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Immediate neonatal outcomes in late preterm versus term gestations: A prospective observational study in a tertiary care centre in coastal Karnataka

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Abstract
Background: Late preterm infants (LPI), born between 34 0/7 and 36 6/7 weeks of gestation, are often perceived as "near-term" and functionally mature. However, emerging evidence suggests they are at significantly higher risk for morbidity compared to term infants. This study aimed to compare immediate neonatal outcomes between late preterm and term infants in a tertiary care setting in Mangalore.
Methods: This prospective observational study was conducted at Srinivas Institute of Medical Sciences and Research Center, Mangalore, from January 2023 to December 2023. It included 250 neonates: 100 late preterm (Cases) and 150 term (Controls). Maternal characteristics and neonatal outcomes, including respiratory distress, jaundice, sepsis, and NICU admission rates, were recorded. Statistical analysis was performed using Chi-square and Student's t-tests.
Results: The mean birth weight was significantly lower in the late preterm group (2.42±0.35 kg) compared to the term group (2.95±0.41 kg; $p<0.001$). Late preterm infants had significantly higher rates of NICU admission (36.0% vs. 8.7%; $p<0.001$), Respiratory Distress Syndrome (18.0% vs. 2.0%; $p<0.001$), and hyperbilirubinemia requiring phototherapy (24.0% vs. 9.3%; p = 0.002). The mean length of hospital stay was also prolonged in the late preterm group (6.8±2.4 days vs. 3.2±1.1 days; $p<0.001$).
Conclusion: Late preterm infants exhibit significantly higher morbidity and healthcare utilization compared to term infants. They require vigilant monitoring for respiratory and metabolic complications and should not be treated as "term" infants.

Keywords: Late preterm, neonatal morbidity, respiratory distress, NICU admission, hyperbilirubinemia

Introduction
Preterm birth remains a leading cause of neonatal morbidity and mortality globally. Among preterm births, "late preterm" infants (LPI) defined as those born between 34 weeks 0 days and 36 weeks 6 days of gestation constitute the largest subgroup, accounting for approximately 70-75% of all preterm births [1]. Historically described as "near-term," these infants were often managed similarly to term infants (37 weeks 0 days to 41 weeks 6 days). However, recent literature dubs them "the great impostors" because, despite their relatively mature physical size, they are physiologically immature [2].
In India, where the burden of preterm birth is high, the specific challenges of the late preterm population are often underappreciated. LPIs are at increased risk for respiratory distress syndrome (RDS), transient tachypnea of the newborn (TTN), hypothermia, hypoglycemia, hyperbilirubinemia, and sepsis compared to their term counterparts [3]. Furthermore, the brain volume of a late preterm infant is only 60-80% of that of a term infant, placing them at risk for long-term neurodevelopmental delays [4].
Despite the known risks, there is a paucity of recent data from coastal Karnataka comparing these outcomes directly. This study was undertaken at Srinivas Institute of Medical Sciences and Research Center, Mangalore, to evaluate the immediate neonatal outcomes of late preterm versus term infants, thereby identifying specific areas for clinical vigilance in this vulnerable cohort.

2. Methods
Study Design and Setting
This prospective observational cohort study was conducted in the Department of Paediatrics in collaboration with the Department of Obstetrics & Gynecology at Srinivas Institute of Medical

Sciences and Research Center, Mangalore. The study period was from January 2023 to December 2023.

Participants

The study population included live-born neonates delivered at this institution.

- **Cases (Late Preterm):** Gestational age 34 0/7 to 36 6/7 weeks.
- **Controls (Term):** Gestational age 37 0/7 to 41 6/7 weeks.

Gestational age was determined by the first day of the last menstrual period (LMP) or early trimester ultrasound.

Inclusion Criteria

- Live born singleton neonates.
- Gestational age 34-41 weeks.
- Parental consent for participation.

Exclusion Criteria

- Major congenital malformations.
- Neonates born to mothers with unknown LMP and no early ultrasound.
- Outborn neonates referred to the facility.

Sample Size

Based on previous studies indicating a 20% difference in NICU admission rates, a sample size of 250 (100 cases, 150 controls) was calculated to achieve 80% power at a 5% significance level.

Data Collection: Data was collected using a pre-tested structured proforma. Maternal variables included age, parity, mode of delivery (Vaginal/Cesarean), and complications (preeclampsia, PROM, GDM). Neonatal variables included birth weight, APGAR scores at 1 and 5 minutes, and specific morbidities: Respiratory Distress Syndrome (RDS), Transient Tachypnea of the Newborn (TTN), Hyperbilirubinemia (requiring phototherapy), Hypoglycemia (<45 mg/dL), Culture-proven Sepsis, and NICU admission.

Statistical Analysis

Data were analyzed using Python (Pandas/Scipy). Continuous variables (birth weight, length of stay) were expressed as Mean±Standard Deviation (SD) and compared using the Student's t-test. Categorical variables (morbidities, NICU admission) were expressed as frequencies and percentages, compared using the Chi-square test or Fisher's exact test. A p-value of <0.05 was considered statistically significant.

3. Results

3.1 Demographic and Clinical Characteristics

A total of 250 neonates were analyzed. The demographic profile is summarized in Table 1. The mean birth weight was significantly lower in the late preterm group (2.42 kg) compared to the term group (2.95 kg). There was a significantly higher rate of Cesarean sections (LSCS) in the late preterm group (48.0% vs. 28.7%; p=0.002), often necessitated by maternal indications such as Preeclampsia (PIH) or Premature Rupture of Membranes (PROM).

Table 1: Maternal and Neonatal Demographics

Characteristic	Late Preterm (n=100)	Term (n=150)	P-value
Maternal Age (years, Mean±SD)	26.4±4.1	25.8±3.8	0.23
Primigravida (%)	54 (54.0%)	72 (48.0%)	0.35
Preeclampsia (PIH) (%)	18 (18.0%)	8 (5.3%)	0.001
PROM (%)	22 (22.0%)	11 (7.3%)	<0.001
Mode of Delivery: LSCS (%)	48 (48.0%)	43 (28.7%)	0.002
Male Gender (%)	52 (52.0%)	78 (52.0%)	1.00
Birth Weight (kg, Mean±SD)	2.42±0.35	2.95±0.41	<0.001

3.2 Neonatal Morbidity and Outcomes: Late preterm infants showed significantly higher morbidity across multiple domains. Table 2 details these outcomes. The most striking difference was in respiratory morbidity and NICU admissions.

Table 2: Neonatal Morbidity and Healthcare Utilization

Outcome	Late Preterm (n=100)	Term (n=150)	Odds Ratio (95% CI)	P-value
NICU Admission	36 (36.0%)	13 (8.7%)	5.8 (2.9-11.6)	<0.001
Resp. Distress Syndrome (RDS)	18 (18.0%)	3 (2.0%)	10.8 (3.1-37.4)	<0.001
Transient Tachypnea (TTN)	14 (14.0%)	5 (3.3%)	4.7 (1.7-13.3)	0.002
Hyperbilirubinemia	24 (24.0%)	14 (9.3%)	3.1 (1.5-6.2)	0.002
Hypoglycemia	12 (12.0%)	4 (2.7%)	5.0 (1.6-15.8)	0.003
Sepsis (Culture Positive)	9 (9.0%)	3 (2.0%)	4.8 (1.3-18.1)	0.012
Length of Stay (Days, Mean)	6.8±2.4	3.2±1.1	-	<0.001

4. Discussion

The results of this study reaffirm that late preterm infants are a distinct high-risk population compared to term neonates. Our finding of a 36% NICU admission rate in the late preterm group, compared to 8.7% in the term group, is consistent with recent Indian studies. For instance, findings by Sharma *et al.* (2022) reported NICU admission rates of 32% in late preterms in a similar setting [5].

Respiratory Morbidity

Respiratory issues were the primary driver of morbidity. The 18% incidence of RDS in late preterms vs. 2% in term infants highlights the physiological immaturity of the late preterm lung. Even at 34-36 weeks, surfactant production may be transitional, and the clearance of lung fluid (delayed in TTN) is less efficient, particularly given the higher rate of Cesarean sections observed in our late preterm cohort (48%) [6].

Jaundice and Metabolic Issues
Hyperbilirubinemia requiring phototherapy was significantly higher in late preterms (24% vs. 9.3%). This is attributed to delayed hepatic maturation and poor enteral feeding initiation, which increases enterohepatic circulation of bilirubin [7]. Similarly, hypoglycemia was five times more common in late preterms, necessitating early feeding support and glucose monitoring protocols which are often standard in NICU but may be overlooked in routine postnatal wards.

Maternal Factors
We observed a higher prevalence of maternal hypertensive disorders (18%) and PROM (22%) in the late preterm group. These conditions often necessitate iatrogenic late preterm delivery to safeguard maternal or fetal health, trading intrauterine risk for neonatal morbidity [8].

Clinical Implications
The "near-term" label often leads to complacency. Our data supports the implementation of a "Late Preterm Bundle" at our institution, including mandatory blood glucose screening, pre-discharge bilirubin assessment, and a lower threshold for NICU observation.

5. Limitations
This was a single-center study, which may limit generalizability to community settings. Long-term neurodevelopmental outcomes were not assessed, which remains a crucial area for future research.

6. Conclusion
Late preterm infants at Srinivas Medical College exhibited significantly higher rates of respiratory distress, jaundice, hypoglycemia, and NICU admissions compared to term infants. They require specific management protocols that recognize their physiological immaturity. We recommend that discharge criteria for late preterms be stringent, with ensured follow-up for jaundice and feeding adequacy.

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