# A prospective study to compare morbidity and mortality profile between late preterm and term neonates from a hospital in Indore

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Received – 28 February 2018 Initial Review – 02 April 2018 Published Online – 08 June 2018

## ABSTRACT

**Background:** Late preterm babies born between 34 and <37 weeks of gestation have documented various short-term and long-term adverse outcomes, extra burden on health care, and increased hospitalization rate. **Objective:** The objective of this study was to evaluate the immediate outcome of late preterm neonates and to compare their morbidity and mortality with term neonates. **Materials and Methods:** A prospective observational study was conducted among late preterm babies and term babies from January 2015 to July 2016 in a hospital of Indore. A pre-structured pro forma was used to record data on antenatal care, maternal risk factors, mode of delivery, birth weight, gestational age, gender, diagnosis, relevant investigations, duration of stay, and outcome. Their mortality and morbidity pattern were compared with the term counterparts. **Results:** The total number of live births during the study period was 14,372, of which 2602 were late preterm neonates (16%). Neonatal intensive care unit admission rate was 24.7% among late preterm while 8.87% in term neonates. Jaundice (9%), septicemia (7.8%), respiratory distress (7.6%), and hypoglycemia (6%) were among the common morbidities in late preterm babies, while in term group the incidence rates of these complications were 3.34%, 3.38%, 3.41%, and 2.56%, respectively. **Conclusion:** The mortality and morbidity among late preterm neonates were higher as compared to their term counterparts, implying the need for special attention to these babies because they may be overlooked among other preterm and sick babies.

**Key words:** *Late preterm birth, Mortality, Neonatal complications, Term*

Infants born between the gestational ages of 34 weeks–36 weeks and 6/7 days (239$^{th}$–259$^{th}$ days) are called near-term or late preterm babies. They constitute 74% of all preterm births and 8% of all births globally [1]. They are recognized as the fastest increasing and largest proportion of singleton preterm births [2]. This increase might be due to a misconception that electively delivered late preterm babies are not at increased risk as compared to their term counterparts [3]. Late preterm babies have documented increased short-term medical risks during their birth, increased hospitalization rates, and increased adverse long-term outcomes (medical, social, and behavior and school performance). A higher prevalence of morbidities and complications such as low Apgar scores, respiratory morbidities (transient tachypnea, respiratory distress syndrome (RDS), apnea, pneumothorax, and pneumonia), meningitis, sepsis, feeding problems [4], hypoglycemia, hypothermia, hyperbilirubinemia, and neonatal death is found in these babies [4-8]. Long-term outcomes such as developmental delay, cerebral palsy, poor school performance, and poor growths are also more common in late preterm births than in term babies [9].

A very limited data are available regarding late preterm babies and their complications, especially in central India. Hence, the present study was conducted with an aim to evaluate the immediate outcome of late preterm neonates and also to compare their morbidity and mortality with term neonates.

## MATERIALS AND METHODS

A prospective observational study was conducted at the Department of Pediatrics at Medical College Hospital of Central India. The study was approved by the institutional ethical committee. Written informed consent was obtained from parents of all subjects before enrollment in the study. All late preterm neonates born between 34 and 37 completed weeks of gestation in our hospital during the study period (January 2015 to July 2016) were enrolled as cases and included in the study. Equal numbers of term babies born during the same period were taken as controls. The babies with major structural anomalies and chromosomal abnormalities were excluded from the study. All consecutively born late preterm and term babies delivered during the study period were screened and recruited in the study according to the requisite inclusion and exclusion criteria.

A pre-structured pro forma was used to record data on antenatal care, maternal risk factors, mode of delivery, birth weight, gestational age, gender, diagnosis, relevant investigations, duration of stay, and outcome. Gestational age was assessed

using Naegele's formula, antenatal ultrasound records, and New Ballard Scoring system. Their mortality and morbidity patterns were compared with the term counterparts.

Immediately after birth, the babies were either shifted to neonatal intensive care unit (NICU) or to mother's side based on the baby's condition and were followed up till discharge or death. Those kept in NICU were further classified into three possible outcomes; discharge, death, or left against medical advice. Those kept to mother's side were assessed for NICU admission during their hospital stay with mother. Survival was defined as the discharge of a live infant from the hospital. Short-term outcomes of late preterm babies were compared with that of term babies. The data of term neonates were retrieved from hospital records.

Data were analyzed using the SPSS software version 22.0 (Statistical Package for the Social Sciences, IBM Inc., New York). Baseline variables were described by descriptive statistics, and dichotomous variables were compared by Chi-square test. $p<0.05$ was considered statistically significant.

## RESULTS

The study included 2602 late preterm births and 11,770 term births that occurred in the year 2015–2016 in our hospital. The flowchart of the study participants and their outcomes is shown in Fig. 1. The most common maternal risk factor was pregnancy-induced hypertension (PIH) (25.2%) followed by premature rupture of membranes (PROM) (16.79%). The NICU admission rate was 24.7% (n=643) among late preterm as compared to 8.47% (n=998) in term neonates. When the cohort of both the types of babies requiring admission to NICU was analyzed, it was seen that several babies in both the groups were having more than one morbid conditions requiring admission.

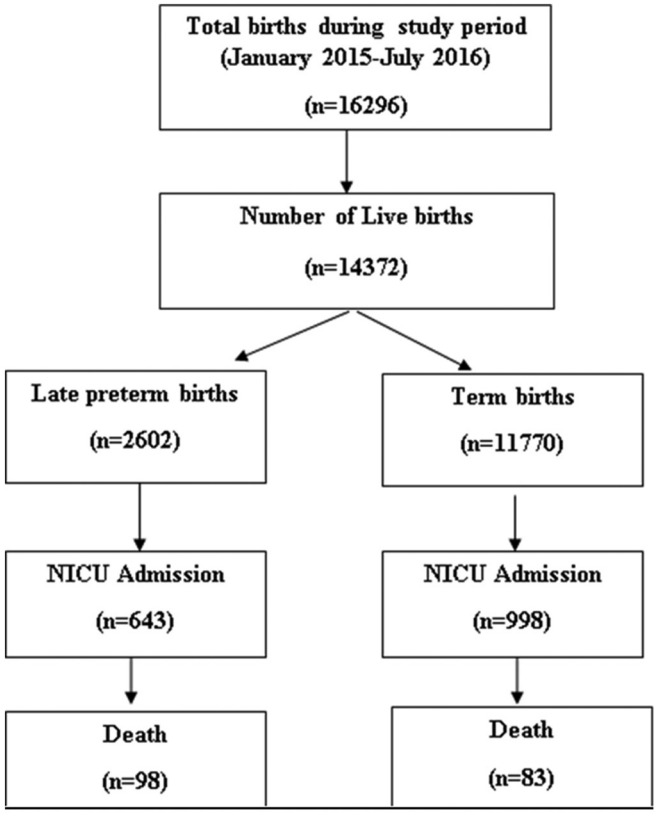


**Figure 1: Flowchart of the study participants and their outcomes**

The most common morbidity, leading to NICU admission among the late preterm babies, was neonatal jaundice (234/643, 36.4%), followed by septicemia (203/643, 31.5%) and respiratory distress (198/643, 30.8%). Most of the term babies who required admission were having respiratory distress (402/998, 40.2%), followed by sepsis (398/998, 39.8%) and jaundice (394/998, 39.4%). The differences between the late preterm and term neonates were found to be statistically significant in terms of septicemia, respiratory distress, hypoglycemia, feed intolerance, neonatal convulsion, apnea, necrotizing enterocolitis, and congenital malformation ($p<0.05$). Transient tachypnea of neonate (TTN) and RDS were the two most common causes of respiratory distress in late preterm babies (Table 1).

When both the birth cohorts, i.e., late preterm (n=2602) and term (n=11770) were compared keeping the total number of births in each group as denominator, jaundice, sepsis, respiratory distress, birth asphyxia, hypoglycemia, and feed intolerance, and many more morbid conditions were significantly higher in late preterm than in term babies ($p<0.05$) as shown in Table 2.

Mortality rate among admitted late preterm was 15.24% (98/643) compared to 8.31% (83/998) in term babies, and the difference was statistically significant. When mortality rates of both the birth cohorts were compared keeping the total number of births in each group as denominator, the late preterm mortality rate was 3.76% while that of term babies were 0.7%, which was again statistically significant. The most common causes of death among the late preterm babies were septicemia, birth asphyxia, and RDS and among the term babies were septicemia, meconium aspiration, and asphyxia. The difference was statistically significant with respect to septicemia, birth asphyxia, RDS, and lethal congenital malformations ($p<0.05$) (Table 3).

## DISCUSSION

Late preterm babies are at higher risk for neonatal morbidities and mortality despite being nearly mature. The aim of the study was to evaluate the short-term outcome of late preterm babies born at our institute and compare with that of babies born at term gestation. Of the total live births (n=14372), 11,770 (75.99%) were term births and 2602 (16.8%) were late preterm births. Hence, almost every 6$^{th}$ live birth in our institute was a late preterm birth during the study period. It indicates that late preterm births constitute a significant proportion of total births. Studies have shown that there is an increase in proportion of late preterm births from 6.2% in 1995 to 7.5% in 2008 [10]. These changes may be a result of early obstetric interventions [11], for example, early termination of pregnancy in eclampsia and other maternal and fetal morbidities.

Among the preterm, 69.98% were late preterm and remaining 30% were <34 weeks which are almost close to a study done in the USA, in 2005, where late preterm babies constituted 70% of

premature births and the remaining 30% were <34 weeks [12]. In our study, the most common maternal risk factor was found to be PIH in 25.2% of late preterm neonate followed by PROM (16.79%). Similar pattern of maternal risk factors was found in a hospital-based prospective study carried out by Selvan *et al.* [11], where PIH was present among 29.3% of late preterm birth.

As far as the neonatal morbidities and NICU admission were considered, the late preterm babies were found to have higher incidence of admission rates and morbidities as compared to their term counterparts. In our study, 9% of all late preterm babies showed levels of hyperbilirubinemia that required admission in NICU. Similar results were observed in a study conducted by Wang *et al.* [13]. Increased susceptibility to infections was documented in our study, similar to the study conducted by Wagh and Jain [14], where sepsis was found in 7.8% cases of late preterm and 0.9% of control group (term neonates).

RDS was seen in 7.6% in late preterm compared to 3.4% in term babies admitted in NICU. Nearly, similar pattern was seen in a study conducted by Moster [15], where RDS was found in 10.5% in late preterm babies and 1.13% in term babies. Respiratory issues in infancy are related to delayed transition to air breathing, delayed fluid clearance, and surfactant deficiency. In our study, birth asphyxia was seen in 5.6% of late preterm neonates who are significantly higher than in term babies. Similar results were shown by a prospective study conducted by Savitha *et al.* [16] in which preterm neonates were found to be at a higher risk for need

**Table 1: Incidence of morbidities in newborns admitted to neonatal intensive care unit**

| Neonatal morbidities | Late preterm (643) N (%) | Term (998) N (%) | "p" value |
|---|---|---|---|
| Jaundice | 234 (36.4) | 394 (39.47) | $\chi^2$=1.57, df=1, p>0.05 |
| Septicemia | 203 (31.6) | 398 (39.87) | $\chi^2$=11.63, df=1, *p<0.05 |
| Respiratory distress | 198 (30.8) | 402 (40.28) | $\chi^2$=15.17, df=1, *p<0.05 |
| Birth asphyxia | 155 (24.1) | 235 (23.54) | $\chi^2$=0.067, df=1, p>0.05 |
| Hypoglycemia | 157 (24.4) | 30 (3) | $\chi^2$=177, df=1, *p<0.05 |
| Feed intolerance | 86 (13.37) | 196 (19.63) | $\chi^2$=10.7, df=1, *p<0.05 |
| Neonatal convulsion | 84 (13.06) | 89 (8.91) | $\chi^2$=7.12, df=1, *p<0.05 |
| Apnea | 79 (12.3) | 54 (5.41) | $\chi^2$=24.81, df=1, *p<0.05 |
| Necrotizing enterocolitis | 55 (8.55) | 26 (2.6) | $\chi^2$=29.48, df=1, *p<0.05 |
| Congenital malformation | 29 (4.5) | 59 (5.91) | $\chi^2$=1.51, df=1, *p<0.05 |

***p<0.05 (statistically significant)**

**Table 2: Differences in morbidities between two birth cohorts**

| Neonatal morbidity | Late preterm birth cohort (2602) N (%) | Term birth cohort (11770) N (%) | p value |
|---|---|---|---|
| Jaundice | 234 (8.9) | 394 (3.34) | $\chi^2$=162, df=1, *p<0.00 |
| Septicemia | 203 (7.8) | 398 (3.38) | $\chi^2$=103, df=1, *p<0.05 |
| Respiratory distress | 198 (7.6) | 402 (3.41) | $\chi^2$=93.69, df=1, *p<0.05 |
| Birth asphyxia | 155 (5.9) | 235 (2) | $\chi^2$=126, df=1, *p<0.00 |
| Hypoglycemia | 157 (6) | 30 (2.54) | $\chi^2$=82.89, df=1, *p<0.00 |
| Feed intolerance | 86 (3.3) | 196 (1.66) | $\chi^2$=29.79, df=1, *p<0.05 |
| Neonatal convulsion | 84 (3.22) | 89 (0.75) | $\chi^2$=109.5, df=1, *p<0.000 |
| Apnea | 79 (3.03) | 54 (0.45) | $\chi^2$=154.4, df=1, *p<0.000 |
| Necrotizing enterocolitis | 55 (2.11) | 26 (0.22) | $\chi^2$=136.2, df=1, *p<0.05 |
| Congenital malformation | 29 (1.11) | 59 (0.5) | $\chi^2$=13.17, df=1, *p<0.0001 |

***p<0.05 (statistically significant)**

**Table 3: Primary causes of death among late preterm neonates and term neonates admitted in NICU**

| Cause | Late preterm (N=643) | Term (N=998) | p value |
|---|---|---|---|
| Septicemia | 42 (6.53) | 31 (3.1) | $\chi^2$=10.82, df=1, *p<0.05 |
| Birth asphyxia | 22 (3.42) | 16 (1.6) | $\chi^2$=5.72, df=1, *p<0.05 |
| Hyaline membrane disease | 10 (1.55) | 1 (0.1) | $\chi^2$=12.38 df=1, *p<0.05 |
| Meconium aspiration | 9 (1.4) | 20 (2) | $\chi^2$=0.81, df=1, p>0.05 |
| Congenital pneumonia | 9 (1.4) | 13 (1.3) | $\chi^2$=0.03, df=1, p>0.05 |
| Lethal congenital malformations | 6 (0.93) | 2 (0.2) | $\chi^2$=4.30, df=1, *p<0.05 |
| Total deaths | 98 | 83 | |

***p<0.05 (statistically significant). NICU: Neonatal intensive care unit**

of resuscitation, nutritional, and supportive care. Hypoglycemia was present in 6% of late preterm neonates and 2.56% of term neonates in the present study. These findings were similar to a study conducted by Jaiswal *et al.* [17] where hypoglycemia was present in 8.8% of late preterm neonates and 1.4% of term neonates ($p<0.001$). Similar findings were shown in studies done by various other authors [18,19].

Mortality rate in late preterm babies was 3.76% of total late preterm births and 15.24% of admitted late preterm babies in the present study. These rates were significantly higher as compared to those of term babies. A similar pattern of mortality rates was documented by Shapiro-Mendoza [19]. A retrospective cohort study by Tsai *et al*. [20] conducted on all late preterm live births indicates that late preterm infant had higher rate of NICU admission (36% vs. 2%) and neonatal mortality rate (0.3% vs. 0.08%, $p=0.03$). A hospital-based retrospective study was conducted by Modi *et al.* [21] showed that the chances of any morbidity (sepsis, jaundice, etc.) are almost 3 times higher in late preterm compared to term neonates. Proportional mortality rate is more than double in late preterm neonates (13.79%) compared to term neonates (6.25%). In a study conducted by McIntire *et al*. [22] found that late preterm neonatal mortality rates per 1000 live births were 1.1, 1.5, and 0.5 at 34, 35, and 36 weeks, respectively, compared with 0.2 at 39 weeks ($p<0.001$). In a prospective cohort study, Shaikh *et al*. [23] demonstrated that as compared with full-term infants, late preterm neonates present with an increased mortality as well as higher risks for complications such as TTN, RDS, persistent pulmonary hypertension, respiratory failure, temperature instability, jaundice, sepsis, feeding difficulties, and prolonged NICU stays.

## CONCLUSION

Late preterm births make a significant proportion of institutional births. As compared to their term counterparts, these babies are at increased risk of morbidities and mortality. Due attention should be paid to the condition of such babies in immediate neonatal period for early recognition of any morbid condition and appropriate intervention. Adequate antenatal and postnatal care should be taken to improve the outcomes of late preterm neonates and also while taking a decision to terminate the pregnancy nearing term gestation.

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*Funding: None; Conflict of Interest: None Stated.*

**How to cite this article:** Mehta N, Jain A. A prospective study to compare morbidity and mortality profile between late preterm and term neonates from a hospital in Indore. Indian J Child Health. 2018; 5(5):332-335.

Doi: 10.32677/IJCH.2018.v05.i05.005