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Cesarean delivery and respiratory distress in late preterm and term infants

Research Article

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Abstract: Preterm delivery is the most important determinant of infant morbidity and mortality. In most countries late-preterm birth accounts for 74% of all premature births. Material and Methods: We conducted a retrospective study of 1244 late preterm infants and 3814 term infants. The files contained maternal demographic characteristics, gravidity, medical complications in pregnancies, labor and delivery complications, mode of delivery and infant's characteristics. Results: in the study group there were 49.2% girls and 50.8% boys. 2982 (52.2%) infants were born by cesarean section. 71.8% of late preterm infants and 41.5% of term infants were born by cesarean section. Late preterm infants were born by cesarean section more frequently than term infants ($p< 0.001$). The Apgar score in late preterm infants delivered by cesarean section was lower than in vaginally delivered late preterm infants. RDS (respiratory distress syndrome) was diagnosed in 15.3% of late preterm and 2.7% of term infants ($p<0.001$). The risk of RDS in cesarean deliveries decreased with advancing weeks of gestation ($p<0.001$). Conclusion: cesarean delivery increases infants' respiratory distress syndrome in late preterm and term infants.

Keywords: *RDS • Cesarean section • Late preterm infants • Term infants*

Preterm delivery is the most important determinant of infant morbidity and mortality. In most countries, late-preterm birth accounts for 74% of all premature births [1].

According to the definition of the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists [2] "late preterm" refers to infants born between the gestational ages of 34 weeks 0/7 days and 36 weeks and 6/7 days. Until now, two terms had been used- " late preterm" and " near term" infants. The panel was of the opinion that "near term" refers to those infants who are almost term and therefore almost mature, but "late preterm" suggests that these infants are still premature and vulnerable [3]. Other authors divide these groups of infants into late preterm (34 0/7-36 6/7 weeks' of gestation) and early term infants (37 0/7- 38 6/7 weeks' of gestation). Both groups of infants may experience short-term and long-term consequences associated with premature delivery [4].We observed an increased risk for respiratory distress syndrome (RDS), temperature instability, hypoglycemia, feeding problems, hyperbilirubinemia and prolonged hospitalization [5]. Most late preterm infants are delivered by elective cesarean section which is why we decided to evaluate the relationship between cesarean delivery and respiratory distress in late preterm and term infants.

1. Aim of the study

The aim of the study is to evaluate the relationship between cesarean delivery and respiratory distress in late preterm and term infants.

2. Material and Methods

We conducted a retrospective study of 1244 late preterm infants and 3814 term infants who were admitted to the Department of Neonatology, Silesian Medical

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University from January, 2004 to December, 2008. The files contained maternal demographic characteristics, gravidity, medical complications in pregnancies, labor and delivery complications, mode of delivery and infants characteristics (sex, Apgar score, presence of respiratory distress and length of hospitalization).

Respiratory distress was clinically defined as signs of tachypnea with a respiratory rate of more than 60 breaths per minute, grunting, nasal flaring, and cyanosis in room air or requiring supplemental oxygen or nasal continuous positive airway pressure (nCPAP) or mechanical ventilation.

Late preterm birth was defined as delivery between 34 weeks 0/7 days and 36 weeks 6/7 days gestational age. Term birth was defined as 37 weeks 0/7 days to 40 weeks and 6/7 days gestational age. Gestational age was defined according to the date of the first day of the last menstrual period, if known and reliable, or by ultrasonography before 20 weeks of pregnancy.

Data analysis was carried out according to the procedures available in Statistica 9.0 software .

Between-group differences were tested using Student's t-test as appropriate. For qualitative variables chi-squared was used.

For significant associations, the maximum likelihood estimate of the conditional odds ratio (OR) and 95% confidence interval (CI) are reported. P<0,05 was considered statistically significant.

3. Results

From January 2004, to December 2008 there were 5058 neonates admitted to the Department of Neonatology, Silesian Medical University.

1244 (21.7%) were born between 34 weeks 0/7 days and 36 weeks 6/7 days gestational age (late preterm infants) and 3814 (66.7%) were born after 37 weeks of gestation.

In the study group there were 49.2% girls and 50.8% boys.

Late preterm newborns were discharged later than term newborns (p<0.001).

Multiparous women delivered two times more late preterm infants.

Analysis of mother's age showed that women aged 35 and above more frequently gave birth to late preterm infants, while mothers aged 25-30 more often gave birth to term infants (Table 1).

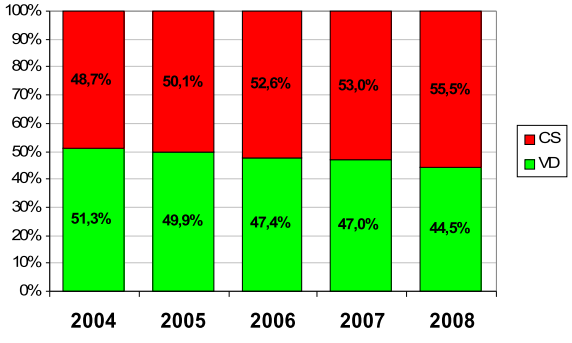
2982 (52.2%) infants were born by cesarean section. The percentage of cesarean sections increased from 48.7% in 2004 to 55.5% in 2008 (Figure 1).

Table 1. Demographic characteristics

Characteristics	Late preterm birth (34-36 wk)	Term birth (37-40 wk)	Statistically diferences
birth	1244	3814	
Mother age <25 y	217 (17.4%)	644 (16.9%)	NS
Mother age 25-30 y	564 (45.4%)	1861(48.8%)	P<0.05
Mother age 31-35 y	316 (24.46%)	966 (25.3%)	NS
Mother age <35 y	147 (11.8%)	343 (9%)	P<0.05
Female gender	610 (49.1%)	1880 (49.3%)	NS
Male gender	634 (50.9%)	1934 (50.7%)	NS
*Nulliparous	351 (28.2%)	2231 (58.5%)	
*Multiparous	893 (71.8%)	1583 (41.5%)	

Abbreviation:
* chi-squard test p<0,001

Figure 1. Delivery mode (cesarean section and vaginaly) between 2004 to 2008 yr



CS cesarean section
VD vaginaly delivery

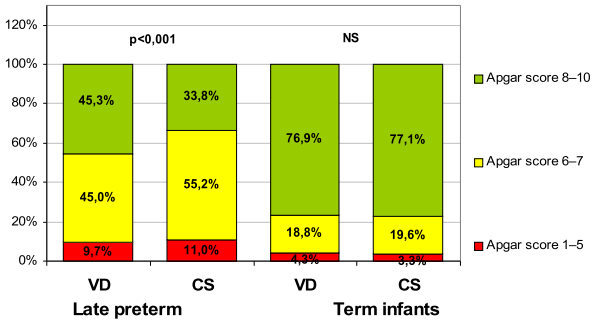
71.8% of late preterm infants and 41.5% of term infants were born by cesarean section. There were no differences in cesarean delivery percentage between the analyzed years in late preterm infants. However, we observed that late preterm infants were born by cesarean section more frequently than term infants (p< 0.001).

The indications associated with cesarean section in late preterm gestation were: preterm prelabor rupture of

Table 2. The indications associated with cesarean section in late preterm gestation and term gestation

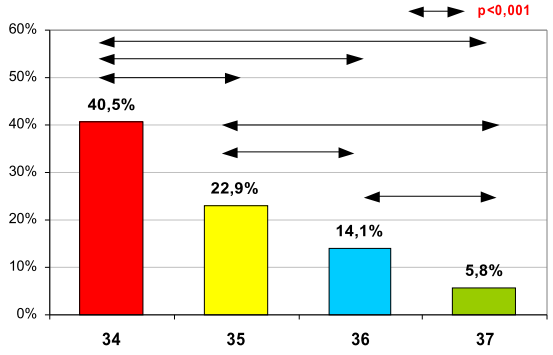
	Near term infants n=1244	Term infants n=3814	p
Ablatio placenta	45 3.6%	43 1.1%	<0.001
Mother hypertension	85 6.8%	68 1.8%	<0.001
Preterm prelabor rapture of membranes	90 7.2%	77 2.0%	<0.001

Figure 2. Apgar score late preterm and term infants delivered by cesarean section and vaginaly



CS cesarean section
VD vaginaly delivery

Figure 3. Statistical deferences in respiratory distress syndrom in neonates who were born between 34 and 37 weeks



membranes, mother hypertension, and ablatio placenta. Those indications were most frequently observed in late preterm in comparison with term gestation (p<0.0001) (Table 2).

We also observed that the Apgar score in late preterm infants delivered by cesarean section was lower than in vaginally delivered late preterm infants. There were no differences in Apgar score in term infants who were born by cesarean deliveries and vaginally (Figure 2).

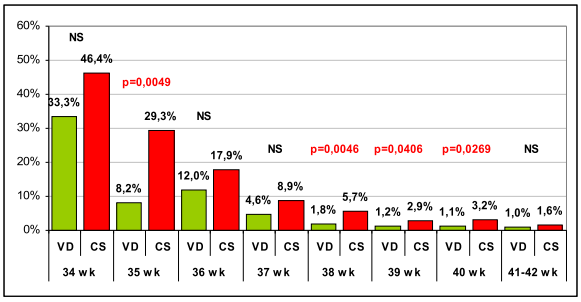
RDS in the adaptation period was diagnosed in 15.3% of late preterm and 2.7% of term infants. It was a statistically significant result (adjusted odds ratio= 6.43, confidence interval =5.01-8.25, p<0.001).

RDS occurred in 40.5% of 34–week deliveries, decreasing with advancing gestational age to 5.8% of 37–week deliveries (p<0.001 for all) (Figure 3).

It was observed that RDS was diagnosed more often in infants delivered by cesarean section than vaginally but we observed statistically significant differences only in term infants (Figure 4).

The risk of RDS in cesarean deliveries decreased with advancing weeks of gestation (Spearman correlation coefficient R=-0.9762 p<0.001) (Figure 5).

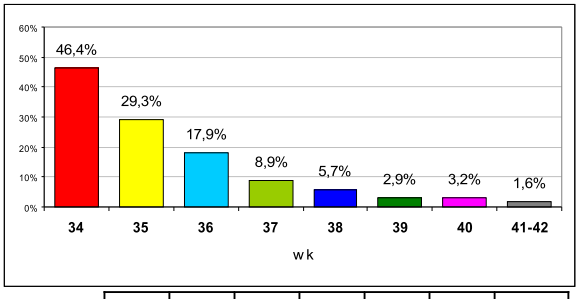
Figure 4. Statistical diferences between respiratory distress syndrom in late preterm and term infants deliveried by cesarean section and vaginaly delivery and conditional odds ratio (OR) and 95% confidence interval (CI)



wk	VD	CS	chi-squard	p	$%	95%CI
34	33,3%	46,4%	1,78	0,1812	1,73	0,77 – 3,89
35	8,2%	29,3%	7,91	0,0049	4,66	1,58 – 13,72
36	12,0%	17,9%	1,42	0,2333	1,60	0,73 – 3,49
37	4,6%	8,9%	3,24	0,0718	2,01	0,94 – 4,29
38	1,8%	5,7%	8,02	0,0046	3,30	1,44 – 7,54
39	1,2%	2,9%	4,19	0,0406	2,55	1,04 – 6,25
40	1,1%	3,2%	4,89	0,0269	2,80	1,12 – 6,96
41–42	1,0%	1,6%	0,43	0,5119	1,65	0,36 – 7,50

CS cesarean section
VD vaginaly delivery

Figure 5. Frequency of respiratory distress syndrom in late preterm and term infants deliveried by cesarean section and statistically diferences.



wk 34	0,0030	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
35		0,0070	<0,001	<0,001	<0,001	<0,001	<0,001
36			0,0012	<0,001	<0,001	<0,001	<0,001
37				NS	<0,001	0,0036	<0,001
38					0,0237	NS	0,0255
39						NS	NS
40							NS

4. Discussion

Late preterm infants have received increased attention over the past several years because of the increasing percentage of births they represent and because of the additional cost that they incur [1,5,6].

Many of them need special care and hospitalization beyond 5 nights [7]. In our study, late preterm newborns were discharged later than term newborns.

Late preterm infants have been recognized to be at increased risk for different kinds of morbidities, especially respiratory morbidities [8,9].

It is not surprising or new that the risk of RDS is associated with gestational age.

In our study we also observed that RDS, especially transient tachypnea of the newborn (TTN), was more frequent in late preterm infants than term infants (OR=6.43; 95% CI 5.01-8.25).

Respiratory distress was also connected with mode of delivery. In our population, infants who were born by cesarean section more frequently suffered from RDS than those born vaginally. Our study confirms that the risk of respiratory distress in infants delivered by cesarean section, especially TTN, could be reduced with each advancing week of gestation (Figure 5). Numerous studies have identified a similar relationship [10,11]. The recommendation, from these studies, is that caesarean delivery at 39 weeks or later significantly reduces the risk of respiratory morbidity, but our research shows that RDS in term infants delivered by cesarean section is statistically more frequent than in those delivered vaginally.

The mechanism, by which cesarean section puts an infant at higher risk for RDS, has been suggested to be associated with iatrogenic prematurity and disruption of the process of transitioning of the lung epithelial sodium channel. In newborns who have difficulty in the transition to air breathing, Na+ channel activity may be diminished. Studies on human neonates have also shown that immaturity of the Na+ transport mechanism contributes to the development of TTN and respiratory distress syndrome [12]. Bland and coworkers, in their animal research, showed that preterm delivery and operative delivery without prior labor result in excessive retention of lung fluid in preterm rabbits and fetal lambs [13]. The mechanism is unknown, but it is postulated to be secondary to activation of epithelial sodium channels in the fetal lungs. Glucocorticoids appear to be a potent up-regulator of the expression of epithelial sodium channel genes and secreted in increasing amounts by the fetal adrenal gland at term [14].

Although respiratory distress, due to TTN, is frequently seen in infants delivered by cesarean section, it is not clearly known how important this is clinically and how many of them become seriously ill in the future. Those infants not only require prolonged hospitalization, but also are at increased risk of chronic lung disease and death [15].

In addition, in cesarean delivery there is a higher incidence of respiratory depression at birth (low Apgar score). In our study infants delivered by cesarean section have a lower Apgar score than infants delivered vaginally ($p<0.001$). This may be related to fluid filled lungs making the transition to air breathing more difficult.

To decrease the risk of TTN , antenatal betamethasone should be used in both late preterm and term gestation deliveries by ECS to prevent respiratory morbidity. Stutchfield and coworkers [16] reported a randomized pragmatic trial evaluating the efficacy of betamethasone in preventing respiratory distress in infants delivered by elective cesarean section (ECS). Their results show that two doses of betamethasone given within 48 hours before delivery significantly decreased admission due to respiratory distress. The reduced incidence of transient tachypnea in their steroid group is consistent with the hypothesis that corticosteroids, increased in mother and fetus through the stress of labour, encourage the expression of the epithelial channel gene and allow the lungs to switch from fluid secretion to fluid absorption.

Because more late preterm newborns are delivered by cesarean section (in our study 71.8% v. 41.5% in term infants) it has been suggested that obstetricians with pressure for early inductions and cesarean deliveries, may too readily deliver preterm infants, though others have documented that indications for late preterm birth are justified [17]. Leveno [18] thinks that most cesarean deliveries conducted before 39 weeks are the result of appropriate use of contemporary obstetric practice guidelines. In the opinion of McIntire et al. [19] 80% of late preterm births were attributed to idiopathic preterm labor or premature rupture of membranes. The remaining deliveries were associated with hypertension, fetal problems or maternal medical problems. There was no information about elective caesarean section without a medical indication. Reddy et al [20] noted that 23% of late preterm births had no recorded indication for delivery. But multivariate analyses revealed that deliveries with no recorded indication were associated increasingly with higher maternal age. We observed that indications for delivery, such as eclampsia, PROM, or abruptio placentae were more frequent in late preterm pregnancies in comparison with term pregnancies and that mother age >35 years more frequently delivered late preterm infants in comparision with mothers delivering term infants. It is well known that women of advanced age are more likely to have pregnancy complications. The development of such complications is probably related to uteroplacental vasculopathy [21]. On the other hand most of them fear pain and fetal complications connected with vaginal delivery and these are the primary reasons to request cesarean delivery.

In summary we suggest that cesarean delivery increases infants' respiratory distress syndrome in late preterm and term infants, and only a careful analysis

of indications for cesarean delivery both in late preterm and term gestations and adherence to guidelines for determining gestational age and elective deliveries (inductions and caesarean sections) will decrease RDS in infants.

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