiratory compromise. It provides essential life support in conditions such as respiratory distress syndrome, apnea of prematurity, perinatal asphyxia, and neonatal sepsis [3]. The introduction of mechanical ventilation and modern neonatal intensive care practices has significantly improved survival rates in preterm infants; however, outcomes remain heterogeneous across different settings, particularly in resource-limited environments [3].

Although mechanical ventilation is lifesaving, it is also associated with potential complications, including ventilator-associated lung injury, bronchopulmonary dysplasia, and adverse neurodevelopmental outcomes. Evidence suggests that both the duration and type of ventilation play a critical role in influencing neonatal outcomes [4]. Furthermore,

the clinical course of mechanically ventilated preterm neonates is often complex and influenced by multiple interrelated factors.

Several studies have identified key predictors of mortality in preterm neonates requiring intensive care. These include lower gestational age, low birth weight, poor Apgar scores, need for resuscitation at birth, and the presence of systemic complications such as sepsis or hemodynamic instability [5]. Additionally, factors related to clinical management—such as timing of ventilation, ventilatory strategies, and availability of skilled neonatal care—have also been shown to significantly impact survival [3].

Recent research focusing specifically on ventilated neonates has highlighted that mortality is not solely dependent on baseline characteristics but also on dynamic clinical variables, including ventilator settings, biochemical parameters, and complications arising during hospitalization [6]. Despite these insights, there remains a paucity of data from many regions regarding the determinants of mortality among mechanically ventilated preterm neonates, particularly in tertiary care settings.

In this context, the present study was undertaken to evaluate the clinical profile and identify determinants of mortality among mechanically ventilated preterm neonates admitted to a neonatal intensive care unit.

MATERIAL AND METHODS

Study design and setting: This prospective observational study was conducted in the Neonatal Intensive Care Unit (NICU) of a tertiary care teaching hospital from April 2025 to March 2026. The objective was to identify clinical and biochemical determinants associated with mortality among mechanically ventilated preterm neonates.

Study population: The study population comprised preterm neonates (gestational age <37 completed weeks) who required invasive mechanical ventilation during their NICU stay. A total of 50 neonates fulfilling the inclusion criteria were enrolled consecutively.

Inclusion criteria: All preterm neonates admitted to the NICU who required mechanical ventilation for respiratory or systemic indications during the study period were included.

Exclusion criteria: Neonates with major congenital malformations incompatible with life, chromosomal anomalies, or those who left against medical advice before outcome assessment were excluded from the study.

Sample size: A sample size of 50 mechanically ventilated preterm neonates was selected based on feasibility and the expected admission load during the study period.

Data collection: Data were collected using a structured and predesigned data collection proforma. Each enrolled neonate was assigned a serial number, and detailed information was recorded under the following domains:

- **Baseline characteristics:** date of admission, sex, gestational age (based on obstetric dates and confirmed using Ballard scoring system), inborn or outborn status.
- **Perinatal variables:** need for resuscitation at birth and APGAR scores at 1, 5, and 10 minutes.
- **Anthropometry:** birth weight, length, and head circumference; ponderal index was calculated and anthropometric parameters were categorized according to centile charts.
- **Maternal history:** maternal age, parity, type of conception, mode of delivery, singleton or multiple gestation, and history of medical, surgical, or drug-related conditions during pregnancy, along with any antenatal complications.
- **Clinical status at initiation of ventilation:** heart rate, respiratory rate, oxygen saturation, capillary refill time, blood pressure, and severity of respiratory distress assessed using the Silverman Andersen Score.
- **Indication for mechanical ventilation:** primary clinical diagnosis necessitating ventilatory support.
- **Laboratory investigations:** complete blood count (hemoglobin, total leukocyte count, platelet count), serum electrolytes (sodium, potassium), C-reactive protein, blood culture, arterial/venous blood gas parameters (pH, pCO₂, pO₂, bicarbonate), and relevant additional investigations including chest radiography.
- **Ventilator parameters:** peak inspiratory pressure (PIP), positive end-expiratory pressure (PEEP), fraction of inspired oxygen (FiO₂), respiratory rate, and type of ventilator used.
- **Clinical course:** occurrence of complications during ventilation, duration of hospital stay, and final diagnosis.

- **Outcome measures:** survival or mortality at the end of hospitalization.

Definitions: Preterm neonates were defined as infants born before 37 completed weeks of gestation. Mortality was defined as death occurring during the NICU stay after initiation of mechanical ventilation.

Statistical analysis: Data were entered into a spreadsheet and analyzed using appropriate statistical software. Continuous variables were summarized as mean \pm standard deviation or median with interquartile range, depending on data distribution. Categorical variables were expressed as proportions and percentages. Comparative analysis between survivors and non-survivors was performed using appropriate statistical tests (Chi-square test or Fisher's exact test for categorical variables and independent t-test or Mann-Whitney U test for continuous variables). A p-value of <0.05 was considered statistically significant.

RESULTS

Baseline demographic and anthropometric parameters were comparable between survivors and non-survivors (Table 1). No significant differences were observed in gestational age, birth weight, or other anthropometric indices ($p > 0.05$). APGAR score at 10 minutes was significantly lower among non-survivors ($p = 0.046$). Duration of hospital stay was significantly shorter in the non-survivor group ($p < 0.001$), while duration of mechanical ventilation was comparable.

Maternal characteristics were largely similar between groups (Table 2). However, lower segment caesarean section was associated with higher survival ($p = 0.032$). Singleton gestation was significantly more common among non-survivors, whereas multiple gestation was more frequent among survivors ($p = 0.022$).

Clinical vitals at initiation of ventilation did not differ significantly between groups (Table 3). Among laboratory parameters, platelet count was significantly lower in non-survivors ($p < 0.001$). Venous blood gas analysis showed significantly lower pH in the non-survivor group ($p = 0.008$), while other parameters were comparable.

Indications for ventilation and most ventilator settings were similar between groups (Table 4). However, FiO₂ requirement at initiation was significantly higher among non-survivors ($p < 0.001$). The incidence of complications and chest X-ray findings did not differ significantly.

On univariate analysis, lower platelet count, lower pH, higher FiO₂, singleton gestation, and vaginal delivery were significantly associated with mortality (Table 5). On multivariate analysis, only platelet count remained an independent predictor of mortality (adjusted OR 0.98, 95% CI 0.97–1.00, $p = 0.018$), while FiO₂ showed a trend without statistical significance.

Table 1.

Baseline neonatal and clinical characteristics of the study population stratified by outcome

Variable	Total (N=50)	Survived (n=30)	Died (n=20)	p-value
Anthropometric & demographic				
Male sex, n (%)	27 (54.0%)	16 (53.3%)	11 (55.0%)	1.000
Gestational age (weeks), mean \pm SD	31.74 \pm 2.82	32.00 \pm 2.65	31.35 \pm 3.08	0.324
Gestational age by Ballard score (weeks), mean \pm SD	31.17 \pm 3.16	31.44 \pm 2.83	30.76 \pm 3.65	0.314
Birth weight (kg), mean \pm SD	1.53 \pm 0.55	1.54 \pm 0.56	1.51 \pm 0.56	0.751
Length (cm), mean \pm SD	40.37 \pm 4.74	40.95 \pm 4.38	39.50 \pm 5.24	0.245

Variable	Total (N=50)	Survived (n=30)	Died (n=20)	p-value
Head circumference (cm), mean ± SD	29.42 ± 2.41	29.53 ± 2.23	29.25 ± 2.70	0.499
Ponderal index, mean ± SD	2.05 ± 0.32	2.04 ± 0.32	2.07 ± 0.34	0.638
Admission characteristics				
Inborn, n (%)	39 (78.0%)	26 (86.7%)	13 (65.0%)	0.090
Resuscitation required at birth, n (%)	8 (16.0%)	5 (16.7%)	3 (15.0%)	1.000
APGAR score at 1 min, mean ± SD	6.19 ± 1.26	6.43 ± 1.19	5.76 ± 1.30	0.071
APGAR score at 5 min, mean ± SD	7.21 ± 1.21	7.43 ± 1.10	6.82 ± 1.33	0.100
APGAR score at 10 min, mean ± SD	8.09 ± 1.04	8.33 ± 0.92	7.65 ± 1.11	0.046*
Primary diagnosis, n (%)				
Respiratory distress syndrome (RDS / HMD)	44 (88.0%)	28 (93.3%)	16 (80.0%)	0.202
Early onset sepsis	29 (58.0%)	17 (56.7%)	12 (60.0%)	1.000
Necrotising enterocolitis (NEC)	13 (26.0%)	9 (30.0%)	4 (20.0%)	0.522
VLBW / LBW	44 (88.0%)	27 (90.0%)	17 (85.0%)	0.672
Duration				
Duration of mechanical ventilation (days), mean ± SD	4.34 ± 4.09	4.06 ± 2.97	4.76 ± 5.41	0.627
Duration of hospital stay (days), mean ± SD	20.95 ± 17.17	31.07 ± 13.95	5.77 ± 7.67	<0.001*

Continuous variables: mean ± SD; categorical: n (%). Comparisons by Mann-Whitney U / independent t-test / χ^2 / Fisher's exact test as appropriate. *p < 0.05. RDS = respiratory distress syndrome; HMD = hyaline membrane disease; NEC = necrotising enterocolitis; VLBW/LBW = very/low birth weight.

Table 2.*Maternal characteristics and obstetric history stratified by neonatal outcome*

Variable	Total (N=50)	Survived (n=30)	Died (n=20)	p- value
Maternal age (years), mean \pm SD	30.18 \pm 5.93	29.50 \pm 5.44	31.20 \pm 6.61	0.347
Primigravida (G1), n (%)	33 (66.0%)	21 (70.0%)	12 (60.0%)	0.670
Mode of delivery, n (%)				
Lower segment caesarean section (LSCS)	44 (88.0%)	29 (96.7%)	15 (75.0%)	0.032*
Normal vaginal delivery (NVD)	6 (12.0%)	1 (3.3%)	5 (25.0%)	0.032*
Type of conception, n (%)				
Spontaneous	34 (68.0%)	20 (66.7%)	14 (70.0%)	1.000
Assisted (ART / IVF)	14 (28.0%)	8 (26.7%)	6 (30.0%)	1.000
Plurality, n (%)				
Singleton	30 (60.0%)	14 (46.7%)	16 (80.0%)	0.022*
Multiple gestation (twin / higher order)	20 (40.0%)	16 (53.3%)	4 (20.0%)	0.022*
Maternal comorbidities, n (%)				
Pre-eclampsia / PIH	2 (4.0%)	1 (3.3%)	1 (5.0%)	1.000
Hypothyroidism	2 (4.0%)	1 (3.3%)	1 (5.0%)	1.000
Fetal growth restriction / abnormal Doppler	8 (16.0%)	4 (13.3%)	4 (20.0%)	0.697
Premature rupture of membranes (PROM)	16 (32.0%)	11 (36.7%)	5 (25.0%)	0.578
Poor CTG / fetal distress	11 (22.0%)	5 (16.7%)	6 (30.0%)	0.443

Continuous: mean \pm SD; categorical: n (%). *p < 0.05. ART = assisted reproductive technology; IVF = in vitro fertilisation; PIH = pregnancy-induced hypertension; PROM = premature rupture of membranes; CTG = cardiotocography.

Table 3.*Clinical vitals and laboratory investigations at initiation of mechanical ventilation stratified by outcome*

Parameter	Total (N=50)	Survived (n=30)	Died (n=20)	p-value
Vitals at time of ventilation				
Heart rate (bpm), mean \pm SD	131.94 \pm 38.40	135.30 \pm 35.40	126.90 \pm 42.96	0.383
Respiratory rate (breaths/min), mean \pm SD	65.07 \pm 12.01	65.50 \pm 12.84	64.38 \pm 10.89	0.500
SpO ₂ (%), mean \pm SD	80.30 \pm 17.01	82.10 \pm 15.93	77.60 \pm 18.61	0.371
CRT >3 seconds, n (%)	12 (24.0%)	6 (20.0%)	6 (30.0%)	0.636
Silverman-Andersen score, mean \pm SD	5.84 \pm 1.54	5.80 \pm 1.47	5.90 \pm 1.68	0.590
Complete blood count				
Haemoglobin (g/dL), mean \pm SD	16.18 \pm 2.95	16.54 \pm 2.15	15.64 \pm 3.85	0.520
Total leucocyte count ($\times 10^3/\mu\text{L}$), mean \pm SD	12.09 \pm 6.66	12.06 \pm 6.17	12.15 \pm 7.49	0.905
Platelet count ($\times 10^3/\mu\text{L}$), mean \pm SD	180.68 \pm 106.42	218.53 \pm 106.01	123.90 \pm 80.00	<0.001*
Serum electrolytes				
Sodium (mEq/L), mean \pm SD	139.25 \pm 5.75	139.58 \pm 5.06	138.78 \pm 6.74	0.205
Potassium (mEq/L), median (IQR)†	4.10 (3.80– 4.20)	4.05 (3.80– 4.20)	4.20 (3.70– 4.50)	0.730
Inflammatory markers & microbiology				
CRP (mg/L), mean \pm SD	34.62 \pm 21.82	32.73 \pm 21.81	37.52 \pm 22.41	0.606
Positive blood culture, n (%)	10 (20.0%)	7 (23.3%)	3 (15.0%)	0.720
Venous blood gas (VBG)				
pH, mean \pm SD	7.19 \pm 0.16	7.24 \pm 0.11	7.12 \pm 0.19	0.008*
paCO ₂ (mmHg), mean \pm SD	48.43 \pm 10.92	45.94 \pm 8.50	52.15 \pm 13.15	0.072
paO ₂ (mmHg), mean \pm SD	36.51 \pm 13.95	32.57 \pm 5.86	42.44 \pm 19.69	0.178

Parameter	Total (N=50)	Survived (n=30)	Died (n=20)	p-value
HCO ₃ ⁻ (mEq/L), mean ± SD	20.66 ± 5.53	20.26 ± 3.08	21.27 ± 7.99	0.254

*p < 0.05. †Potassium reported as median (IQR) due to one probable data-entry outlier (K = 138 mEq/L, excluded from parametric summary). SpO₂ = peripheral oxygen saturation; CRT = capillary refill time; CRP = C-reactive protein; IQR = interquartile range.

Table 4.

Indications for mechanical ventilation, initial ventilator settings, complications, and chest X-ray findings stratified by outcome

Variable	Total (N=50)	Survived (n=30)	Died (n=20)	p-value
Indication for mechanical ventilation, n (%)				
CPAP failure / severe respiratory distress	33 (66.0%)	21 (70.0%)	12 (60.0%)	0.670
Poor peripheral perfusion / haemodynamic instability	11 (22.0%)	5 (16.7%)	6 (30.0%)	0.443
Apnoea of prematurity	8 (16.0%)	6 (20.0%)	2 (10.0%)	0.450
Meconium aspiration syndrome (MAS)	2 (4.0%)	2 (6.7%)	0 (0.0%)	0.510
Surgical (under general anaesthesia)	2 (4.0%)	2 (6.7%)	0 (0.0%)	0.510
Spontaneous pneumothorax	1 (2.0%)	0 (0.0%)	1 (5.0%)	0.400
Initial ventilator settings, mean ± SD				
Peak inspiratory pressure — PIP (cmH ₂ O)	19.98 ± 1.45	20.10 ± 1.18	19.80 ± 1.79	0.733
Positive end-expiratory pressure — PEEP (cmH ₂ O)	5.80 ± 0.40	5.83 ± 0.38	5.75 ± 0.44	0.484
FiO ₂ (%), mean ± SD	53.80 ± 25.73	42.67 ± 18.79	70.50 ± 26.05	<0.001*
Set respiratory rate (breaths/min), mean ± SD	44.70 ± 1.57	45.00 ± 0.00	44.25 ± 2.45	0.085
Complications, n (%)				
Ventilator-associated pneumonia (VAP)	5 (10.0%)	3 (10.0%)	2 (10.0%)	1.000
No complications (NIL)	24 (48.0%)	16 (53.3%)	8 (40.0%)	0.525

Variable	Total (N=50)	Survived (n=30)	Died (n=20)	p-value
Chest X-ray findings, n (%)				
HMD pattern (bilateral ground glass opacity)	24 (48.0%)	14 (46.7%)	10 (50.0%)	1.000
Consolidation / pneumonia	5 (10.0%)	3 (10.0%)	2 (10.0%)	1.000
Normal / no acute finding	9 (18.0%)	8 (26.7%)	1 (5.0%)	0.067

*p < 0.05. CPAP = continuous positive airway pressure; MAS = meconium aspiration syndrome; PIP = peak inspiratory pressure; PEEP = positive end-expiratory pressure; FiO₂ = fraction of inspired oxygen; VAP = ventilator-associated pneumonia; HMD = hyaline membrane disease.

Table 5.

Determinants of in-hospital mortality — univariate and multivariate logistic regression analysis (N = 50)

Variable	Univariate analysis		Multivariate analysis‡	
	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Neonatal factors				
Gestational age (per 1-week increase)	0.92 (0.75–1.13)	0.422	—	—
Birth weight (per 0.1 kg)	0.99 (0.89–1.10)	0.814	—	—
Male sex	1.07 (0.34–3.33)	1.000	—	—
Outborn status	3.50 (0.87–14.16)	0.090	1.88 (0.22–16.41)	0.566
Resuscitation at birth	0.88 (0.19–4.19)	1.000	—	—
APGAR score at 10 min	—§	0.046	2.14 (0.58–7.84)	0.251
Clinical & laboratory factors				
Platelet count (per 10 ³ /μL increase)	0.99 (0.98–1.00)	0.004*	0.98 (0.97–1.00)	0.018*
Blood pH (per 0.1-unit increase)	0.55 (0.34–0.90)	0.017*	0.59 (0.22–1.57)	0.293
paCO ₂ (per mmHg increase)	1.06 (1.00–1.12)	0.057	1.02 (0.92–1.12)	0.768
SpO ₂ at ventilation (per %)	0.98 (0.95–1.02)	0.359	—	—
CRP (per mg/L increase)	1.01 (0.98–1.04)	0.534	—	—
Positive blood culture	0.58 (0.13–2.57)	0.720	—	—
Ventilator & treatment factors				
FiO ₂ at initiation (per 1% increase)	1.05 (1.02–1.09)	0.001*	1.05 (0.99–1.11)	0.098
VAP	0.47 (0.05–4.91)	0.641	—	—
Maternal factors				
Singleton gestation	4.57 (1.23–16.94)	0.022*	4.33 (0.71–26.45)	0.112
Multiple gestation	0.20 (0.05–0.84)	0.032*	—	—
LSCS (vs. NVD)	0.10 (0.01–0.97)	0.032*	—	—

Variable	Univariate analysis		Multivariate analysis‡	
	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Pre-eclampsia / PIH	1.53 (0.09–25.91)	1.000	—	—

OR = odds ratio; CI = confidence interval. *p < 0.05 (bold). — = not entered into multivariate model (univariate p ≥ 0.2). ‡ Multivariate model (n = 47 after listwise deletion) includes variables with univariate p < 0.2: platelet count, pH, FiO₂, paCO₂, APGAR at 10 min, outborn status, singleton gestation. § OR for APGAR at 10 min not shown as continuous univariate due to small variability; entered into multivariate as continuous. FiO₂ = fraction of inspired oxygen; CRP = C-reactive protein; VAP = ventilator-associated pneumonia; PIH = pregnancy-induced hypertension; LSCS = lower segment caesarean section; NVD = normal vaginal delivery.

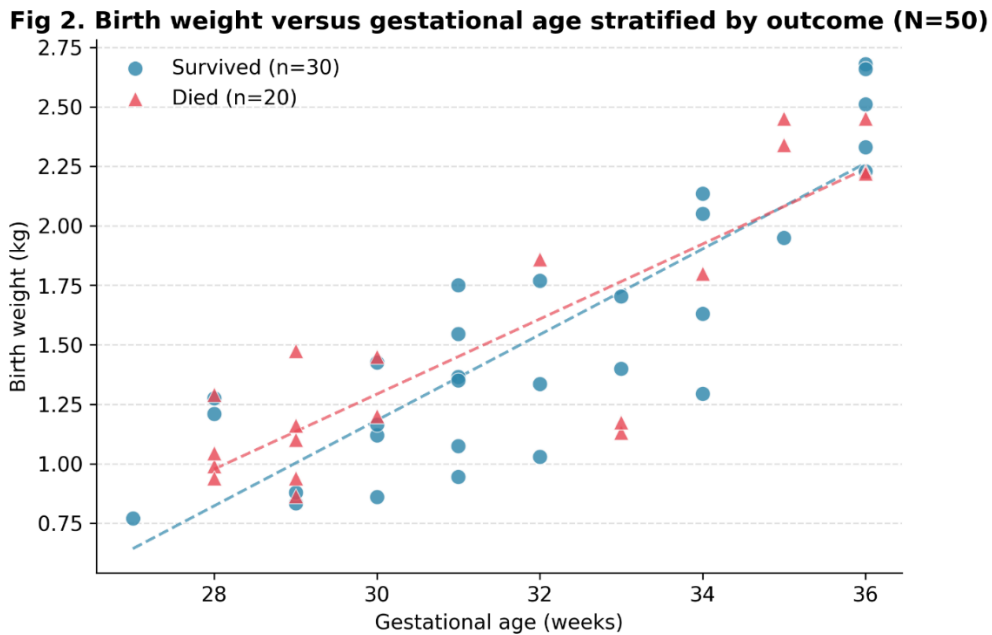
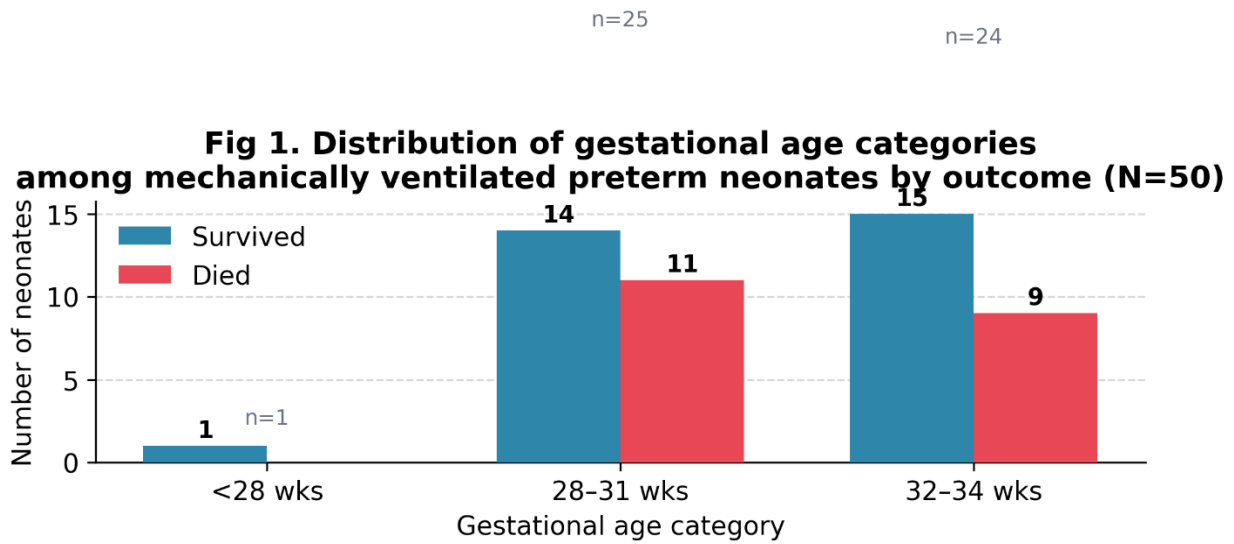


Fig 3. Causative organisms in blood culture-positive neonates (10 positive of 50 total; blood culture positivity rate = 20%)

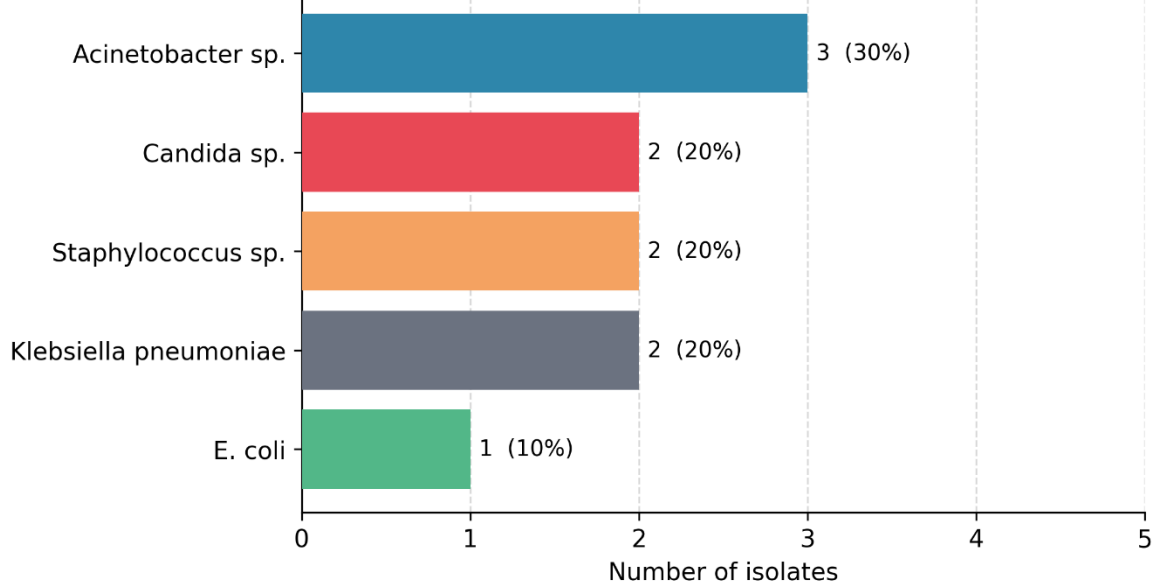


Fig 4. Kaplan-Meier survival curves by gestational age group (N=50)

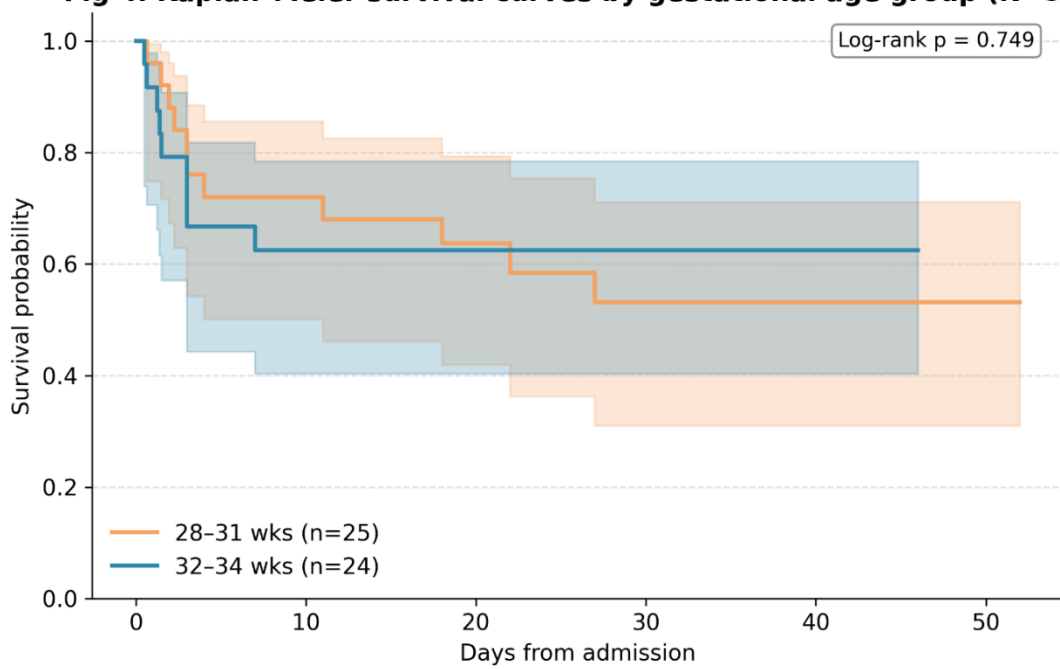


Fig 5. Duration of mechanical ventilation in survivors versus non-survivors (N=50)

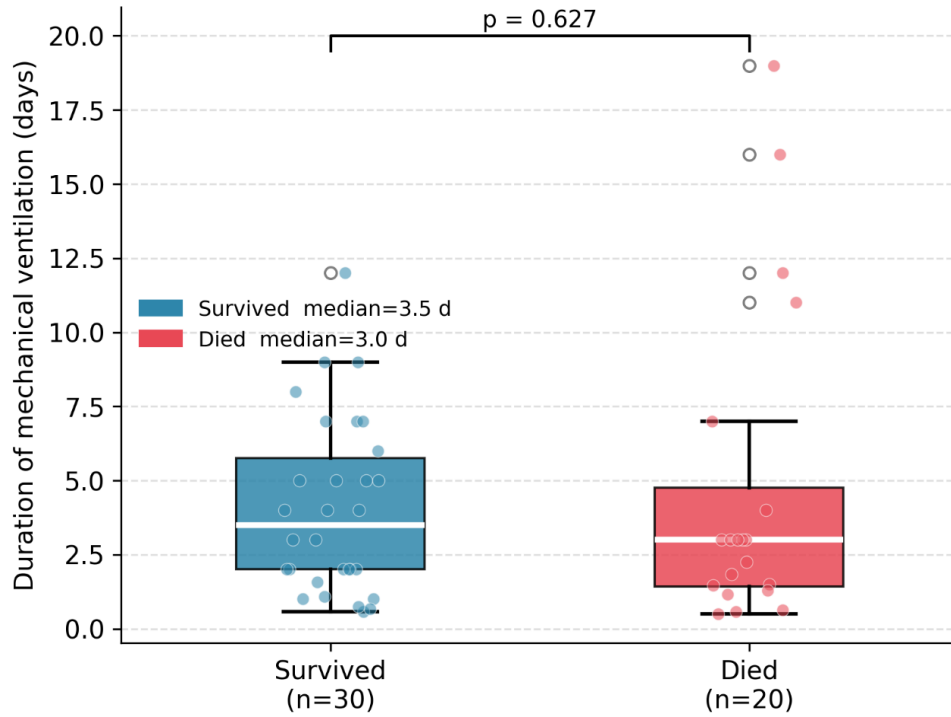


Fig 6. ROC curves for key predictors of mortality (N=50)

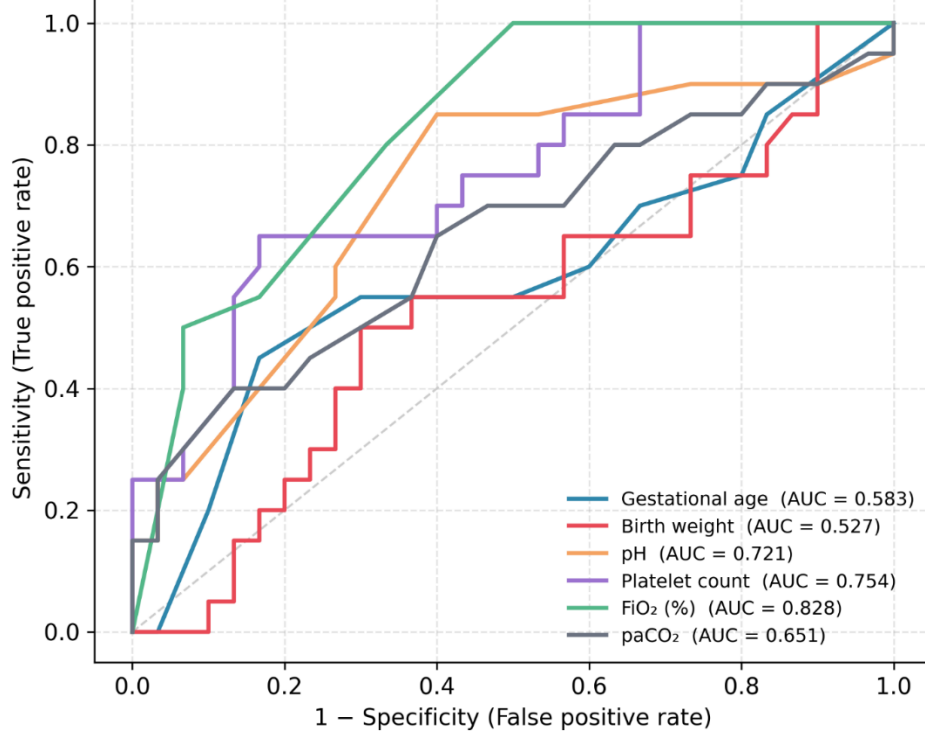


Fig 7. Proportion of preterm neonates by primary indication for mechanical ventilation (N=50)

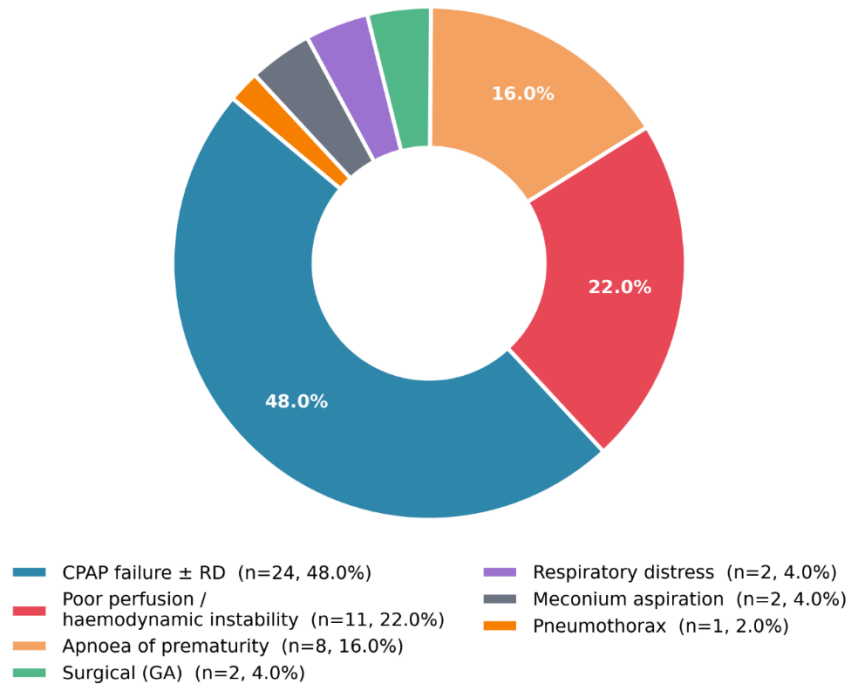
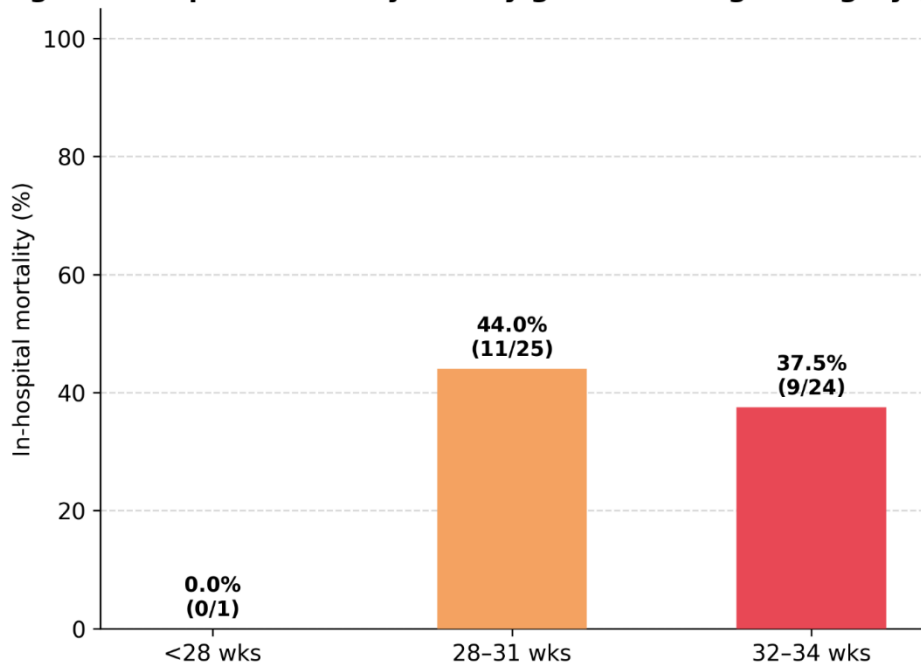


Fig 8. In-hospital mortality rate by gestational age category (N=50)



DISCUSSION

The present study evaluated determinants of mortality among mechanically ventilated preterm neonates and demonstrated a mortality rate of 40%. This finding is consistent with recent reports from tertiary care settings, where mortality among ventilated neonates remains substantial despite advances in neonatal intensive care [7]. High mortality in this subgroup reflects the combined impact of prematurity, respiratory failure, and associated systemic complications.

In the current study, baseline demographic and anthropometric parameters, including gestational age and birth weight, were not significantly associated with mortality. This contrasts with recent evidence indicating that lower gestational age and birth weight are strong predictors of mortality in preterm infants, particularly those with respiratory distress syndrome [8]. The lack of significance in the present study may be attributable to a relatively homogeneous study population or limited sample size, which can reduce the ability to detect such associations.

APGAR score at 10 minutes was significantly lower among non-survivors, highlighting the importance of early postnatal adaptation. Similar findings have been reported in recent studies, where lower APGAR scores were independently associated with increased mortality, reflecting perinatal compromise and the need for intensive resuscitative support [8]. This underscores the role of immediate neonatal condition as a critical determinant of outcome.

Maternal and obstetric factors demonstrated selective associations with mortality. In the present study, vaginal delivery and singleton gestation were associated with higher mortality, whereas caesarean delivery and multiple gestation were associated with improved survival. While evidence on these associations remains variable, recent literature suggests that obstetric factors may influence neonatal outcomes through their relationship with antenatal complications, timing of delivery, and perinatal care practices [9]. However, these factors often act indirectly and may not retain significance after adjustment for neonatal clinical variables.

Among clinical and laboratory parameters, thrombocytopenia emerged as a strong independent predictor of mortality. This finding is biologically plausible, as low platelet counts in neonates are frequently associated with sepsis, disseminated intravascular coagulation, and systemic inflammatory responses, all of which are linked to poor outcomes. Recent studies have similarly identified hematological abnormalities and markers of systemic instability as important predictors of neonatal mortality in intensive care settings [10].

Acid–base status at initiation of ventilation was also significantly associated with outcome, with lower pH observed among non-survivors. Acidosis reflects impaired tissue perfusion and respiratory failure, both of which are critical determinants of prognosis. Comparable findings have been reported in recent studies, where metabolic and respiratory acidosis were associated with increased mortality and adverse outcomes in critically ill preterm neonates [9].

The requirement of higher FiO₂ at initiation of mechanical ventilation was significantly associated with mortality on univariate analysis, although it did not remain an independent predictor after adjustment. This observation is consistent with existing evidence indicating that higher oxygen requirements reflect more severe pulmonary dysfunction and disease severity [11]. Moreover, prolonged or high-concentration oxygen exposure has been associated with increased risk of lung injury and adverse outcomes in preterm infants [11].

Interestingly, duration of mechanical ventilation was not significantly different between survivors and non-survivors, whereas duration of hospital stay was significantly shorter in the non-survivor group. This pattern has been observed in other studies, where early mortality results in shorter hospital stay, while survivors require prolonged supportive care and monitoring [8].

The present study did not find a significant association between complications such as ventilator-associated pneumonia and mortality. This may be due to the relatively low incidence of such complications or early mortality before their development. However, previous studies have highlighted that complications related to mechanical ventilation, including ventilator-associated lung injury and nosocomial infections, contribute to adverse outcomes and long-term morbidity [12].

CONCLUSION

Mortality among mechanically ventilated preterm neonates remains high and is influenced by multiple interrelated factors. While baseline characteristics such as gestational age and birth weight were not significantly associated with outcome, markers of illness severity at presentation—particularly lower platelet count, acidosis, and higher oxygen requirement—were more closely linked to mortality. Among these, thrombocytopenia emerged as an independent predictor, underscoring its potential role as an early prognostic indicator. These findings highlight the importance of prompt recognition of physiological derangements and targeted management strategies to improve outcomes in this vulnerable population.

REFERENCES

1. Fisseha B, Gidey EB, Tewele BG, Haile TG. Time to neonatal mortality and its predictors among preterm neonates admitted to the neonatal intensive care unit in northern Ethiopia, 2023/2024: a retrospective cohort study. *Arch Public Health*. 2025 Jan 14;83(1):13. doi: 10.1186/s13690-024-01497-w.
2. Vargas Caicedo V, de la Plaza San Frutos M, Sosa Reina MD, Garcia Arrabe M, Salniccia F, Reina Aguilar C, et al. Effects of mechanical ventilation on neurodevelopment at 12 months in preterm low birth weight pediatric patients: a systematic review. *Front Pediatr*. 2024;12:1363472. doi:10.3389/fped.2024.1363472.
3. Tekulu TG, Lemma HH, Hadgu A, et al. Clinical profile and predictors of mortality of mechanically ventilated neonates in a tertiary hospital in Ethiopia. *Discov Med*. 2025;2:258. doi:10.1007/s44337-025-00506-3.
4. Nagaraj YK, Balushi SA, Robb C, Uppal N, Dutta S, Mukerji A. Peri-extubation settings in preterm neonates: a systematic review and meta-analysis. *J Perinatol*. 2024 Feb;44(2):257-265. doi: 10.1038/s41372-024-01870-1.
5. Vrakela L, Polić B, Mrčela D, Markić J, Čatipović Ardalić T, Kovačević T, et al. Predictors of Mortality in Preterm Infants with Respiratory Distress Syndrome: A Retrospective Analysis. *Journal of Clinical Medicine*. 2026; 15(2):691. <https://doi.org/10.3390/jcm15020691>
6. Brady S, Martin M, Keerthy D, Liao G, Breslin N, Parravicini E. Respiratory outcomes of neonates born after pre-viable premature rupture of membranes and treated with gentle ventilation. *J Perinatol*. 2024 Sep;44(9):1285-1290. doi: 10.1038/s41372-024-02014-1.
7. Madavi D, Rohadkar LA, Kursunge N, Kshirsagar S, Sardar S, Keshattiwari S, et al. Clinical Profile and Immediate Outcome of Ventilated Neonates Admitted in NICU of Tertiary Care Hospital in Central India. *Curr Pediatr Res* 2025; 29 (03): 715-719
8. Gebreheat G, Tadesse B, Teame H. Predictors of respiratory distress syndrome, sepsis and mortality among preterm neonates admitted to neonatal intensive care unit in northern Ethiopia. *J Pediatr Nurs*. 2022 Mar-Apr;63:e113-e120. doi: 10.1016/j.pedn.2021.09.029.
9. Birhanu D, Gebremichael B, Tesfaye T, Tadesse M, Belege F, Godie Y, et al. Survival status and predictors of mortality among preterm neonates admitted to neonatal intensive care unit of Addis Ababa public hospitals, Ethiopia, 2021. A prospective cohort study. *BMC Pediatr*. 2022 Mar 23;22(1):153. doi: 10.1186/s12887-022-03176-7.
10. Özalkaya E, Arifoğlu İ, Yarış E, Topcuoğlu S, Sancak S, Dinçer E, Alkan ÖY, Karatekin G. A new mortality score in preterm infants: the vasoactive inotropic score. *BMC Pediatr*. 2025 Apr 23;25(1):317. doi: 10.1186/s12887-025-05638-0.
11. van der Marel I, de Jonge R, Duvekot J, Reiss I, Brussé I. Maternal and Neonatal Outcomes of Preterm Premature Rupture of Membranes before Viability. *Klin Padiatr*. 2016 Mar;228(2):69-76. doi: 10.1055/s-0041-111174.
12. Moultrie F, Durrmeyer X, van den Bosch GE, Tauzin M, Roué JM, Olsson E, et al. Analgesia and sedation in premature infants receiving invasive ventilation: a systematic scoping review. *Pediatr Res*. 2025 Nov 20. doi: 10.1038/s41390-025-04441-y.