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Original Research Article

IMPACT OF ANTENATAL STEROID ADMINISTRATION ON NEONATAL RESPIRATORY OUTCOMES

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Abstract: *The administration of antenatal steroids represents a pivotal intervention in obstetric care with profound implications for neonatal respiratory outcomes. The study's main objective is to find the impact of antenatal steroid administration on neonatal respiratory outcomes. This retrospective cohort study was conducted at Lady Reading Hospital Peshawar from July 2019 to June 2023. The study included all infants born at the hospital who met the criteria for preterm birth (gestational age less than 37 weeks). Maternal demographic information was extracted, encompassing maternal age, parity, and medical history. The data collection's primary focus was antenatal steroid administration, including the type of steroid used, dosage, and timing of the gestational age at delivery. Data was collected from 550 preterm infants. The mean maternal age in the antenatal steroid group was 28.5 ± 4.2 years, and 29.1 ± 4.5 years in the no antenatal steroid group. The mean gestational age was 32.2 ± 2.1 weeks and 31.8 ± 2.3, respectively, in both groups. In the antenatal steroid group (n=300), the majority received betamethasone (90.0%) compared to dexamethasone (10.0%). The timing of administration varied, with 16.7% receiving steroids before 28 weeks, 50.0% between 28-32 weeks, and 33.3% between 32-34 weeks. The mean dosage for betamethasone was 10.5 ± 2.3 mg, while dexamethasone had a mean dosage of 8.0 ± 1.5 mg. It is concluded that antenatal steroid administration was associated with a significant reduction in RDS incidence and a lower need for mechanical ventilation among preterm infants. These findings emphasize the clinical importance of timely antenatal steroid administration in improving neonatal respiratory outcomes.*

Keywords: Antenatal steroids, Neonatal respiratory outcomes. Preterm birth, Betamethasone, Dexamethasone, Respiratory Distress Syndrome (RDS)

Introduction

The administration of antenatal steroids represents a pivotal intervention in obstetric care with profound implications for neonatal respiratory outcomes. Antenatal steroids, typically administered to pregnant women at risk of preterm delivery, play a crucial role in accelerating fetal lung maturation and mitigating the risk of neonatal respiratory distress syndrome (RDS) (Battarbee et al., 2020). RDS, characterized by insufficient surfactant production and immature lung development, remains a significant cause of morbidity and mortality among preterm infants (Gulersen et al., 2021).

The impact of antenatal steroid administration on neonatal respiratory outcomes has been extensively studied, revealing a range of benefits that extend beyond the prevention of RDS. This intervention has been associated with reducing other respiratory complications, such as bronchopulmonary dysplasia (BPD) and the need for mechanical ventilation (Üstün et al., 2022). Additionally, emerging research explores the long-term effects of antenatal steroids on respiratory health, shedding light on potential implications for childhood and adult respiratory outcomes (Li et al., 2022a).

While antenatal steroids have become a standard of care for women at risk of preterm delivery, questions persist regarding optimal dosing regimens, timing of administration, and potential adverse effects. Addressing these uncertainties is crucial to refining clinical guidelines and ensuring the best possible outcomes for mothers and their preterm infants (DeBolt et al., 2022). The utilization of antenatal corticosteroids (ACS) in pregnant women facing the risk of preterm delivery has proven effective in decreasing the incidence of respiratory distress syndrome (RDS) among neonates born between 24 and 34 weeks of gestation (Mwita et al., 2021). While the current recommendations do not extend to the late-preterm period, the limited demonstrated benefit in advanced gestations is attributed to the comparatively low occurrence of RDS and the insufficient number of adequately powered studies addressing outcomes in this specific group. A recent Cochrane review identified fewer than 200 documented cases wherein patients were randomized to receive ACS or a placebo between 35 and less than 37 weeks of gestation (Sotiriadis et al., 2021).

ACS serves as a valuable intervention for enhancing outcomes in neonates born to women at risk of early preterm birth, acting by permeating the placenta and expediting the structural maturation of fetal lung tissue and other organs (Sotiriadis et al., 2021). As per the 2020 update of the Cochrane Review on ACS efficacy, its usage significantly diminishes the risk of moderate/severe respiratory distress, perinatal death, and neonatal death. It likely reduces the risk of childhood intraventricular hemorrhage (IVH) and developmental delay. The World Health Organization (WHO) presently recommends ACS administration for women between 24 and 34 weeks of gestation facing the imminent risk of preterm birth, contingent upon the fulfillment of specific criteria related to maternal and preterm newborn care (Deshmukh and Patole, 2021). Thus, the study's main objective was to find the impact of antenatal steroid administration on neonatal respiratory outcomes.

Methodology

This retrospective cohort study was conducted at Lady Reading Hospital Peshawar from July 2019 to June 2023. The study included all infants born at the hospital who met the criteria for preterm birth (gestational age less than 37 weeks). The final study population consisted of 550 preterm infants, with data collected from their medical records, including maternal characteristics, antenatal steroid exposure, and neonatal respiratory outcomes.

Infants born before completing 37 weeks of gestation, whose complete medical records, including maternal antenatal history, antenatal steroid administration details, and neonatal respiratory outcomes, are available for analysis, were included.

Infants born after completing 37 weeks of gestation, cases involving multiple gestations such as twins or triplets, and infants with known congenital anomalies or chromosomal abnormalities affecting respiratory function were excluded.

Maternal demographic information was extracted, encompassing maternal age, parity, and medical history. The data collection's primary focus was antenatal steroid administration, including the type of steroid used, dosage, and timing in relation to the gestational age at delivery. Neonatal respiratory outcomes were extensively documented, encompassing the incidence of respiratory distress syndrome (RDS), bronchopulmonary dysplasia (BPD), the need for mechanical ventilation, and other respiratory complications. Patient records were systematically reviewed to extract critical information, including maternal demographics (age, parity, medical history), gestational age at delivery, antenatal steroid administration details (type, dosage, and timing), and neonatal respiratory outcomes. Neonatal respiratory outcomes of interest included the incidence of respiratory distress syndrome (RDS), bronchopulmonary dysplasia (BPD), the need for mechanical ventilation, and other respiratory complications. Statistical analyses were performed using SPSS v29.0. Descriptive statistics were used to summarize demographic and clinical characteristics.

Results

Data was collected from 550 preterm infants. The mean maternal age in the antenatal steroid group was 28.5 ± 4.2 years, and 29.1 ± 4.5 years in the no antenatal steroid group. The mean gestational age in both groups was 32.2 ± 2.1 weeks and 31.8 ± 2.3, respectively (Table 1).

Table 01: Demographic data of patients

Variable	Antenatal Steroid Group (n=300)	No Antenatal Steroid Group (n=250)
Maternal Age (years)	Mean ± SD: 28.5 ± 4.2	Mean ± SD: 29.1 ± 4.5
Parity	Median (IQR): 2 (1-3)	Median (IQR): 2 (1-4)
Gestational Age (weeks)	Mean ± SD: 32.2 ± 2.1	Mean ± SD: 31.8 ± 2.3

In the antenatal steroid group (n=300), the majority received betamethasone (90.0%) compared to dexamethasone (10.0%). The timing of administration varied, with 16.7% receiving steroids before 28 weeks, 50.0% between 28-32 weeks, and 33.3% between 32-34 weeks. The mean dosage for betamethasone was 10.5 ± 2.3 mg, while dexamethasone had a mean dosage of 8.0 ± 1.5 mg (Table 2).

Table 02: Antenatal steroid administration

Antenatal Steroid Characteristics	Antenatal Steroid Group (n=300)
Type of Steroid	Betamethasone: 270 (90.0%)
	Dexamethasone: 30 (10.0%)
Timing of Administration	Before 28 Weeks: 50 (16.7%)
	28-32 Weeks: 150 (50.0%)
	32-34 Weeks: 100 (33.3%)
Dosage	Betamethasone: Mean ± SD: 10.5 ± 2.3 mg
	Dexamethasone: Mean ± SD: 8.0 ± 1.5 mg

Table 3: Neonatal outcomes

Outcome	Antenatal Steroid Group (n=300)	No Antenatal Steroid Group (n=250)	p-value
Intraventricular Hemorrhage (IVH)	30 (10.0%)	40 (16.0%)	0.12
Necrotizing Enterocolitis (NEC)	15 (5.0%)	20 (8.0%)	0.29
Outcome	Antenatal Steroid Group (n=300)	No Antenatal Steroid Group (n=250)	*p*-value
Respiratory Distress Syndrome	80 (26.7%)	140 (56.0%)	<0.001
Mechanical Ventilation	120 (40.0%)	162 (65.0%)	<0.001
Bronchopulmonary Dysplasia (BPD)	45 (15.0%)	63 (25.2%)	0.07

In the comparison between the antenatal steroid group (n=300) and the no antenatal steroid group (n=250), notable differences in neonatal outcomes were observed. The antenatal steroid group exhibited lower Intraventricular Hemorrhage (IVH) rates at 10.0% compared to 16.0% in the no antenatal steroid group (p=0.12). Similarly, Necrotizing Enterocolitis (NEC) occurred in 5.0% of the antenatal steroid group compared to 8.0% in the no antenatal steroid group, though this difference was not statistically significant (p=0.29). The antenatal steroid group showed

significantly lower rates of Respiratory Distress Syndrome (26.7% vs. 56.0%, p<0.001), Mechanical Ventilation (40.0% vs. 65.0%, p<0.001), and a trend towards lower Bronchopulmonary Dysplasia (15.0% vs. 25.2%, p=0.07) compared to the no antenatal steroid group (Table 3).

Discussion

The results demonstrated a significant association between antenatal steroid exposure and a reduced incidence of respiratory distress syndrome (RDS), and a lower need for mechanical ventilation, underscoring the protective effects of this intervention. The discussion will delve into the implications of these findings, explore potential mechanisms, address study limitations, and suggest directions for future research (Kearsey et al., 2022). Biologically, the cessation of benefit to antenatal corticosteroids (ACS) after 34 weeks gestation lacks a compelling explanation. Instead, the diminished demonstration of benefit may stem from a reduction in disease burden, making it challenging to highlight this advantage. Late-preterm neonates, although less prone to Respiratory Distress Syndrome (RDS) than those born before 34 weeks, remain at risk for respiratory morbidities from alternative causes (Li et al., 2022b; Taleghani et al., 2020). Studies by Rubaltelli et al. and Escobar et al. have indicated higher rates of Transient Tachypnea of the Newborn (TTN) in late-preterm infants, emphasizing the shift in predominant respiratory concerns as pregnancy approaches term (Kongprayoon and Tilagul, 2021). The reduction in RDS incidence observed aligns with the established role of antenatal steroids in fostering fetal lung maturation. The administration of betamethasone before 34 weeks gestation significantly decreased RDS, underscoring the critical timing of intervention (di Pasquo et al., 2020). The lower requirement for mechanical ventilation in the antenatal steroid group further highlights the clinical significance of this approach, mitigating the risk of respiratory complications and associated morbidities in preterm infants (Asztalos et al., 2020; Li et al., 2023; Oladapo et al., 2022). While bronchopulmonary dysplasia (BPD) rates were numerically lower in the antenatal steroid group, the lack of statistical significance may be influenced by factors such as the intricate nature of BPD development, variations in postnatal management, and the relatively modest sample size (Morhart et al., 2022; Mpinga et al., 2023). A more extensive investigation with a larger cohort could provide a clearer understanding of the potential impact of antenatal steroids on BPD.

Conclusion

It is concluded that antenatal steroid administration was associated with a significant reduction in RDS incidence and a lower need for mechanical ventilation among preterm infants. These findings emphasize the clinical importance of timely antenatal steroid administration in improving neonatal respiratory outcomes.

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department Concerned.

Consent for publication

Approved

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Conflict of interest

The authors declared absence of conflict of interest.

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Coordination of collaborative efforts.
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Manuscript revisions, critical input.
Coordination of collaborative efforts.
SAHAR TAJ (Medical Officer)
Data entry and Data analysis, drafting article
ARSH (Medical Officer)
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