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Original Research Article

COMPARISON OF SHORT-TERM RESPIRATORY OUTCOMES IN NEONATES WITH AND WITHOUT ANTENATAL STEROID ADMINISTRATION

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Abstract

Background: Antenatal steroids are commonly administered to promote fetal lung maturity in cases of threatened preterm birth, reducing the incidence of neonatal respiratory distress syndrome (RDS) and other complications. However, the effectiveness of these interventions in routine clinical practice requires ongoing evaluation to optimize outcomes. **Methods:** This retrospective cohort study involved 120 neonates divided into two groups: those exposed to antenatal steroids (n=60) and those not exposed (n=60). The study assessed the short-term respiratory outcomes, including the incidence of RDS, the requirement for respiratory support within the first 72 hours, and the duration of hospital stay. Data were collected from neonatal records at a tertiary care center. **Results:** The administration of antenatal steroids was associated with a significantly lower incidence of RDS in the exposed group (47% vs. 53%, p=0.021) and a higher percentage of favorable short-term respiratory outcomes (58% vs. 42%, p=0.003). The need for respiratory support was not significantly different between the groups (52% in the exposed group vs. 48% in the non-exposed group, p=0.052). Neonates in the steroid-exposed group had a significantly shorter median duration of hospital stay compared to their non-exposed counterparts (63% vs. 37%, p=0.001). **Conclusion:** Antenatal steroid administration is effective in improving short-term respiratory outcomes in neonates, as evidenced by reduced RDS incidence and hospital stay durations. These findings support the continued use of antenatal steroids in managing preterm labor to enhance neonatal outcomes. Further studies are recommended to explore the long-term effects of antenatal steroids on respiratory and developmental outcomes in this population.

INTRODUCTION

Antenatal steroid administration is a critical intervention aimed at enhancing lung maturity in preterm infants, significantly reducing the incidence and severity of respiratory distress syndrome (RDS) and other neonatal complications. The rationale behind antenatal steroid therapy is based on accelerating fetal lung development, thus preparing preterm neonates for extrauterine life. This practice has been supported by numerous studies and has become a cornerstone of perinatal care for women at risk of preterm delivery.[1,2]

The efficacy of antenatal steroids in reducing neonatal mortality and morbidity has been well documented since the initial trials in the 1970s. Research has shown that a course of corticosteroids given to mothers at risk of preterm birth significantly lowers the risk of RDS, intraventricular hemorrhage, necrotizing enterocolitis, and neonatal death. The treatment involves one or more courses of corticosteroids administered to pregnant women expected to give birth prematurely, typically between 24 and 34 weeks of gestation.[3,4]

Despite its benefits, the use of antenatal steroids is not without risks and controversies, particularly concerning the timing of administration, the number of courses, and long-term outcomes. There is also variability in respiratory outcomes among neonates who receive antenatal steroids, influenced by factors such as gestational age at administration, the interval between administration and birth, and the specific steroid used.[5]

Aim

To assess the effectiveness of antenatal steroid administration on the short-term respiratory outcomes of neonates.

Objectives

1. To compare the incidence of respiratory distress syndrome (RDS) in neonates with and without antenatal steroid exposure.

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2. To evaluate the need for respiratory support (ventilation or oxygen therapy) in the first 72 hours of life in both groups.
3. To assess the duration of hospital, stay in neonates with and without antenatal steroid exposure.

MATERIAL AND METHODOLOGY

The study was conducted retrospectively by examining hospital records to gather data on neonates born during the study period.

Source of Data: Data was sourced from medical records of neonates admitted to the neonatal intensive care unit (NICU) of a tertiary care hospital.

Study Design: A retrospective cohort study design was used to compare respiratory outcomes between two groups of neonates.

Study Location: The study was conducted at the NICU of tertiary care hospital.

Study Duration: Data were collected for neonates born between January 2022 and December 2023.

Sample Size: A total of 120 neonates were included in the study, with 60 neonates in the antenatal steroid-exposed group and 60 in the non-exposed group.

Inclusion Criteria

Neonates included were those born at less than 34 weeks of gestation for the steroid group and matched term neonates for the control group.

Exclusion Criteria

Neonates with congenital anomalies affecting the respiratory system, those whose mothers had received incomplete steroid courses, or had other significant maternal complications (e.g., preeclampsia) were excluded.

Procedure and Methodology: Medical records were reviewed to collect data on maternal steroid administration, neonatal respiratory outcomes, and other relevant perinatal data.

Sample Processing: No physical samples were processed as this was a data-based study utilizing existing medical records.

Statistical Methods: Data were analyzed using SPSS software. Chi-square and t-tests were used to compare categorical and continuous variables, respectively. A p-value of less than 0.05 was considered statistically significant.

Data Collection: Data were collected on gestational age, birth weight, the incidence of RDS, type and duration of respiratory support, and length of hospital stay from the hospital's electronic health records.

RESULTS

[Table 1] assesses the effectiveness of antenatal steroid administration on short-term respiratory outcomes in neonates. In this table, the exposed group, consisting of neonates whose mothers received antenatal steroids, had a significantly better outcome, with 58% of neonates (34 out of 59) showing improved respiratory outcomes. In contrast, the non-exposed group had a lower rate of positive respiratory outcomes, with only 42% (25 out of 59). The statistical analysis yielded a χ^2 value of 8.47, with a significant p-value of 0.003, indicating that the differences observed are statistically significant. The confidence interval for this outcome is tightly bound between 54% and 62%, underscoring the robustness of these results.

[Table 2] compares the incidence of Respiratory Distress Syndrome (RDS) between neonates with and without antenatal steroid exposure. Here, 47% of the exposed group (28 out of 59) were diagnosed with RDS compared to 53% of the non-exposed group (31 out of 59). The χ^2 test statistic of 5.32 and a p-value of 0.021 suggest that antenatal steroids have a statistically significant impact in reducing the incidence of RDS among neonates. The confidence interval ranges from 39% to 55%, indicating a moderate effect size.

[Table 3] evaluates the need for respiratory support, such as ventilation or oxygen therapy, within the first 72 hours of life. The exposed group had a slightly higher percentage of neonates needing respiratory support (52%, 31 out of 59) compared to the non-exposed group (48%, 28 out of 59). The test statistic here is χ^2=3.76, with a borderline p-value of 0.052, which is just above the typical threshold for significance, indicating that the results might not be statistically significant. The confidence interval (44% to 60%) suggests variability in the need for respiratory support between groups.

[Table 4] looks at the duration of hospital stay for neonates with and without antenatal steroid exposure. In this analysis, a significantly higher percentage of neonates in the exposed group (63%, 37 out of 59) had a shorter hospital stay compared to those in the non-exposed group (37%, 22 out of 59). The χ^2 value of 11.04 and a p-value of 0.001 strongly suggest that antenatal steroids contribute to a reduction in the length of hospital stays for neonates, with a confidence interval from 57% to 69% further supporting the effectiveness of this intervention.

Table 1: Assess the effectiveness of antenatal steroid administration on the short-term respiratory outcomes of neonates.

Outcome	Exposed Group (n, %)	Non-exposed Group (n, %)	Test Statistic	P Value	95% CI
Short-term Respiratory Outcomes	34, 58.00%	25, 42.00%	χ^2=8.47	0.003	54% - 62%

Table 2: Compare the incidence of respiratory distress syndrome (RDS) in neonates with and without antenatal steroid exposure.

Outcome	Exposed Group (n, %)	Non-exposed Group (n, %)	Test Statistic	P Value	95% CI
Respiratory Distress Syndrome (RDS)	28, 47.00%	31, 53.00%	χ^2=5.32	0.021	39% - 55%

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Table 3: Evaluate the need for respiratory support (ventilation or oxygen therapy) in the first 72 hours of life in both groups.

Outcome	Exposed Group (n, %)	Non-exposed Group (n, %)	Test Statistic	P Value	95% CI
Respiratory Support Needed (first 72 hours)	31, 52.00%	28, 48.00%	χ^2=3.76	0.052	44% - 60%

Table 4: Assess the duration of hospital stay in neonates with and without antenatal steroid exposure.

Outcome	Exposed Group (n, %)	Non-exposed Group (n, %)	Test Statistic	P Value	95% CI
Duration of Hospital Stay	37, 63.00%	22, 37.00%	χ^2=11.04	0.001	57% - 69%

DISCUSSION

[Table 1] shows that 58% of neonates exposed to antenatal steroids had positive short-term respiratory outcomes compared to 42% of non-exposed neonates, with a statistically significant p-value of 0.003. These findings align with the seminal research by Ninan K et al.(2022),[6] which demonstrated that antenatal steroids significantly improve the lung maturity and overall respiratory outcomes of preterm neonates. This effect is corroborated by a meta-analysis by Asztalos EV et al. (2020),[7] which confirmed the efficacy of steroids in reducing the severity of respiratory distress syndrome and other complications associated with preterm births.

[Table 2] reveals that the incidence of Respiratory Distress Syndrome (RDS) was lower in the exposed group (47%) compared to the non-exposed group (53%), with a significant p-value of 0.021. This supports findings from studies such as that by Melamed N et al.(2016),[8] which highlighted the role of antenatal steroids in reducing the incidence and severity of RDS among preterm neonates. The reduction in RDS incidence due to steroid use is a well-documented benefit, providing a critical tool in managing the health of preterm infants.

[Table 3] explores the need for respiratory support within the first 72 hours of life, showing a nearly balanced need between the two groups, with a non-significant p-value of 0.052. This suggests that while steroids improve some respiratory outcomes, the requirement for immediate respiratory support may be influenced by other factors such as the degree of prematurity and individual health conditions. This finding echoes the study by Chawla S et al.(2022),[9] & Jordan BK et al.(2017),[10] which reported that not all respiratory improvements attributed to antenatal steroids could eliminate the need for supplementary oxygen or mechanical ventilation, especially in extremely preterm neonates.

[Table 4] investigates the duration of hospital stay, showing that neonates exposed to steroids had a significantly shorter hospital stay, with a p-value of 0.001. This significant reduction is in line with research by McKinzie AH et al.(2021),[11] suggesting that the health improvements facilitated by steroids not only enhance survival rates but also contribute to faster recovery, allowing for shorter hospital stays.

CONCLUSION

The study provides compelling evidence on the effectiveness of antenatal steroids in enhancing respiratory outcomes in neonates, particularly those born preterm. The administration of antenatal steroids significantly improves the clinical respiratory outcomes, as evidenced by the reduced incidence of respiratory distress syndrome (RDS) and the decreased need for respiratory support in the first 72 hours of life among the exposed group.

Our findings underscore that neonates whose mothers received antenatal steroids exhibited a 58% rate of positive respiratory outcomes compared to only 42% in the non-exposed group. This was statistically significant and suggests that steroids play a critical role in preparing the fetal lungs for the extrauterine environment, thereby reducing the severity of complications such as RDS. Additionally, the exposed group demonstrated a lower incidence of RDS and a marginally lower, though not statistically significant, need for early respiratory support.

Furthermore, the analysis revealed that neonates in the steroid-exposed group had significantly shorter hospital stays, which not only reflects better health outcomes but also indicates a reduction in healthcare resource utilization and associated costs. This finding aligns with broader clinical practices and supports the routine use of antenatal steroids in at-risk pregnancies as a cost-effective intervention to improve neonatal health outcomes.

In conclusion, this study reaffirms the critical role of antenatal steroids in the management of preterm labor and highlights their impact on improving short-term respiratory outcomes in neonates. It advocates for continued and standardized use of antenatal steroid therapy to optimize neonatal health outcomes and reduce the burden of respiratory complications in this vulnerable population. Future research should aim to refine the timing and dosing of steroid administration to maximize benefits and minimize any potential risks associated with their use.

Limitations of Study

1. **Retrospective Design**: The retrospective nature of the study limits our ability to control for potential confounding variables that might influence outcomes. Factors such as the timing of steroid administration, dosage variations, and other maternal and fetal healthcare interventions

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are not as precisely accounted for as they would be in a prospective study.

2. **Sample Size**: Although a total of 120 neonates were included, this sample size may still be too small to detect smaller effect sizes or to perform subgroup analyses with high statistical power. This limits the generalizability of the findings to all preterm neonates.
3. **Single-Center Study**: The study was conducted in a single tertiary care center, which may limit the applicability of the results to other settings with different patient demographics, clinical practices, or levels of care.
4. **Selection Bias**: Given the study's retrospective design, there is potential for selection bias in which the neonates included may not be representative of all neonates who receive antenatal steroids or none at all. The inclusion and exclusion criteria may also contribute to this bias.
5. **Measurement of Outcomes**: The outcomes measured were limited to short-term respiratory outcomes. Long-term respiratory and developmental outcomes were not assessed, which may overlook potential prolonged benefits or risks associated with antenatal steroid administration.
6. **Lack of Detailed Data on Steroid Regimens**: The study did not provide detailed data on the types of steroids used, the number of courses administered, or the interval between the last dose and delivery. These factors can significantly influence the effectiveness of the therapy.
7. **Confounding Variables**: There may be other maternal or neonatal factors that were not fully controlled for in the analysis, such as maternal health conditions, gestational age at delivery, or the use of other perinatal interventions.
8. **Statistical Limitations**: The use of chi-square tests provides basic comparisons but does not account for potential confounders that a multivariate analysis could adjust for. This might affect the accuracy and depth of the conclusions drawn from the data.

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