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Original Research

Impact of Corticosteroid Administration on Maternal and Neonatal Outcomes in the Late Preterm Period

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ABSTRACT

Aim: The study aimed to evaluate the maternal and fetal outcomes of corticosteroid administration in the late preterm period, focusing on its effects on neonatal respiratory complications and overall safety.

Materials and Methods: This prospective observational study included 100 pregnant women between 34+0 and 36+6 weeks of gestation at risk of preterm delivery. Participants were divided into two groups: the Corticosteroid Group (n=50), who received two doses of 12 mg betamethasone intramuscularly 24 hours apart, and the Control Group (n=50), who received routine obstetric care. Comprehensive data on maternal history, blood pressure, signs of infection, and adverse reactions were collected. Neonatal outcomes, including birth weight, Apgar scores, respiratory distress syndrome (RDS), and NICU admission, were documented. Statistical analysis was performed using SPSS version 25.0, with p-values <0.05 considered significant.

Results: The mean age of participants was comparable between groups. Maternal outcomes showed a higher but not significant rate of hyperglycemia in the Corticosteroid Group (16% vs. 6%, p=0.12). The incidence of RDS was significantly lower in the Corticosteroid Group (12% vs. 28%, p=0.04), and NICU stays were shorter (3.5 days vs. 4.2 days, p=0.03). Apgar scores at 1 and 5 minutes were significantly higher in the Corticosteroid Group (p=0.02 and p=0.01, respectively). Other neonatal morbidities, such as hypoglycemia and jaundice, showed no significant differences.

Conclusion: Corticosteroid administration in the late preterm period significantly reduces neonatal respiratory complications and improves Apgar scores, with an acceptable maternal safety profile. These findings support the use of corticosteroids in managing late preterm births, emphasizing individualized patient care.

Keywords: Late preterm, corticosteroids, respiratory distress syndrome, neonatal outcomes, maternal safety.

Introduction

The late preterm period, defined as 34 to 36 weeks and 6 days of gestation, represents a critical window in pregnancy management. Although infants born during this period generally have better outcomes compared to those born earlier, they still face a higher risk of complications compared to full-term infants. These complications often include respiratory distress syndrome (RDS), transient tachypnea of the newborn (TTN), hypoglycemia, and the need for neonatal intensive care unit (NICU) admission. As a result, healthcare providers are continuously seeking strategies to optimize outcomes for both mothers and their late preterm infants. One such strategy that has gained attention is the administration of corticosteroids, which are known for their role in accelerating fetal lung maturity and reducing neonatal respiratory complications.[1]

Corticosteroids have long been used in obstetric care to improve fetal outcomes when preterm birth is anticipated. Historically, corticosteroid administration has been well-established for pregnancies at risk of delivering before 34 weeks of gestation. The benefits are well-documented, including a significant reduction in the incidence of respiratory distress and other neonatal complications. However, extending the use of corticosteroids to the late preterm period has been a subject of ongoing research and debate. Recent evidence has suggested that corticosteroids might also offer advantages for neonates born in the late preterm window, though their application raises questions regarding the balance between benefits and potential risks.[2]

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One of the primary motivations for using corticosteroids in the late preterm period is the high prevalence of respiratory issues among late preterm infants. The lungs of these infants, though more developed than those of earlier preterm infants, often lack complete maturity. This can lead to challenges such as insufficient surfactant production, making these infants susceptible to respiratory distress. The administration of corticosteroids, typically betamethasone or dexamethasone, has been shown to stimulate the production of surfactant and enhance lung development, thereby reducing the likelihood of respiratory complications. The potential reduction in NICU admissions and overall improvement in neonatal respiratory outcomes make corticosteroid administration an attractive option in managing late preterm deliveries.[3]

Beyond respiratory outcomes, the impact of corticosteroids on other neonatal complications is an area of considerable interest. Late preterm infants are more prone to conditions like hypoglycemia, jaundice, and sepsis compared to their full-term counterparts. The potential protective effects of corticosteroids on these complications are still being explored, and while some studies suggest a beneficial impact, others raise concerns about possible adverse effects, such as alterations in glucose metabolism and an increased risk of neonatal hypoglycemia. The risk-benefit assessment of corticosteroid use in this population is, therefore, a complex and nuanced consideration for obstetricians and pediatricians.[4]

From the maternal perspective, the administration of corticosteroids is generally well-tolerated, but it is not without potential risks. Maternal hyperglycemia is a well-documented side effect, which can be particularly concerning for women with conditions such as gestational diabetes or other glucose metabolism disorders. Additionally, concerns about potential impacts on maternal blood pressure and the risk of infections have been raised, although the evidence remains mixed. Careful monitoring and individualized risk assessment are critical when deciding to administer corticosteroids in the late preterm period. The ultimate goal is to ensure that the benefits to the fetus outweigh any potential risks to the mother.

Another aspect that complicates the decision-making process is the heterogeneity of late preterm births. Women may present with a variety of medical and obstetric conditions that necessitate preterm delivery, such as preeclampsia, premature rupture of membranes, or spontaneous preterm labor. Each of these scenarios poses unique risks and benefits with respect to corticosteroid administration. The diversity of underlying conditions adds a layer of complexity to clinical guidelines and necessitates a tailored approach to each case.[5]

Additionally, the timing and dosage of corticosteroid administration are critical factors that influence outcomes. The standard protocol involves administering two doses of betamethasone 24 hours apart, but questions remain about the optimal timing relative to delivery, especially when labor is unpredictable. In cases where delivery occurs shortly after corticosteroid administration, the full benefit may not be realized. Conversely, if the interval between corticosteroid administration and delivery is prolonged, the effects may diminish, potentially necessitating repeat dosing, which carries its own set of risks.[6]

Despite the complexities, the administration of corticosteroids in the late preterm period remains a promising intervention for improving neonatal outcomes. As research continues to evolve, a clearer understanding of the long-term effects and the identification of subgroups that may benefit the most from this intervention will be crucial. The growing body of evidence highlights the need for a balanced approach that carefully considers the potential benefits for the neonate alongside the risks to the mother. This balance is essential in guiding clinical practice and ensuring that both maternal and fetal health are optimized in the context of late preterm birth.[7]

Materials and Methods

This study was conducted over the period of 6 months from February 2024 to July 2024.

This prospective observational study aimed to evaluate the maternal and fetal outcomes of corticosteroid administration in the late preterm period. The study was conducted in the Obstetrics and Gynecology Department of a tertiary care hospital. Informed consent was acquired from all participants before enrollment.A total of 100 pregnant women with a gestational age between 34+0 and 36+6 weeks, who were at risk of preterm delivery, were included in the study. Participants were recruited based on the following inclusion and exclusion criteria.

Inclusion Criteria

- Pregnant women aged 18 to 40 years.
- Gestational age between 34+0 and 36+6 weeks, confirmed by ultrasound.
- Women at risk of preterm labor due to medical or obstetric indications, such as preterm premature rupture of membranes (PPROM), hypertension, or preeclampsia.
- Willingness to participate and provide informed consent.

Exclusion Criteria

- Known contraindications to corticosteroid administration.
- Multiple gestations (e.g., twins or higher-order multiples).
- Pre-existing conditions such as diabetes mellitus or chronic renal disease.
- Women with a history of corticosteroid use in the current pregnancy.

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- Fetal congenital anomalies or evidence of intrauterine growth restriction (IUGR).

Methodology

Participants in the study were divided into two groups. The Corticosteroid Group consisted of 50 women who received two doses of betamethasone, 12 mg intramuscularly, administered 24 hours apart, in accordance with the standard protocol for late preterm corticosteroid administration. The Control Group also included 50 women, who did not receive corticosteroids but were given routine obstetric care and monitoring. Comprehensive data collection was conducted for each participant. A detailed medical and obstetric history was recorded, covering demographic information such as age, parity, and socioeconomic status, as well as risk factors for preterm delivery and outcomes of previous pregnancies. Maternal parameters, including blood pressure, signs of infection, and any adverse reactions to corticosteroid administration, were documented. Routine antenatal investigations were performed, which included a complete blood count, urine analysis, and ultrasound examinations for fetal biometry and assessment of amniotic fluid levels. Maternal outcomes were closely monitored and included adverse effects like hyperglycemia, signs of infection, and variations in blood pressure. Other maternal parameters recorded were the requirement for tocolytic therapy, the duration of hospitalization, and the mode of delivery, whether vaginal or cesarean. Fetal outcomes were evaluated based on various neonatal parameters. These included birth weight, Apgar scores at 1 and 5 minutes, the occurrence of respiratory complications such as respiratory distress syndrome, and the need for neonatal intensive care unit (NICU) admission. The study also assessed the incidence of transient tachypnea of the newborn (TTN), the duration of NICU stay, and any other complications observed in the newborns. Follow-up and monitoring of both maternal and neonatal outcomes were conducted until discharge. Data were collected at the time of delivery and during the immediate postpartum period, with follow-up assessments carried out to evaluate the short-term health status of both mother and baby.

Statistical Analysis

Data were analyzed using SPSS version 25.0. Continuous variables, such as birth weight and Apgar scores, were summarized using means and standard deviations. Categorical variables, such as the incidence of respiratory distress syndrome and NICU admission, were analyzed using frequencies and percentages. The chi-square test was used to compare categorical outcomes between the corticosteroid and control groups. Independent t-tests were applied for continuous variables. A p-value of <0.05 was considered statistically significant, and 95% confidence intervals were used to estimate the precision of the outcomes.

Results

Demographic Characteristics

Table 1 highlights the demographic characteristics of the study population, which included 100 pregnant women divided equally between the Corticosteroid Group and the Control Group. The mean age was comparable between both groups, with 29.5 years (± 4.2) in the Corticosteroid Group and 29.8 years (± 4.5) in the Control Group, giving an overall average age of 29.7 years (± 4.3). Parity distribution was also similar, with 52% of women in the Corticosteroid Group being primigravida compared to 48% in the Control Group, while multigravida women accounted for 48% and 52% in the respective groups. Socioeconomic status was evenly distributed, with 38% of participants classified as low, 52% as middle, and 10% as high in both groups, ensuring a balanced representation of varying socioeconomic backgrounds. These demographic similarities provide a strong basis for comparing the outcomes of corticosteroid administration.

Maternal Outcomes

Table 2 outlines the maternal outcomes observed in both groups. Hyperglycemia was more frequent in the Corticosteroid Group (16%) compared to the Control Group (6%), but this difference was not statistically significant ($p = 0.12$). Signs of infection were similar, affecting 8% of the Corticosteroid Group and 10% of the Control Group ($p = 0.73$). Changes in blood pressure were reported in 14% of the Corticosteroid Group and 12% of the Control Group ($p = 0.77$). The need for tocolytic therapy was higher in the Control Group (36%) than in the Corticosteroid Group (24%), although this difference did not reach statistical significance ($p = 0.18$). The duration of hospitalization was slightly shorter in the Corticosteroid Group (4.5 days ± 1.2) compared to the Control Group (5.0 days ± 1.4), but the difference was not statistically significant ($p = 0.10$). Mode of delivery was also comparable, with vaginal delivery occurring in 60% of the Corticosteroid Group and 56% of the Control Group ($p = 0.69$), and cesarean delivery rates of 40% and 44%, respectively.

Neonatal Outcomes - Birth Parameters

Table 3 presents the neonatal birth parameters. The mean birth weight was similar between both groups, with 2700 g (± 250) in the Corticosteroid Group and 2650 g (± 300) in the Control Group ($p = 0.34$). However, Apgar scores showed significant differences. The mean Apgar score at 1 minute was higher in the Corticosteroid Group (7.8 ± 0.5) compared to the Control Group (7.5 ± 0.6), with a p-value of 0.02, indicating a statistically significant improvement. At 5 minutes, the mean Apgar score in the Corticosteroid Group was 8.8 (± 0.4), significantly higher than 8.5 (± 0.5) in the Control Group ($p = 0.01$). These results suggest that corticosteroid

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administration had a positive effect on neonatal well-being immediately after birth.

Neonatal Outcomes - Respiratory Complications

Table 4 addresses respiratory complications among the newborns. The incidence of Respiratory Distress Syndrome (RDS) was significantly lower in the Corticosteroid Group (12%) compared to the Control Group (28%), with a p-value of 0.04. Transient Tachypnea of the Newborn (TTN) was slightly more common in the Control Group (20%) than in the Corticosteroid Group (16%), but the difference was not statistically significant (p = 0.61). The need for NICU admission was higher in the Control Group (36%) compared to the Corticosteroid Group (20%), with a p-value of 0.08, approaching significance. The duration of NICU stay was significantly shorter in the Corticosteroid Group (3.5 days ± 1.0) compared to the Control Group (4.2 days ± 1.3), with a p-value of 0.03. These findings indicate that corticosteroid administration may reduce the severity of respiratory complications and shorten NICU stays.

Neonatal Morbidity and Other Complications

Table 5 shows neonatal morbidity and other complications. Hypoglycemia occurred in 10% of the Corticosteroid Group and 14% of the Control Group (p = 0.54), while jaundice was observed in 8% of the Corticosteroid Group and 12% of the Control Group (p = 0.51). The incidence of sepsis was low, affecting 4% of the Corticosteroid Group and 8% of the Control Group (p = 0.40). Neonatal death rates were also low, with 2% in the Corticosteroid Group and 4% in the Control Group (p = 0.56). These results suggest that the overall morbidity and mortality rates were comparable between the groups, with no significant differences.

Maternal and Fetal Follow-Up Outcomes

Table 6 outlines maternal and fetal follow-up outcomes. Maternal readmission rates were 6% in the Corticosteroid Group and 10% in the Control Group (p = 0.47), while postpartum infections were slightly higher in the Corticosteroid Group (8%) compared to the Control Group (6%) (p = 0.72). NICU readmission within 30 days occurred in 4% of the Corticosteroid Group and 8% of the Control Group (p = 0.40). These outcomes indicate that there were no significant differences in post-discharge complications for both mothers and newborns, suggesting that corticosteroid administration does not increase the risk of adverse events in the follow-up period.

Table 1: Demographic Characteristics of the Study Population

Parameter	Corticosteroid Group (n=50)	Control Group (n=50)	Total (n=100)
Mean Age (years ± SD)	29.5 ± 4.2	29.8 ± 4.5	29.7 ± 4.3
Parity			
- Primigravida	26 (52.0%)	24 (48.0%)	50 (50.0%)
- Multigravida	24 (48.0%)	26 (52.0%)	50 (50.0%)
Socioeconomic Status			
- Low	20 (40.0%)	18 (36.0%)	38 (38.0%)
- Middle	25 (50.0%)	27 (54.0%)	52 (52.0%)
- High	5 (10.0%)	5 (10.0%)	10 (10.0%)

Table 2: Maternal Outcomes

Parameter	Corticosteroid Group (n=50)	Control Group (n=50)	p-value
Hyperglycemia	8 (16.0%)	3 (6.0%)	0.12
Signs of Infection	4 (8.0%)	5 (10.0%)	0.73
Blood Pressure Changes	7 (14.0%)	6 (12.0%)	0.77
Need for Tocolytic Therapy	12 (24.0%)	18 (36.0%)	0.18
Duration of Hospitalization (days ± SD)	4.5 ± 1.2	5.0 ± 1.4	0.10
Mode of Delivery			
- Vaginal	30 (60.0%)	28 (56.0%)	0.69
- Cesarean	20 (40.0%)	22 (44.0%)	0.69

Table 3: Neonatal Outcomes - Birth Parameters

Parameter	Corticosteroid Group (n=50)	Control Group (n=50)	p-value
Mean Birth Weight (g ± SD)	2700 ± 250	2650 ± 300	0.34
Apgar Score at 1 Minute			
- Mean (± SD)	7.8 ± 0.5	7.5 ± 0.6	0.02*
Apgar Score at 5 Minutes			
- Mean (± SD)	8.8 ± 0.4	8.5 ± 0.5	0.01*

*Significant difference

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Table 4: Neonatal Outcomes - Respiratory Complications

Parameter	Corticosteroid Group (n=50)	Control Group (n=50)	p-value
Respiratory Distress Syndrome	6 (12.0%)	14 (28.0%)	0.04*
Transient Tachypnea of the Newborn (TTN)	8 (16.0%)	10 (20.0%)	0.61
Need for NICU Admission	10 (20.0%)	18 (36.0%)	0.08
Duration of NICU Stay (days ± SD)	3.5 ± 1.0	4.2 ± 1.3	0.03*

Table 5: Neonatal Morbidity and Other Complications

Complication	Corticosteroid Group (n=50)	Control Group (n=50)	p-value
Hypoglycemia	5 (10%)	7 (14%)	0.54
Jaundice	4 (8%)	6 (12%)	0.51
Sepsis	2 (4%)	4 (8%)	0.40
Neonatal Death	1 (2%)	2 (4%)	0.56

Table 6: Maternal and Fetal Follow-Up Outcomes

Outcome	Corticosteroid Group (n=50)	Control Group (n=50)	p-value
Maternal Readmission	3 (6%)	5 (10%)	0.47
Postpartum Infection	4 (8%)	3 (6%)	0.72
Follow-up NICU Readmission (Within 30 Days)	2 (4%)	4 (8%)	0.40

Discussion

The demographic distribution of the study sample, with no significant differences in age, parity, or socioeconomic status between the Corticosteroid and Control groups, was well-matched and representative of a typical cohort in late preterm pregnancy research. The mean age of approximately 29.7 years and balanced parity ratio closely mirror findings from Saccone et al. (2019), who reported an average age of 29.4 years and a comparable parity distribution in a similar population of women receiving late preterm corticosteroids.[8]This comparability ensures the reliability of the study outcomes by reducing the risk of demographic confounding factors. Groom et al. (2017) similarly emphasized the importance of balanced socioeconomic status, as socioeconomic variables can influence maternal and neonatal outcomes. The even distribution of socioeconomic status in this study adds robustness to the findings.[9]

The observed maternal outcomes, including an increased but not statistically significant rate of hyperglycemia in the Corticosteroid Group (16%) compared to the Control Group (6%), align with previous research. Gyamfi-Bannerman et al. (2016) reported transient hyperglycemia rates ranging from 15-18% in women receiving late preterm corticosteroids, consistent with the findings of this study.[10] Additionally, the similarity in rates of infection and blood pressure changes between groups supports findings from Wapner et al. (2019), who found no significant increase in maternal infections or hypertensive events after corticosteroid use.[11] The reduced, though not significant, need for tocolytic therapy in the Corticosteroid Group (24% compared to 36% in the Control Group) suggests a potential benefit of corticosteroids in stabilizing preterm labor. This observation is consistent with Jobe and Goldenberg (2018), who reported a trend toward reduced tocolytic use in their corticosteroid-treated cohort.[12]The similar rates of vaginal and cesarean deliveries between the groups also align with findings from a meta-analysis by Jobe and Goldenberg (2018), which concluded that corticosteroid administration does not significantly alter the mode of delivery.[12]

The significantly higher Apgar scores at both 1 and 5 minutes in the Corticosteroid Group ($p = 0.02$ and $p = 0.01$, respectively) reflect improved immediate neonatal outcomes following corticosteroid administration. These findings are in line with Roberts and Dalziel (2017), who highlighted that corticosteroid treatment in late preterm infants enhances respiratory function and overall neonatal well-being at birth.[13] The comparable mean birth weights between groups further validate the safety of corticosteroids regarding fetal growth, as McKinlay et al. (2020) found no significant differences in birth weight between treated and untreated late preterm infants.[14]

A major finding of this study was the significant reduction in Respiratory Distress Syndrome (RDS) in the Corticosteroid Group (12%) compared to the Control Group (28%, $p = 0.04$). This result is consistent with Balci et al. (2018), who demonstrated a 40% reduction in RDS risk among late preterm infants receiving corticosteroids.[15] The shorter NICU stay observed in the Corticosteroid Group (3.5 days vs. 4.2 days, $p = 0.03$) supports the efficacy of corticosteroids in improving neonatal respiratory outcomes, as reported by Jobe and Goldenberg (2018), who found that corticosteroid administration

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leads to shorter NICU admissions and fewer respiratory interventions. Although the difference in NICU admission rates (20% in the Corticosteroid Group vs. 36% in the Control Group) did not reach statistical significance, it still aligns with Roberts et al. (2019), who observed a trend toward reduced NICU admissions in corticosteroid-treated late preterm infants.[16]

The comparable rates of neonatal hypoglycemia (10% in the Corticosteroid Group and 14% in the Control Group) are consistent with Wapner et al. (2019), who found that corticosteroid administration can transiently impact neonatal glucose metabolism but does not lead to severe hypoglycemia. The incidence rates of jaundice, sepsis, and neonatal death were also similar between the groups, indicating that corticosteroid use does not increase neonatal morbidity or mortality.[11]These results align with findings from McKinlay et al. (2020), who reported no significant differences in these complications between treated and untreated groups.[17]

The follow-up outcomes, including maternal readmission rates and postpartum infections, were not significantly different between groups. The maternal readmission rates of 6% in the Corticosteroid Group and 10% in the Control Group are comparable to those reported by Saccone et al. (2019), who found no increase in maternal complications requiring hospitalization post-corticosteroid administration.[8] Similarly, the rates of NICU readmission within 30 days were low and comparable, supporting the findings of Jobe and Goldenberg (2018), who concluded that corticosteroid administration is safe and does not increase the risk of adverse post-discharge outcomes.[12]

Conclusion

In conclusion, this study highlights that the administration of corticosteroids in the late preterm period can significantly improve neonatal outcomes, particularly by reducing the incidence of respiratory distress syndrome and shortening NICU stays. The higher Apgar scores in the corticosteroid group further underscore the potential benefits for neonatal well-being. While maternal outcomes, including the risk of hyperglycemia, were higher but not statistically significant, the overall safety profile remained acceptable. These findings support the judicious use of corticosteroids in managing late preterm births, emphasizing the importance of individualized risk assessment to optimize both maternal and fetal health.

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