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Effect of Corticosteroids on Neonates Born to Mothers Positive for COVID-19

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ABSTRACT

Background: Corticosteroids reduce this overstimulation, which helps balance the immune system responses so that they are effective and do not cause damage to the person themselves. The administration of antenatal corticosteroids is known to enhance fetal lung maturity and reduce neonatal morbidity in preterm births. However, the safety and efficacy of corticosteroid use in COVID-19 positive pregnancies remain uncertain. This study aimed to evaluate neonatal outcomes following maternal corticosteroid administration in COVID-19 positive pregnant women.

Objectives: To assess and compare the clinical and infection-related outcomes of neonates born to COVID-19 positive mothers who received antenatal corticosteroids versus those who did not.

Methods: This prospective observational study included 174 neonates born to RT-PCR confirmed COVID-19 positive pregnant women between August 2021 and October 2023 at Saraswati Medical College and Hospital, Unnao. Among them, 102 neonates were exposed to antenatal corticosteroids (Group A), and 72 were not exposed (Group B). Maternal and neonatal data were collected, including birth weight, Apgar scores, NICU admission, respiratory distress, neonatal infection status, and other clinical outcomes. Statistical analysis was performed using SPSS software version 20, with $p < 0.05$ considered significant.

Results: Group A (corticosteroid-exposed) neonates had significantly higher Apgar scores at 1 minute (median: 8 vs. 7, $p = 0.042$) and 5 minutes (median: 9 vs. 8, $p = 0.038$). Although not statistically significant, respiratory distress (15.6% vs. 25.0%), need for ventilatory support (5.8% vs. 11.1%), and need for resuscitation at birth (7.8% vs. 13.9%) were lower in Group A. No significant differences were found in neonatal SARS-CoV-2 positivity (2.9% vs. 2.8%), NICU admission (27.4% vs. 30.6%), hypoglycemia, sepsis, jaundice, or neonatal mortality (2.0% vs. 4.2%).

Conclusion: Antenatal corticosteroid use in COVID-19 positive pregnant women was associated with improved neonatal Apgar scores and a non-significant trend toward reduced respiratory complications. These findings support the continued use of corticosteroids in indicated cases during COVID-19 infection, with no increased risk of neonatal infection or short-term morbidity.

Keywords: *COVID-19, corticosteroids, neonates, Apgar score, respiratory distress, antenatal care*

1. INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic has posed significant challenges to maternal and neonatal health worldwide [1]. Pregnant women infected with SARS-CoV-2 are at increased risk of developing severe respiratory illness, which may necessitate hospitalization and pharmacologic intervention, including the use of corticosteroids [2]. Corticosteroids, particularly dexamethasone and betamethasone, have been widely administered in pregnant women to accelerate fetal lung maturity in cases of anticipated preterm delivery, as well as to manage severe COVID-19 symptoms [3].

While corticosteroids have known neonatal benefits in specific obstetric contexts, such as reducing the incidence of neonatal respiratory distress syndrome, their impact in the setting of maternal COVID-19 infection remains unclear. Questions persist regarding the safety and long-term effects of corticosteroid exposure in utero when administered due to maternal SARS-CoV-2 infection, especially in relation to neonatal birth weight, Apgar scores, infection risk, respiratory function, and neurodevelopmental outcomes [4,5].

Concerns have emerged regarding possible alterations in neonatal immune response, birth weight, metabolic adaptation, and neurodevelopmental trajectories [6,7]. Furthermore, neonates born to mothers with COVID-19 may already be at risk of complications such as preterm birth, fetal distress, and inflammatory exposure, potentially amplifying the influence of corticosteroid exposure. In this context, it becomes critical to evaluate how maternal corticosteroid therapy affects neonatal health, including respiratory adaptation, infection susceptibility, and overall clinical course in the early neonatal period [8,9].

This knowledge gap is particularly critical in low- and middle-income countries, where both the burden of COVID-19 and corticosteroid usage patterns may differ significantly from those in high-resource settings. As such, evaluating the neonatal outcomes of corticosteroid exposure in this unique clinical scenario is essential for guiding treatment protocols and ensuring optimal neonatal care [10].

The present study aims to investigate the effects of antenatal corticosteroid administration in COVID-19-positive pregnant women on immediate neonatal outcomes. By comparing neonates exposed and unexposed to corticosteroids in this context, we seek to provide evidence-based insights into the benefits and potential risks of such interventions.

2. METHODOLOGY

This was a prospective observational cohort study conducted at Department of Pharmacology in collaboration with Gynaecology, Saraswati Medical College, a tertiary care hospital in Unnao, between August 2020 and October 2022. The study was approved by the Institutional Ethics Committee (IEC No: SMC/021/06), and written informed consent was obtained from all participating mothers.

Study participants:

The study included pregnant women who tested positive for SARS-CoV-2 using RT-PCR during the third trimester and their live-born neonates. This study included pregnant women aged 18–45 years, confirmed SARS-CoV-2 positivity within 14 days prior to delivery, singleton live birth, received antenatal corticosteroids for fetal lung maturity either dexamethasone or betamethasone. The study excluded neonates with known congenital anomalies, pre-existing maternal comorbidities like uncontrolled diabetes, eclampsia, or autoimmune disorders, multiple pregnancies, neonates requiring immediate surgical intervention. The patients with a gestational age below 24 weeks or above 34 weeks was prescribed methylprednisolone (32 mg/day), and dexamethasone (6 mg/day) in four doses followed by 32 mg/day methylprednisolone for the other pregnant patients (with gestational age of 24 weeks and above or those with gestational age of less than 34 weeks).

Grouping

Participants were divided into two groups based on maternal corticosteroid administration:

Group A (Corticosteroid-exposed group): These neonates born to mothers who received antenatal corticosteroids

Group B (Non-exposed group): These neonates born to mothers who did not receive corticosteroids

Data Collection

Maternal and neonatal data were collected from medical records and through direct clinical observation. Maternal data were collected through patients recording form age, gestational age at delivery, covid-19 symptom severity, timing and dosage of corticosteroids, mode of delivery, other medications. Several neonatal outcomes were assessed within the first 72 hours and during the hospital stay such as birth weight and Apgar scores, need for NICU admission, respiratory distress or requirement of oxygen/ventilator support, neonatal infection rate (RT-PCR or antibody testing), blood glucose, calcium levels, and signs of adrenal suppression, Mortality and morbidity outcomes.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using SPSS version 20 (IBM, Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables percentage. The comparison between groups was performed using independent t-test or Mann-Whitney U test for continuous variables. The chi-square test or Fisher's exact test for categorical variables. The result was considered statistically significant p-value < 0.05.

3. RESULTS

Out of the 250 COVID-19 positive pregnant women screened during the study period, 174 met the inclusion criteria and were enrolled in the study. The remaining 76 women were excluded due to factors such as multiple pregnancies (n = 22), incomplete records (n = 18), pre-existing maternal comorbidities (n = 20), and congenital anomalies in neonates (n = 16).

Among the 174 participants, Group A (Corticosteroid-exposed group) included 102 neonates whose mothers received antenatal corticosteroids. Group B (Non-exposed group) included 72 neonates whose mothers did not receive corticosteroids.

Maternal Characteristics

The maternal demographic and clinical characteristics were comparable between the two groups. The mean maternal age was 29.4 ± 4.7 years, and the mean gestational age at delivery was 37.1 ± 1.9 weeks. The severity of COVID-19 symptoms was mostly mild to moderate in both groups.

Neonatal Outcomes

Table: 1. Comprehensive comparison of clinical and outcome parameters in neonates born to COVID-19 positive mothers with and without antenatal corticosteroid exposure

Parameter	Group A (n=102)	Group B (n=72)	p-value
Mean Birth Weight (g)	2712 ± 318	2635 ± 352	0.121
Gestational Age at Birth (weeks)	37.4 ± 1.8	36.9 ± 2.0	0.087
Apgar Score at 1 min (median)	8 (7–9)	7 (6–9)	0.042*
NICU Admission (%)	28 (27.4%)	22 (30.6%)	0.658
Respiratory Distress (%)	16 (15.6%)	18 (25.0%)	0.112
Need for Ventilatory Support (%)	6 (5.8%)	8 (11.1%)	0.218
Neonatal SARS-CoV-2 Positivity (%)	3 (2.9%)	2 (2.8%)	0.976
Hypoglycemia (%)	9 (8.8%)	5 (6.9%)	0.672
Neonatal Mortality (%)	2 (2.0%)	3 (4.2%)	0.391
*P value <0.05 are statically significant			

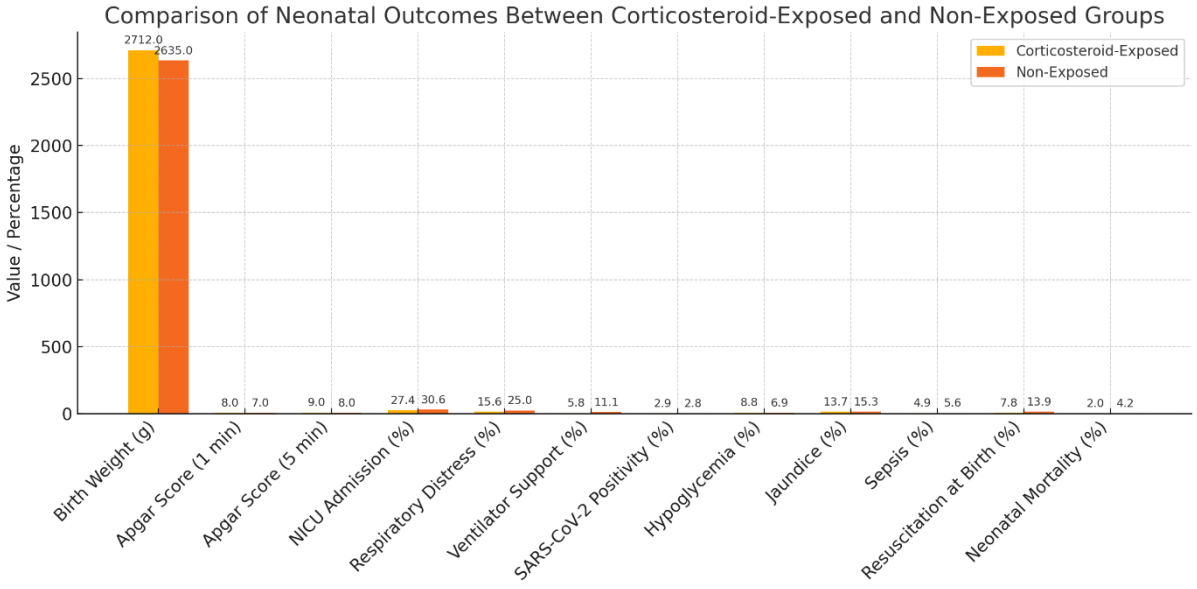

Figure:1 Comparison of neonatal outcomes between corticosteroid-exposed and non-exposed groups

4. DISCUSSION

This study evaluated the impact of antenatal corticosteroid administration on neonatal outcomes in mothers infected with COVID-19 during the third trimester. Among 174 neonates included, 102 were exposed to antenatal corticosteroids, while 72 were not. Our findings suggest that antenatal corticosteroid use was associated with certain beneficial neonatal outcomes, although most differences did not reach statistical significance.

Our study major finding was the significantly higher Apgar scores at 1 and 5 minutes in the corticosteroid-exposed group (Table-1). This indicates improved immediate postnatal adaptation, potentially due to enhanced fetal lung maturity—a known benefit of antenatal corticosteroids. These results are consistent with prior studies on non-COVID populations, where corticosteroids have been shown to reduce respiratory complications in preterm neonates [11,12].

In addition, cohort study corticosteroid used in pregnant women for antenatal care. While corticosteroids are crucial for fetal lung maturation in preterm births, they may worsen outcomes in COVID-19 patients [13]. Similarly, another evidence supports using dexamethasone in severe COVID-19 cases, but it may be harmful in mild case [14]. For pregnant women with COVID-19 at risk of preterm delivery, a decision analysis found that administering corticosteroids resulted in better combined maternal and infant outcomes up to 31 weeks gestation for hospitalized patients and 29 weeks for ICU patients [16]. However, careful consideration of maternal risks and fetal benefits is essential, and practices should be adjusted during the pandemic [17]. Clinicians must weigh the potential adverse effects on the fetus or neonate against the maternal benefits when considering corticosteroid therapy in pregnant COVID-19 patients [18].

Although birth weights and gestational ages were slightly higher in the corticosteroid group, the differences were not statistically significant. Interestingly, the incidence of respiratory distress syndrome (RDS) and need for ventilatory support was lower in the corticosteroid group, but this also did not reach statistical significance. This trend aligns with existing evidence that corticosteroids promote surfactant production and reduce RDS, suggesting a protective role, even in the context of maternal COVID-19 infection [19].

The rate of NICU admission and duration of NICU stay were comparable between the two groups. While some neonates required resuscitation at birth, the rate was lower in the corticosteroid group, possibly reflecting improved perinatal respiratory adaptation. However, this difference was not statistically significant [20].

There was no significant difference in neonatal SARS-CoV-2 positivity, supporting previous findings that vertical transmission of the virus remains low and is likely unaffected by corticosteroid use [21]. Similarly, rates of neonatal hypoglycemia, jaundice, sepsis, and mortality were comparable, indicating that corticosteroids did not contribute to increased short-term morbidity or adverse outcomes in this cohort [22].

Overall, the findings suggest that antenatal corticosteroids may provide respiratory and perinatal adaptation benefits without increasing the risk of neonatal infection or complications in COVID-19 positive pregnancies. However, the lack of statistically significant differences in many parameters highlights the need for larger, multicentric studies to confirm these trends and evaluate long-term outcomes.

5. LIMITATIONS

This study has several limitations. First, it was conducted at a single tertiary center with a relatively small sample size, which may limit generalizability. Second, long-term neurodevelopmental outcomes were not assessed. Third, the corticosteroid regimen and timing may have varied slightly among participants, possibly influencing neonatal outcomes.

6. CONCLUSION

In conclusion, antenatal corticosteroid use in COVID-19 positive pregnant women was associated with better immediate neonatal adaptation, as evidenced by higher Apgar scores, and showed a non-significant trend toward reduced respiratory complications. These findings support the continued use of corticosteroids in indicated cases, even in the context of maternal COVID-19 infection, under close clinical monitoring.

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