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Original Research Article

Maternal risk factors and early neonatal outcome among late preterm and term neonates in a neonatal intensive care unit in Punjab, India

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ABSTRACT

Background: Late preterm neonates (34 to 36 weeks 6/7 days) were considered as 'near term' as they appeared apparently mature and comparable to term neonates. Many studies have now reported significantly higher rates of morbidity and mortality among this group of neonates. This study aims to evaluate the maternal risk factors associated with and short-term outcome of late preterm neonates compared to term neonates.
Methods: A Retrospective cohort study was conducted in the Neonatal Intensive Care Unit of a tertiary care teaching hospital. All intramural late preterm neonates with gestational age of 34-36 weeks born during the study period were enrolled. The control group included term neonates (37-42 weeks) born during the study period. Data regarding the maternal risk factors and neonatal outcomes for both the late preterm and term neonates were collected from records maintained in the NICU.
Results: There were 3275 deliveries during the study period, of which 2447 (74.8%) were term. Among the 828 preterm neonates, 500 (60.4%) were late preterms. The maternal risk factors significantly associated with late preterm neonates were PIH, eclampsia, APH, multiple gestation, PROM, oligohydramnios and abnormal dopplers. Incidence of Respiratory distress syndrome (RDS), sepsis and hypoglycemia were higher among the late preterm group with an odd's ratio of 56.01, 9.9 and 7.8 respectively. Incidence of hypocalcemia, seizures and Persistent Pulmonary Hypertension (PPHN) were also higher among this group. There was no statistically significant difference in mortality among the two groups.
Conclusions: Late preterm neonates have a significantly higher neonatal morbidity compared to term neonates.

Keywords: Late preterm, Maternal risk factors, Neonatal outcomes

INTRODUCTION

Preterm delivery is an important determinant of neonatal morbidity and mortality. Most clinical studies on preterm neonates focused on neonates born before 33 weeks of gestation, also known as very preterm births.[1]

Late preterm neonates (34 to 36 weeks 6/7 days) were considered as 'near term' as they appeared apparently mature with birth weight comparable to those of term neonates.[2] However, late preterm neonates constitute the fastest growing subset of neonates accounting for approximately 74% of all preterms and about 8% of total births.[3] The primary reason for this increase is early delivery of high risk pregnancies to prevent sudden and unexpected fetal demise.[4]

Many studies have now focused on outcomes of late preterm babies compared to term neonates. Majority of them have reported significantly higher rates of morbidity and mortality among this group of neonates.[5-10] A study from Brazil reported a higher mortality among late

preterm neonates versus term neonates with adjusted Odd's Ratio of 5.3. Late preterms are physiologically less mature and have limited compensatory responses to the extra-uterine environment.[4] The neonatal problems documented among late preterm infants include feeding difficulties, hypoglycemia, respiratory distress syndrome (RDS), temperature instability, presumed or confirmed sepsis, apnea, hypoglycemia and jaundice.[11] An understanding of the morbidities associated with late preterm babies is helpful for the healthcare providers to anticipate and manage potential complications, to improve maternal care and reduce non-emergency obstetrics decisions. This study aims to evaluate the maternal risk factors associated with and short-term outcome of late preterm neonates compared to term neonates.

METHODS

We conducted a retrospective cohort study, in the Neonatal Intensive Care Unit (NICU) of a teaching hospital in North India from October 2014 to December 2016.

Setting: The NICU, with seven ventilated beds, is an accredited level II B unit for intramural neonates and caters to about 1300-1500 deliveries annually. All late preterm neonates with gestational age of 34-36 weeks born during the study period were enrolled. The control group included term neonates (37-42 weeks) born during the study period. Gestational assessment for prematurity in the NICU was done on the basis of LMP/EDD and ultrasound dating and was confirmed by modified Ballard's scoring in case of discrepancy. Neonates who could not be resuscitated at birth and those with major congenital anomalies were excluded. Data regarding the maternal risk factors and neonatal outcomes for both the late preterm and term neonates were collected from records maintained in the NICU.

Maternal risk factors included booked status, pregnancy induced hypertension (PIH), eclampsia, antepartum hemorrhage (APH), gestational diabetes (GDM), multiple pregnancy, meconium stained amniotic fluid (MSAF), oligo/polyhydramnios, abnormal Doppler study, hypothyroidism and anemia. The mode of delivery, gestational age, birth weight and gender of the neonates were also noted.

Neonatal outcomes assessed were death and common neonatal morbidities like neonatal hyperbilirubinemia, respiratory distress syndrome (RDS), birth asphyxia, hypoglycemia, hypocalcemia, seizures, necrotising enterocolitis (NEC), sepsis, intrauterine pneumonia, meconium aspiration pneumonia, patent ductus arteriosus (PDA) and persistent pulmonary hypertension (PPHN). Need for and mode of ventilation was also noted.

Statistical analysis

The data was entered in MS EXCEL spreadsheet and analysis done using Open Epi info/Statistical Package for Social Sciences (SPSS) version 21.0. Categorical variables were presented in number and percentage (%) and continuous variables presented as mean±SD. Comparisons between late preterm and term outcomes and maternal risk factors were done using Chi Square test/ Fisher's exact test. A p value of <0.05 was taken as statistically significant.

RESULTS

There were 3275 deliveries during the study period, of which 828 (25.2%) were preterm and 2447 (74.8%) were term. Among the 828 preterm neonates, 500 (60.4%) were late preterms and 328 (39.6%) were preterm neonates ≤33 weeks. Maternal risk factors among the late preterm and term neonates are shown in Table 1.

Table 1: Maternal risk factors among late preterm and term neonates.

Maternal risk factors	Late Preterm	Term	OR	95% CI	p-value
Unbooked	245 (49.0)	591 (24.2)	3.02	2.47-3.68	<0.0001
Anemia	218 (43.6)	983 (40.2)	1.15	0.94-1.39	0.16
Hypothyroidism	123 (24.6)	631 (25.7)	0.94	0.75-1.73	0.58
Pregnancy induced hypertension	110 (22)	188 (4.8)	3.39	2.62-4.39	<0.0001
Eclampsia	11 (2.2)	20 (0.8)	2.73	1.3-5.73	0.013
Oligohydramnios	100 (20.0)	114 (4.6)	5.12	3.83-6.83	<0.0001
PROM	97 (19.4)	109 (4.5)	5.16	3.85-6.92	<0.0001
Multiple gestation	58 (11.6)	38 (1.5)	8.31	5.45-12.68	<0.0001
Antepartum haemorrhage	43 (8.6)	98 (4.0)	2.23	1.54-3.2	04
Abnormal Doppler	41 (8.2)	48 (1.9)	4.35	2.83-6.68	<0.0001
Gestational diabetes	40 (8.0)	198 (8.0)	0.98	0.69-1.48	0.95
MSAF	38 (7.6)	401(16.4)	0.42	0.29-0.59	<0.0001
Polyhydramnios	7 (1.4)	42 (1.7)	0.81	0.36-1.22	0.64

Table 2: Profile of late-preterm and term neonates at birth.

Variable Number (%)	Late Preterm (n=500) Number (%)	Term (n=2447) Number (%)	p-value
Mode of delivery			
Vaginal	175 (35.0)	308 (53.5)	<0.0001
Cesarean	312 (62.4)	29 (37.9)	
Instrumental	13 (2.6)	10 (8.5)	
Birth weight category			
AGA	420 (84.0)	2068 (84.5)	0.0046
SGA	43 (8.6)	25 (5.1)	
LGA	37 (7.4)	32 (9.5)	
Sex			
Male	301 (60.2)	263 (51.6)	0.0004
Female	199 (39.8)	184 (49.4)	

There were a significantly higher number of unbooked deliveries among the late preterm neonates compared to term neonates with an odd's ratio of 3.02. The maternal risk factors associated with late preterm neonates were PIH, eclampsia, APH, multiple gestation, PROM, oligohydramnios and abnormal dopplers. MSAF was present more frequently among term neonates. The profile of late preterm and term neonates is shown in Table 2.

The mean gestational age among the late preterm neonates was 35.3±0.8 weeks and the mean birth weight was 2267.6±475.8 gm (range:980-4120 gm). The mean gestational age among term neonates was 38.2±0.88 weeks and mean birth weight was 2937.2±359.5 gm. A significantly higher number of late preterm neonates compared to term were delivered by LSCS.

In the birth weight category, proportion of AGA neonates was same in both the groups, but incidence of SGA was higher in late preterm group while term neonates had higher proportion of LGA neonates. The number of males in the late preterm group was significantly higher compared to term babies.

Table 3: Neonatal morbidities, mortality and ventilation requirement among late-preterm and term neonates.

Neonatal outcome	Late Preterm	Term	OR	5% CI	p-value
	Number (%)	Number (%)			
Morbidity					
Respiratory distress syndrome	42 (8.4)	4 (0.1)	56.01	19.9-156.9	<0.0001
Neonatal	20 (4.0)	09 (4.4)	0.89	0.54-1.45	0.67
Hyperbilirubinemia					
Meconium aspiration pneumonia	17(3.4)	7 (2.7)	1.25	0.72-2.14	0.416
Hypoglycaemia	14 (2.8)	9 (0.3)	7.8	3.36-18.13	<0.0001
Intrauterine pneumonia	4 (2.8)	39 (1.6)	1.779	0.95-3.3	0.079
Birth asphyxia					
Severe	10 (2.0)	79 (3.2)	0.62	0.3-1.19	0.137
Moderate	17 (3.4)	49 (2.0)	1.72	0.98-3.01	0.67
Sepsis	6 (1.2)	3 (0.1)	9.89	2.46-39.7	0.002
Seizures	6 (1.2)	2 (0.08)	18.85	2.98-73.77	0.0009
Hypocalcemia	5 (1.0)	2 (0.08)	12.35	2.39-63.82	0.004
PPHN	3 (0.6)	1 (0.04)	14.76	1.53-14.22	0.0339
Mortality	3 (0.6)	9 (0.36)	1.638	0.44-6.06	0.66
Ventilation requirement					
Mechanical ventilation	15 (3.0)	61(2.5)	1.21	0.68-2.146	0.507
CPAP/HFNC	40 (8.0)	73(2.9)	2.82	1.89-4.21	<0.0001

Incidence of Respiratory distress syndrome (RDS), sepsis and hypoglycemia were higher among the late preterm group with odd's ratio of 56.01, 9.9 and 7.8 respectively. Incidence of hypocalcaemia, seizures and Persistent Pulmonary Hypertension (PPHN) were also higher among this group. Delayed adaptation was seen in 29 (5.8%) of the late preterm neonates.

PDA and IVH occurred in 1 (0.2%) and 4 (0.8%) of the late preterm neonates respectively while they were not seen in the term neonates. None of the neonates in either group developed necrotising enterocolitis, bronchopulmonary dysplasia or retinopathy of prematurity.

Though the proportion of neonates requiring mechanical ventilation was similar, a significantly higher number of late preterm neonates received CPAP/High flow nasal cannula (Odd's ratio 2.82). There was no statistically significant difference in mortality among the two groups.

DISCUSSION

Our study shows a significantly higher incidence of morbidities among late preterm neonates compared to term neonates. Late preterms constituted 60.4% of all preterm deliveries and 15.2 % of all deliveries. This reflects a recent increasing trend of incidence of late preterm birth. This finding has also been reported by other authors who reported that late preterms constituted 10-15.2% of all deliveries and up to 70% of total preterm neonates.[12-14]

There were a significantly higher number of unbooked deliveries among the near preterm neonates compared to term with an odd's ratio of 3.02. The maternal risk factors significantly associated with near preterm deliveries were PIH (OR 3.39), eclampsia, APH (OR 2.23), multiple gestation (OR 8.31), PROM (OR 5.16), oligohydramnios (OR 5.11) and abnormal dopplers (4.35). This is explained by the fact that these maternal factors would be associated with increased risk of induced or spontaneous preterm birth. This finding is supported by other studies. Selvan et al reported that commonest maternal risk factor for late preterm birth was PIH in 29.3% followed by PROM in 17.2% and APH in 13.7%.[4] Another study also reported a significantly higher incidence of PIH (12.5% versus 1.5%) and PROM (8.9% versus 4.0%) in late preterm compared to term neonates.[15] Similarly, a study from Brazil reported OR of 2.35 for maternal hypertension and 1.42 for other maternal diseases.[1] Visruthan et al reported an OR of 20.14 for twin pregnancy and 45.53 for PROM. MSAF was present more significantly among term neonates.[12]

The mean gestational age and weight of the late preterm neonates in the present study were comparable to those reported by Modi et al (35.3±0.8 weeks versus 35.3±0.7 week and 2267.6±475.8 gm versus 2350±430 gm).[16]

Almost two thirds (62.4%) of late preterm neonates were delivered by LSCS. Modi et al also reported a similar rate of 67.8% LSCS delivery among late preterm compared to 42.64% in term.[16] Visruthan et al also reported significantly higher cesarean rate among late preterm neonates with OR of 1.95.[12] The reason could be related to the higher incidence of maternal antenatal risk factors warranting both elective and emergency caesarean deliveries. The proportion of male neonates in the late preterm group (60.2%) was significantly higher compared to term babies (51.6%). Machado et al also reported a higher proportion (56% versus 51.6%) of male neonates in the late preterm group compared to term neonates.[1] Modi et al from Gujarat also reported a higher preponderance of male neonates among late preterm (54.6%) compared to term (51.1%).[16] The higher proportion of males in this group could be due to gender bias prevalent in India, particularly in Punjab where male children are preferred.[17]

This could lead to higher number of high risk pregnancies with male fetus being brought to tertiary care for delivery. Incidence of respiratory distress syndrome (RDS), sepsis and hypoglycaemia were significantly higher among the late preterm group with an odd's ratio of 56.01, 9.9 and 7.8 respectively. Incidence of hypocalcaemia, seizures and persistent pulmonary hypertension (PPHN) were also significantly higher among this group. Delayed adaptation was seen in 29 (5.8%) of the late preterm neonates. Other studies have similarly reported higher rates of morbidities among late preterm neonates compared to term. Modi et al reported a three times higher risk for overall morbidity due to any cause, 3.8 times higher risk for respiratory morbidity, 3 times higher risk of hypoglycemia and any infection.[16] A study from Singapore reported 7 times higher risk for RDS, 17 times higher risk of hypoglycemia and 7.8 times risk of hypothermia.[12] A study from North Bengal also reported a significantly higher incidence of RDS (13.06 versus 1.7), hypoglycemia (10.99 versus 1.44), sepsis (9.78 versus 1.76), apnea (4.2 versus 1.2) and hypothermia (7.94 versus 1.74) among late preterms compared to term neonates.[18] In a study from Brazil, the OR for pulmonary hypertension was reported as 4.12, Bronchopulmonary dysplasia 19.82, pneumonia 6.23 and hypocalcemia 3.97 for late preterm births compared to term neonates. Incidence of Meconium aspiration syndrome was however lower than term neonates with OR of 0.66.[1] Present study did not find any significant difference in incidence of Meconium aspiration syndrome among the two groups. None of the neonates in our study developed bronchopulmonary dysplasia.

Though the proportion of neonates requiring mechanical ventilation was similar, a significantly higher number of late preterm neonates received CPAP/high flow nasal cannula (Odd's ratio 2.82). The need for non-invasive as well as invasive ventilatory support was comparable to other studies. Visruthan et al also reported a significantly higher need for CPAP among late preterm neonates with OR of 4.78.[12]

There was no statistically significant difference in mortality among the two groups (0.6 versus 0.36). Selvan et al reported similar mortality of 0.9 versus 0.48.[4] This was in contrast with other studies that reported a higher risk for mortality among late preterm neonates. Machado et al reported an OR for mortality of 30.57 at 34 weeks compared to 40 weeks.[1]

They had a relatively larger sample size and the comparison is for 34 weeks of gestation, which are the neonates that are at highest risk among the late preterm neonates, while ours includes all late preterm neonates. Tiwari et al reported mortality of 7.29 versus 1.18 among late preterms compared to term neonates.[18] This variation is probably a reflection of the different admission criteria and difference in quality of neonatal care.

The limitation of this study is that being a retrospective analysis, real time decision making may not have been always reflected in the records.

CONCLUSION

We conclude that late preterm neonates have a significantly higher neonatal morbidity compared to term neonates. Further studies are recommended to develop strategies to reduce early delivery of high risk pregnancies to decrease incidence of late preterm births and reduce morbidities.

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