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Original Research Article

CORD SERUM PROLACTIN LEVELS IN NORMAL AND HIGH-RISK PREGNANCIES AND THEIR ASSOCIATION WITH NEONATAL RESPIRATORY DISTRESS SYNDROME

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ABSTRACT

Background: Respiratory distress syndrome (RDS) is a major cause of neonatal morbidity, particularly in preterm and high-risk pregnancies. Cord blood prolactin has been proposed as a biochemical marker of fetal lung maturity and neonatal respiratory adaptation. The objective is to evaluate cord serum prolactin levels in normal and high-risk pregnancies and to determine their association with the incidence and severity of neonatal respiratory distress syndrome.

Materials and Methods: This analytical observational study with prospective data collection was conducted from September 2024 to August 2025 at two tertiary care centers in Chennai. A total of 160 pregnant women were enrolled by consecutive sampling, including 80 normal pregnancies and 80 high-risk pregnancies. High-risk pregnancies included preterm labor, preterm premature rupture of membranes, gestational hypertension, gestational diabetes mellitus, fetal growth restriction, and maternal anemia. Umbilical cord blood was collected immediately after delivery and cord clamping, and prolactin was measured by enzyme immunoassay (EIA). Neonatal RDS was assessed clinically and radiographically by a neonatologist. Statistical analysis was performed using SPSS version 23.

Results: Mean cord serum prolactin was significantly lower in the high-risk group than in the normal pregnancy group (142.7 ± 47.8 ng/mL vs 194.6 ± 35.2 ng/mL, $p < 0.001$). RDS occurred in 30.0% of neonates in the high-risk group compared with 5.0% in the normal group ($p < 0.001$). Neonates with RDS had significantly lower prolactin levels than those without RDS (132.5 ± 42.1 ng/mL vs 182.9 ± 38.7 ng/mL, $p < 0.001$). Prolactin levels decreased significantly with increasing RDS severity ($p = 0.004$). Cord prolactin showed positive correlation with gestational age ($r = 0.48$, $p < 0.001$) and birth weight ($r = 0.44$, $p < 0.001$). On logistic regression, cord prolactin <150 ng/mL (OR 4.72, 95% CI 2.01-11.1, $p < 0.001$), gestational age <37 weeks (OR 5.35, 95% CI 2.23-12.9, $p < 0.001$), and birth weight <2500 g (OR 3.48, 95% CI 1.52-7.97, $p = 0.003$) independently predicted RDS.

Conclusion: Cord serum prolactin levels were significantly associated with neonatal respiratory outcome. Lower levels were seen in high-risk pregnancies, in neonates who developed RDS, and with greater RDS severity. Cord prolactin may be useful as an adjunctive marker for early neonatal respiratory risk stratification, particularly in high-risk and preterm deliveries.

Keywords: Prolactin; cord blood; respiratory distress syndrome; high-risk pregnancy; neonatal outcome; fetal lung maturity.

INTRODUCTION

Respiratory distress syndrome (RDS) remains an important cause of neonatal morbidity, particularly in preterm and high-risk pregnancies. Delayed pulmonary maturation and surfactant deficiency are central to its pathogenesis, and early identification of neonates at increased risk may help guide immediate postnatal management.

Prolactin is primarily known for its reproductive and lactational functions, but it also has an established role in fetal development, including pulmonary maturation. Cord blood prolactin has been proposed as a biochemical marker of fetal lung maturity and neonatal respiratory adaptation. Previous studies have reported lower cord prolactin levels in neonates who developed RDS and in pregnancies complicated by obstetric risk factors .[1-4]

This hormonal evaluation is particularly relevant in high-risk pregnancies such as preterm labor, preterm premature rupture of membranes, gestational hypertension, gestational diabetes mellitus, fetal growth restriction, and maternal anemia, where fetal endocrine balance and pulmonary maturation may be altered. Other studies have also supported an association between lower cord prolactin levels and adverse neonatal respiratory outcomes in high-risk pregnancies. [5-9]

The present study was therefore undertaken to evaluate cord serum prolactin levels in normal and high-risk pregnancies and to examine their association with the incidence and severity of neonatal respiratory distress syndrome.

MATERIALS AND METHODS

This analytical observational study with prospective data collection was conducted from September 2024 to August 2025 at two tertiary care centers in Chennai: the Institute of Obstetrics and Gynaecology, Madras Medical College, and the Institute of Social Obstetrics and Government Kasturba Gandhi Hospital. A total of 160 pregnant women admitted for delivery were enrolled by consecutive sampling, including 80 with normal pregnancies and 80 with high-risk pregnancies. High-risk pregnancies included preterm labor, preterm premature rupture of membranes, gestational hypertension, gestational diabetes mellitus, fetal growth restriction, and maternal anemia.

Women with congenital anomalies or malformed fetuses, maternal thyroid disorders, antenatal corticosteroid exposure, prolactinoma, or lack of informed consent were excluded. Ethics approval was obtained from the Institutional Ethics Committee, Madras Medical College, Chennai, and written informed consent was obtained from all participants.

Maternal variables recorded included age, parity, gestational age at delivery, antenatal risk factors, maternal comorbidities, mode of delivery, duration of labor, and fetal distress. Neonatal variables recorded included sex, birth weight, APGAR scores, respiratory status, chest radiographic findings, respiratory support requirement, NICU admission, duration of NICU stay, and neonatal outcome.

Umbilical cord blood was collected immediately after delivery and cord clamping in a plain tube. Cord serum prolactin was measured by enzyme immunoassay (EIA) and expressed in ng/mL. Respiratory distress syndrome was assessed by a neonatologist using clinical features, need for respiratory support, and chest X-ray findings. RDS severity was classified as mild, moderate, or severe.

Data were analyzed using SPSS version 23. Continuous variables were summarized as mean ± standard deviation and categorical variables as frequency and percentage. Group comparisons were performed using the t-test, Mann-Whitney U test, or analysis of variance (ANOVA) for continuous variables, and the chi-square test for categorical variables. Correlation analysis was used to assess the association of cord prolactin with gestational age and birth weight. Logistic regression analysis was performed to identify independent predictors of RDS. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 160 pregnant women were included, with 80 in the normal pregnancy group and 80 in the high-risk pregnancy group. Maternal age and parity were comparable between groups, whereas gestational age at delivery, mode of delivery, and mean birth weight differed significantly between the groups [Table 1].

Among the high-risk pregnancies, gestational hypertension and preterm labor were the most frequent risk conditions. Mean birth weight was significantly higher in the normal pregnancy group than in the high-risk group (2980.5 ± 412.3 g vs 2487.6 ± 511.7 g, $p < 0.001$) [Table 1].

Mean cord serum prolactin was significantly higher in the normal pregnancy group than in the high-risk group (194.6 ± 35.2 ng/mL vs 142.7 ± 47.8 ng/mL, $p < 0.001$). Respiratory distress syndrome occurred in 4 of 80 neonates (5.0%) in the normal pregnancy group and in 24 of 80 neonates (30.0%) in the high-risk group ($p < 0.001$) [Table 2].

Cord prolactin levels were significantly lower in neonates who developed RDS than in those who did not (132.5 ± 42.1 ng/mL vs 182.9 ± 38.7 ng/mL, $p < 0.001$). Prolactin levels also decreased significantly with increasing RDS severity, with mean values of 148.3 ± 28.6 ng/mL in mild RDS, 132.9 ± 29.4 ng/mL in moderate RDS, and 118.5 ± 30.1 ng/mL in severe RDS ($p = 0.004$) [Table 2].

Cord prolactin showed a positive correlation with gestational age ($r = 0.48$, $p < 0.001$) and birth weight ($r = 0.44$, $p < 0.001$). Among the high-risk subgroups, fetal growth restriction and preterm premature

rupture of membranes showed the lowest mean prolactin levels [Table 2].

On logistic regression analysis, cord prolactin <150 ng/mL (OR 4.72, 95% CI 2.01-11.1, p < 0.001), gestational age <37 weeks (OR 5.35, 95% CI 2.23-12.9, p < 0.001), and birth weight <2500 g (OR 3.48, 95% CI 1.52-7.97, p = 0.003) were independent predictors of RDS, whereas cesarean delivery and male sex were not significant predictors [Table 3].

Table 1: Baseline characteristics of normal and high-risk pregnancy groups

Variable	Normal pregnancy group (n=80)	High-risk pregnancy group (n=80)	P value
Maternal age categories			0.88
<20 years	10 (12.5%)	14 (17.5%)	
21–25 years	32 (40.0%)	28 (35.0%)	
26–30 years	25 (31.3%)	26 (32.5%)	
>30 years	13 (16.2%)	12 (15.0%)	
Parity			0.78
Primi	36 (45.0%)	40 (50.0%)	
Multipara (1–2)	39 (48.8%)	35 (43.8%)	
Grand multipara (>2)	5 (6.2%)	5 (6.2%)	
Gestational age at delivery			<0.001
<34 weeks	0 (0%)	18 (22.5%)	
34–36+6 weeks	10 (12.5%)	22 (27.5%)	
≥37 weeks	70 (87.5%)	40 (50.0%)	
Mode of delivery			<0.001
Vaginal delivery	54 (67.5%)	28 (35.0%)	
Cesarean section (elective)	12 (15.0%)	20 (25.0%)	
Cesarean section (emergency)	14 (17.5%)	32 (40.0%)	
Mean birth weight (mean ± SD)	2980.5 ± 412.3 g	2487.6 ± 511.7 g	<0.001

High-risk conditions among the 80 high-risk pregnancies were gestational hypertension in 18 (22.5%), preterm labor in 16 (20.0%), PPROM in 14 (17.5%), GDM in 12 (15.0%), FGR in 10 (12.5%), and maternal anemia in 10 (12.5%).

Table 2: Cord serum prolactin levels and neonatal respiratory outcomes

Variable / comparison	Result	P value
Mean cord serum prolactin in normal pregnancy group	194.6 ± 35.2 ng/mL	
Mean cord serum prolactin in high-risk pregnancy group	142.7 ± 47.8 ng/mL	<0.001
Incidence of RDS in normal pregnancy group	4/80 (5.0%)	
Incidence of RDS in high-risk pregnancy group	24/80 (30.0%)	<0.001
Mean cord prolactin in neonates with RDS	132.5 ± 42.1 ng/mL	
Mean cord prolactin in neonates without RDS	182.9 ± 38.7 ng/mL	<0.001
Correlation of cord prolactin with gestational age	r = 0.48	<0.001
Correlation of cord prolactin with birth weight	r = 0.44	<0.001
Mean prolactin in mild RDS	148.3 ± 28.6 ng/mL	0.004*
Mean prolactin in moderate RDS	132.9 ± 29.4 ng/mL	—
Mean prolactin in severe RDS	118.5 ± 30.1 ng/mL	—
Mean prolactin in FGR subgroup	125.6 ± 39.6 ng/mL	0.038**
Mean prolactin in PPROM subgroup	134.9 ± 31.5 ng/mL	—

* Overall p value for comparison across mild, moderate, and severe RDS categories.

** Overall p value for comparison across all high-risk pregnancy subgroups.

Primary results tables and summary were used for correlation coefficients.

Table 3: Logistic regression analysis for predictors of respiratory distress syndrome

Predictor	Odds ratio	95% confidence interval	P value
Cord prolactin <150 ng/mL	4.72	2.01–11.1	<0.001
Gestational age <37 weeks	5.35	2.23–12.9	<0.001
Birth weight <2500 g	3.48	1.52–7.97	0.003
Cesarean delivery	1.92	0.82–4.51	0.13
Male sex	1.54	0.68–3.46	0.30

DISCUSSION

In this analytical observational study, cord serum prolactin levels were significantly lower in high-risk pregnancies than in normal pregnancies, and neonates who developed respiratory distress syndrome had markedly lower prolactin levels than those without RDS. RDS was more frequent in the high-risk group, and lower cord prolactin was also associated with increasing severity of respiratory distress. In addition, cord prolactin <150 ng/mL remained an independent predictor of RDS, along with prematurity and low birth weight.

The lower prolactin levels observed in high-risk pregnancies are consistent with earlier studies that reported reduced cord prolactin concentrations in pregnancies complicated by maternal or obstetric risk factors.[9-13]

Similarly, the association between lower cord prolactin and neonatal RDS in the present study is in

agreement with previous studies showing lower prolactin levels in neonates who developed respiratory morbidity.[9-13]

Cord prolactin also showed positive correlations with gestational age and birth weight in the present study. This pattern is similar to that reported in other studies, where increasing prolactin levels were associated with greater fetal maturity and improved respiratory adaptation.[8,10,13] The finding that prematurity and low birth weight were also independent predictors of RDS suggests that prolactin should be interpreted within the broader context of fetal maturity rather than as an isolated marker.

Among the high-risk subgroups, fetal growth restriction and preterm premature rupture of membranes showed the lowest prolactin levels. These conditions may reflect placental dysfunction, fetal stress, or prematurity-related endocrine disruption, although the present study was not designed to determine subgroup-specific mechanisms. The identified prolactin threshold of <150 ng/mL is clinically relevant because it remained independently associated with RDS on regression analysis. This is broadly in keeping with prior studies that have also examined similar threshold-based predictive use of cord prolactin.[9,11]

The strengths of the study include equal group sizes, prospective data collection, and conduct at two tertiary care centers. The findings are clinically relevant because cord blood sampling is feasible at delivery and prolactin measurement may provide an additional tool for early neonatal respiratory risk assessment. However, some limitations should be acknowledged. Preanalytical laboratory details such as blood volume collected, exact cord vessel sampled, and storage conditions were not systematically documented. The study also did not include long-term neonatal follow-up or full diagnostic performance analysis for the prolactin threshold. Overall, cord serum prolactin may be useful as an adjunctive marker for early neonatal respiratory risk stratification, particularly in high-risk and preterm deliveries.

CONCLUSION

Cord serum prolactin levels were significantly lower in high-risk pregnancies and in neonates who developed respiratory distress syndrome. Lower prolactin levels were also associated with greater RDS severity, while cord prolactin <150 ng/mL, prematurity, and low birth weight independently predicted RDS. Cord serum prolactin may therefore serve as a useful adjunctive marker for early neonatal respiratory risk stratification, particularly in high-risk and preterm deliveries.

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