



Original Research Article

CLINICAL PROFILE AND EARLY OUTCOMES OF VERY LOW BIRTH WEIGHT NEONATES REQUIRING RESPIRATORY SUPPORT: A PROSPECTIVE OBSERVATIONAL STUDY FROM A TERTIARY CARE NICU IN INDIA

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ABSTRACT

Background: Very low birth weight (VLBW) neonates (<1500 g) account for a disproportionate share of neonatal morbidity and mortality, particularly in low- and middle-income countries (LMICs). Contemporary prospective data describing their clinical profile and early outcomes are essential for benchmarking and quality improvement. **Objectives:** To describe maternal characteristics, neonatal clinical profile, respiratory burden, and early in-hospital outcomes of VLBW neonates requiring respiratory support. **Materials and Methods:** This prospective observational study was conducted in a tertiary-care neonatal intensive care unit (NICU) in India. Neonates with birth weight <1500 g, admitted within 24 hours of life and requiring respiratory support, were enrolled. Maternal and neonatal variables, cumulative duration of respiratory support, surfactant use, neonatal morbidities, and outcomes until discharge, death, or leaving against medical advice (LAMA) were recorded. Adverse outcome was defined as death or LAMA. Univariate logistic regression was performed to assess the association between birth weight and culture-positive sepsis.

Results: Forty-three VLBW neonates were included. Mean gestational age was approximately 31 weeks and mean birth weight approximately 1150 g. The median cumulative duration of respiratory support was 7 days. Culture-positive sepsis occurred in approximately one-fifth of neonates. Overall survival to discharge was around three-quarters of the cohort. Lower birth weight was significantly associated with culture-positive sepsis.

Conclusions: VLBW neonates requiring respiratory support experience substantial respiratory and infectious morbidity in LMIC settings. Birth weight remains a key determinant of early adverse outcomes.

Keywords: Preterm, VLBW, Respiratory distress, surfactant, neonatal morbidity.

INTRODUCTION

Very low birth weight neonates represent one of the most vulnerable populations cared for in neonatal intensive care units worldwide. Although they

constitute a relatively small proportion of all live births, they contribute disproportionately to neonatal mortality, prolonged hospitalization, and long-term neurodevelopmental impairment. Advances in perinatal and neonatal care have led to significant

improvements in survival in high-income countries; however, outcomes in low- and middle-income countries remain comparatively poorer.

India bears a substantial burden of preterm and VLBW births, accounting for nearly one-fifth of the global preterm population.^[1] Tertiary-care NICUs in India frequently manage extremely fragile neonates with limited physiological reserves, high susceptibility to infection, and significant respiratory morbidity. Despite this, contemporary prospective data describing the clinical profile and early outcomes of VLBW neonates from LMIC settings remain sparse.

Large international databases such as the Vermont Oxford Network (VON), the NICHD Neonatal Research Network, and the Canadian Neonatal Network provide robust benchmarks for outcomes among VLBW neonates.^[2,3,4] However, direct extrapolation of these data to LMIC settings is challenging due to differences in antenatal care coverage, referral patterns, infection control practices, resource availability, and socioeconomic factors.

Respiratory illness is a central driver of morbidity in VLBW neonates. In LMIC settings, escalation and de-escalation between respiratory modalities are common and often dictated by resource availability and clinical response. Consequently, cumulative duration of respiratory support may serve as a pragmatic surrogate marker of respiratory disease severity.

This study was therefore designed to prospectively describe the clinical profile, respiratory burden, and early outcomes of VLBW neonates requiring respiratory support in a tertiary-care NICU in India, and to explore the association between birth weight and culture-positive sepsis.

MATERIALS AND METHODS

Study design and setting: This prospective observational study was conducted in the neonatal intensive care unit of a tertiary-care teaching hospital in India.

Study Population: All live-born neonates with birth weight <1500 g, admitted to the NICU within the first 24 hours of life and requiring respiratory support, were eligible for inclusion. Neonates with major congenital malformations or chromosomal abnormalities were excluded.

Data Collection: Maternal variables included age, parity, antenatal booking status, antenatal steroid exposure, and major obstetric comorbidities. Neonatal variables included gestational age, birth

weight, sex, growth status, inborn or outborn status, and need for resuscitation at birth.

Respiratory burden: Respiratory illness severity was quantified using the cumulative duration of respiratory support (days), irrespective of the mode of support. Mode-wise respiratory support details were intentionally not analyzed to avoid confounding related to device selection and escalation practices. Surfactant administration was recorded as a binary variable.

Definitions: Neonatal morbidities were defined using standard criteria: bronchopulmonary dysplasia according to NICHD definitions; intraventricular hemorrhage using the Papile classification; necrotizing enterocolitis as Bell stage II or higher; retinopathy of prematurity according to ICROP requiring treatment; and hemodynamically significant patent ductus arteriosus requiring treatment.^[2] Sepsis was classified as suspected, probable, or culture-positive.

Outcomes: The primary outcome was survival to discharge. Adverse outcome was defined as death or leaving against medical advice (LAMA). Secondary outcomes included neonatal morbidities, duration of respiratory support, and length of hospital stay.

Statistical Analysis: Continuous variables were expressed as mean \pm standard deviation or median with interquartile range, as appropriate. Categorical variables were expressed as frequencies and percentages. Univariate logistic regression was performed to assess the association between birth weight (per 100 g decrease) and culture-positive sepsis. Statistical significance was set at $p < 0.05$.

RESULTS

A total of 43 very low birth weight neonates were included in the study, with a mean gestational age of 30.6 ± 1.7 weeks and mean birth weight of 1149.5 ± 166.0 g. Males constituted 62.8% of the cohort, and 34.9% were small for gestational age. The median cumulative duration of respiratory support was 7 days (IQR 4–11), and surfactant therapy was administered to 55.8% of neonates. Sepsis occurred in 44.2% of infants, with culture-positive sepsis documented in 20.9%. Major neonatal morbidities included bronchopulmonary dysplasia (18.6%), PDA requiring treatment (23.3%), and retinopathy of prematurity requiring treatment (11.6%). Overall, 76.7% of neonates survived to discharge, while 23.3% experienced an adverse outcome (death or leaving against medical advice).

Tables 1–4 summarize baseline characteristics, respiratory burden, neonatal morbidities, and clinical outcomes.

Table 1: Baseline maternal and neonatal characteristics

Characteristic	Value
Sample size	43
Gestational age, weeks (mean ± SD)	30.6 ± 1.7
Birth weight, g (mean ± SD)	1149.5 ± 166.0
Male sex, n (%)	27 (62.8)
Small for gestational age, n (%)	15 (34.9)
Inborn, n (%)	29 (67.4)
Antenatal steroids received, n (%)	33 (76.7)

Table 2: Respiratory support and related interventions

Variable	Value
Cumulative respiratory support, days (median [IQR])	7 [4–11]
Surfactant therapy, n (%)	24 (55.8)

Table 3: Major neonatal morbidities

Morbidity	n (%)
Any sepsis	19 (44.2)
Culture-positive sepsis	9 (20.9)
Bronchopulmonary dysplasia	8 (18.6)
PDA requiring treatment	10 (23.3)
Necrotizing enterocolitis ≥ stage II	4 (9.3)
Severe IVH (grade 3–4)	3 (7.0)
ROP requiring treatment	5 (11.6)

Table 4: Clinical outcomes

Outcome	Value
Survived to discharge, n (%)	33 (76.7)
Death, n (%)	6 (14.0)
LAMA, n (%)	4 (9.3)
Adverse outcome (death or LAMA), n (%)	10 (23.3)
Hospital stay, days (median [IQR])	36 [22–54]

DISCUSSION

This prospective observational study provides a detailed clinical profile of very low birth weight neonates requiring respiratory support in a tertiary-care NICU in a low- and middle-income country setting. The findings highlight the substantial respiratory and infectious morbidity faced by this vulnerable population and reaffirm birth weight as a key determinant of early adverse outcomes, particularly culture-positive sepsis.

Respiratory morbidity remains a dominant contributor to neonatal outcomes among VLBW infants. The median cumulative duration of respiratory support of 7 days observed in this cohort reflects significant respiratory disease severity. By focusing on cumulative respiratory support rather than individual respiratory modalities, this study adopts a pragmatic approach that aligns closely with real-world practice in LMIC NICUs, where escalation and de-escalation between modalities are frequent and often influenced by resource availability and clinical response.

Sepsis emerged as a major morbidity in this cohort, with culture-positive sepsis documented in approximately one-fifth of neonates. This rate exceeds that reported in high-income country networks but is comparable to Indian tertiary-care studies and national datasets.^[3,4] The persistent burden of sepsis in LMIC NICUs likely reflects a combination of extreme prematurity, prolonged hospitalization, frequent invasive procedures, and

challenges related to infection prevention and control.^[5,6]

Lower birth weight was significantly associated with an increased risk of culture-positive sepsis on univariate analysis. This association is biologically plausible, as smaller preterm neonates exhibit immature immune responses, reduced barrier function, and prolonged exposure to invasive interventions.^[2,7,8,9] Similar findings have been reported across international and Indian cohorts, supporting the robustness of this observation.

The survival to discharge rate observed in this study is comparable to other Indian single-center reports but remains lower than that reported in high-income settings. Importantly, inclusion of leaving against medical advice as part of adverse outcomes provides a realistic assessment of neonatal outcomes in LMIC contexts, where socioeconomic factors frequently influence continuation of intensive care.

Overall, these findings underscore the need for targeted strategies to reduce respiratory morbidity and infection risk among the smallest VLBW neonates. Prospective unit-level data such as those presented here are essential for benchmarking, guiding quality-improvement initiatives, and improving outcomes in resource-limited settings.

CONCLUSION

VLBW neonates admitted within the first 24 hours of life and requiring respiratory support experience a substantial burden of respiratory illness and infection

in LMIC NICUs. Birth weight remains a key determinant of early adverse outcomes. Context-specific prospective data are essential to guide quality-improvement initiatives and optimize outcomes for this high-risk population.

Ethics Statement: The study protocol was approved by the Institutional Ethics Committee. Written informed consent was obtained from parents or legal guardians prior to enrolment.

Data Availability Statement: De-identified data are available from the corresponding author upon reasonable request.

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