



IMPACT OF CORTICOSTEROIDE AND MAGNESIUM SULFATE USE ON 32-WEEK NEWBORN OUTCOMES

IMPACTO DO USO DE CORTICOSTERÓIDES E SULFATO DE MAGNÉSIO EM RECÉM-NASCIDOS DE 32 SEMANAS

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ABSTRACT: The objective of this study was to evaluate the impact of corticosteroid use and magnesium sulfate administration in newborns at 32 weeks of gestation. This was a cross-sectional study including 132 patients divided into three groups: complete cycle of corticosteroid and magnesium sulfate (n = 62), corticosteroid only (n = 22), and no treatment (n = 48), and the outcomes assessed were neonatal intensive care unit admission (NICU), respiratory distress syndrome (RDS), mechanical ventilation (MV), neurological impairment (NI), and death, with data analyzed at a significance level of $p \leq 0.05$. The outcomes differed mainly regarding the need for NICU admission, which was less frequent in the complete cycle group (n = 3) and in the corticosteroid-only group (n = 1) compared with the no-treatment group (n = 10), and there was also a lower need for mechanical ventilation in the complete cycle group (n = 5) and in the corticosteroid-only group (n = 4). It is concluded that corticosteroid therapy, whether associated or not with magnesium sulfate, had a positive impact by reducing the need for NICU admission and mechanical ventilation.

KEYWORDS: Corticosteroids; Gestational; Magnesium Sulfate.

RESUMO: O objetivo foi avaliar o impacto do uso do corticoide e sulfato de magnésio em recém-nascidos de 32 semanas. Estudo de corte transversal contendo 132 pacientes divididos em grupos: ciclo completo de corticoide e sulfato de magnésio (n=62), apenas corticoide (n=22) e sem tratamento (n=48). Os desfechos avaliados foram: UTI neonatal (UTIneo), síndrome do desconforto respiratório (SDR), ventilação mecânica (VM), prejuízo neurológico (PN) e morte. Os dados foram avaliados com nível de significância $p \leq 0,05$. Os desfechos diferiram na necessidade de internação na UTIneo, sendo menos observada no grupo do ciclo completo (n=3) e no grupo de apenas corticoide (n=1) quando comparado ao grupo sem tratamento (n=10). Houve menor necessidade de ventilação mecânica no grupo do ciclo completo (n=5) e no grupo de corticoide (n=4). Conclui-se que o corticoide associado ou não ao sulfato de magnésio teve um impacto positivo na necessidade de UTIneo e VM.

PALAVRAS-CHAVE: Corticoide. Gravidez. Sulfato de Magnésio.

INTRODUCTION

Preterm birth, defined by the World Health Organization (WHO) as delivery before 37 completed weeks of gestation, is a major global public health concern due to its implications for morbidity and mortality at the population level. It remains the leading cause of death among children under five years of age, primarily because of prematurity-related complications. For preterm neonates, this condition can result in immediate health risks and long-term developmental impacts. Preterm birth is associated with short-term complications such as neonatal respiratory disorders—including respiratory distress syndrome (RDS)—and neurological conditions such as periventricular leukomalacia, seizures, intraventricular hemorrhage, cerebral palsy, and hypoxic-ischemic encephalopathy. These outcomes place a significant burden on healthcare systems. In this context, antenatal interventions are critical to reducing prematurity-related complications. In cases of anticipated preterm birth, antenatal corticosteroids for fetal lung maturation and magnesium sulfate (MgSO_4) for fetal neuroprotection have been shown to improve neonatal outcomes¹.

During the third trimester of pregnancy, several active developmental processes are underway, rendering the fetal brain especially vulnerable to both endogenous and exogenous insults. As a result, preterm birth can lead to neurodevelopmental complications such as brain injury, and a considerable number of preterm neonates survive with severe neurological impairment. In addition to short-term consequences, structural brain alterations have been reported in the second decade of life among individuals born preterm, including volume reductions in the hippocampus, caudate nucleus, thalamus, corpus callosum, and cerebellum. To reduce neurological complications associated with prematurity, magnesium sulfate has been investigated in observational studies since the 1990s and has shown promise as a preventive strategy for anticipated preterm birth². Evidence suggests that its administration may lower the risk of cerebral palsy and improve long-term developmental outcomes. However, no international consensus has been reached regarding this practice, and additional studies are needed to better understand the effects of magnesium sulfate.

In addition to neurological complications, respiratory morbidity—particularly RDS—is a serious consequence of preterm birth and remains a leading cause of neonatal mortality and early disability³. Antenatal corticosteroids are widely used in obstetric care to reduce adverse outcomes in pregnancies at risk of early preterm birth. Their use increased significantly after a 1994 consensus conference held by the National Institutes of Health, which concluded that strong evidence supported the use of glucocorticoids to improve neonatal outcomes when administered to women likely to deliver before 34 weeks of gestation. A 2022 Cochrane systematic review reaffirmed the essential role of corticosteroids in accelerating fetal lung maturation, highlighting that both betamethasone and dexamethasone are effective, with consistent evidence of improved neonatal respiratory outcomes. However, the choice of drug and dosing regimen still depends on factors such as availability, clinical preference, and pregnancy characteristics⁴.

This cross-sectional observational study aims to assess the effects of administering magnesium sulfate and corticosteroids to pregnant women at imminent risk of preterm birth, specifically for fetal neuroprotection and lung maturation. The purpose is to inform healthcare professionals about the potential benefits of incorporating this practice into routine preterm labor management.

METHODOLOGY

The Research Ethics Committee approved this cross-sectional study under number 5.443.504. Data were obtained through the analysis of the Unified Patient Record (UPR) at Darcy Vargas Maternity

Hospital, focusing on mothers and preterm neonates born at or before 32 weeks of gestation. Participants were divided into three groups: those who received a complete course of corticosteroids with magnesium sulfate, those who received corticosteroids only, and those who received no therapy. Maternal variables included socioeconomic profile, body mass index (BMI), and gestational weight gain. Additional data included obstetric history, lifestyle habits, pre-existing conditions during pregnancy, timing and number of prenatal care visits, risk classification, and follow-up in the High-Risk Unit at Darcy Vargas Maternity Hospital.

Data collection and interpretation took place throughout 2022. Because the study used secondary data from the UPR with preserved patient confidentiality, it qualified for a waiver of informed consent.

Neonatal variables obtained from the UPR included Capurro method scores, birth weight, 1- and 5-minute Apgar scores, date and time of admission and birth, mode of delivery, NICU admission, and administration of corticosteroids and/or magnesium sulfate. Adverse outcomes were also recorded, including prematurity, low birth weight, and perinatal death.

According to the World Health Organization (WHO), BMI was classified as underweight for values below 18.5, normal weight for values between 18.5 and 24.9, and overweight for values from 25.0 to 29.9. Obesity was categorized as grade 1 for BMI between 30.0 and 34.9, grade 2 for values between 35.0 and 39.9, and grade 3 for values above 40.0.

Gestational weight gain was classified according to the guidelines of the Institute of Medicine (IOM, 2009). For underweight women (BMI < 18.5), the recommended gain was 12.5–18 kg. For those with normal weight (BMI 18.5–24.9), the range was 11–16 kg. Overweight women (BMI 25.0–29.9) were advised to gain 7–11.5 kg, and women with obesity were recommended to gain 5–9 kg during pregnancy.

Participants were categorized into three groups: the *complete-course group* (corticosteroids and magnesium sulfate), the *corticosteroids-only group*, and the *no-therapy group*. A total of 132 participants were included in the study: 62 received both corticosteroids and magnesium sulfate, 22 received corticosteroids only, and 48 received no therapy.

Data were entered into a double-entry electronic database concurrently with collection to ensure concordance and identify potential transcription errors. Statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS), version 21.0. All variables were analyzed descriptively. Continuous variables were summarized using means and standard deviations, while categorical variables were presented as absolute and relative frequencies.

To compare group means, the Student's t-test was used when the data followed a normal distribution; otherwise, the non-parametric Mann-Whitney test was applied. Normality was assessed using the Kolmogorov-Smirnov test. Group differences in proportions were evaluated using the chi-square test or Fisher's exact test (for expected frequencies below 5).

Multinomial logistic regression models were employed to investigate the association between prematurity and adverse perinatal outcomes. The strength of associations was estimated using adjusted odds ratios (ORs) with corresponding 95% confidence intervals (95% CI), accounting for potential confounding variables. The outcomes evaluated were neonatal intensive care unit (NICU) admission, respiratory distress syndrome (RDS), mechanical ventilation (MV), neurological impairment (NI), and death. Results were considered statistically significant at $p \leq 0.05$.

RESULTS

The groups evaluated included the complete-course group (corticosteroids and magnesium sulfate, $n = 62$), the corticosteroids-only group ($n = 22$), and the no-therapy group ($n = 48$). The tables analyzed maternal characteristics, newborn characteristics, and adverse neonatal outcomes.

Table 1 presents maternal characteristics. Based on the results, there was a higher proportion of never married women in all three groups compared to those who were married, in a common-law marriage, or divorced, regardless of whether they received the full course. However, no statistically significant differences were found for the presence of comorbidities, maternal age, or race, as these outcomes had p-values > 0.05. These data are summarized in Table 1.

Table 1. Maternal characteristics.

MATERNAL CHARACTERISTICS				
	Corticosteroids and magnesium sulfate n=62	Corticosteroids n=22	No therapy n=48	P
Age (years)				0.764*
<20	7 (11.2%)	2 (9.0%)	5 (10.4%)	
20 - 24	14 (22.5%)	3 (13.6%)	9 (18.7%)	
25 - 29	17 (27.4%)	5 (22.7%)	13 (27.0%)	
30 - 34	14 (22.5%)	8 (36.3%)	11 (22.9%)	
35 - 39	5 (8.0%)	4 (18.1%)	8 (16.7%)	
40 - 44	5 (8.0%)	0 (0.0%)	2 (4.1%)	
Marital status				0.005*
Married	15 (24.1%)	4 (18.1%)	5 (10.4%)	
Never married	45 (72.5%)	13 (59.0%)	39 (81.2%)	
Common-law marriage	2 (4.1%)	1 (4.5%)	2 (4.1%)	
Divorced	0 (0.0%)	4 (18.1%)	1 (2.0%)	
Race				0.147**
White	53 (85.4)	18 (81.8)	33 (68.7)	
Black	4 (6.4)	2 (9.0)	1 (2.0)	
Indigenous	0	0	0	
Prenatal care	61 (98.3%)	21 (95.4%)	47 (97.9%)	0.726*
Associated conditions				
Gestational diabetes mellitus	12 (19.35)	8 (36.3%)	9 (18.7%)	0.202*
Preexisting diabetes mellitus	0 (0.0%)	2 (9.0%)	1 (2.0%)	0.048**
Gestational hypertension	20 (32.2%)	7 (31.8%)	11 (22.9%)	0.530*
Chronic hypertensive disorder	5 (8.0%)	3 (13.6%)	5 (10.4%)	0.743**
Covid	0 (0.0%)	0 (0.0%)	6 (12.5%)	0.004**
Urinary tract infection	16 (39.0%)	11 (50%)	14 (29.1%)	0.102*
Alcohol use	2 (3.2%)	2 (9.0%)	3 (6.25%)	0.536**
Tobacco use	6 (9.7%)	2 (9.0%)	7 (14.5%)	0.676*

* χ^2 test; ** Fisher's exact test.

Table 2 presents newborn characteristics. The complete-course group (n = 62), corticosteroids-only group (n = 22), and no-therapy group (n = 48) were compared based on gestational age, vaginal birth, birth weight, and weight classification. According to the findings, neonates born to mothers who did not receive either medication had higher birth weights compared to those whose mothers received treatment. However, no significant differences were observed for weight classification, gestational age, or vaginal birth, as these variables also had p-values > 0.05. These data are summarized in Table 2.

Table 3 reports adverse neonatal outcomes for the three groups. Outcomes analyzed included the proportion of neonates admitted to the NICU, RDS, mechanical ventilation, neurological impairment, and death. NICU admissions were lower among neonates exposed to either the complete-course regimen or corticosteroids alone compared to those in the no-therapy group. Likewise, the need for mechanical ventilation was more prevalent among neonates who did not receive the complete course or corticosteroids alone. No significant differences were found for RDS, neurological impairment, or death, as these outcomes had p-values > 0.05. These data are summarized in Table 3.

Table 2. Newborn characteristics.

FETAL CHARACTERISTICS				
	Corticosteroids and magnesium sulfate	Corticosteroids	No therapy	<i>P</i>
	n=62	n=22	n=48	
Vaginal birth	31 (50%)	8 (36.3%)	29 (60.4%)	0.165*
Weight	1282.89 (± 469.1)	1351.95 (± 539.32)	1655.56 (± 751.86)	0.034***
Weight classification				0.276**
SGA	20 (32.2%)	6 (27.2%)	7 (14.5%)	
AGA	34 (54.8%)	15 (68.1%)	39 (81.2%)	
LGA	3 (4.8%)	1 (4.5%)	1 (2.0%)	
Malformation	2 (3.2%)	1 (4.5%)	0 (0.0%)	0.390**

SGA: small for gestational age; AGA: appropriate for gestational age; LGA: large for gestational age. * χ^2 test; ** Fisher's exact test; *** Mann-Whitney test.

Table 3. Adverse neonatal outcomes.

NEONATAL OUTCOMES				
	Corticosteroids and magnesium sulfate	Corticosteroids	No therapy	<i>P</i>
	n=62	n=22	n=48	
NICU admission	3 (4.8%)	1 (4.5%)	10 (20.8%)	0.016**
RDS	13 (20.9%)	12 (54.5%)	18 (37.5%)	0.126*
Mechanical ventilation	5 (8.1%)	4 (18.1%)	13 (27.0%)	0.006*
Neurological impairment	4 (6.4%)	4 (18.1%)	2 (4.16%)	0.116*
Death	3 (4.8%)	1 (4.5%)	1 (2.08%)	0.743**

NICU: neonatal intensive care unit; RDS: respiratory distress syndrome. * χ^2 test; ** Fisher's exact test.

DISCUSSION

The increased emphasis on prenatal care has led to higher survival rates among preterm neonates. In this context, clinical guidelines have been developed to reduce short-term complications associated with prematurity, such as intracranial hemorrhage and respiratory and cardiovascular issues, among others³. To clarify the effects of current therapies used in preterm infants, such as magnesium sulfate and corticosteroids, the current study included 132 patients and compared the outcomes of three groups: Group 1 received both corticosteroids and magnesium sulfate (n = 62); Group 2 received corticosteroids only (n = 22); and Group 3 received no therapy (n = 48).

The study population consisted of mothers who delivered preterm infants with a gestational age under 32 weeks. Most participants were over 45 years old and identified as White. Notably, a similar proportion of women had and had not received prenatal care. Regarding maternal conditions during pregnancy, most participants had gestational or preexisting diabetes and/or hypertensive disorders of pregnancy—factors potentially associated with preterm delivery. In addition, many women experienced urinary tract infections during pregnancy.

The findings of this study revealed no statistically significant association between the therapies and neurological outcomes in newborns. However, these results contradict earlier studies that demonstrated a reduction in adverse neurological outcomes, such as cerebral palsy or neonatal death^{5,6}. Other research also found a higher incidence of cerebral palsy in the placebo group than those treated with magnesium sulfate, suggesting a neuroprotective effect of the medication^{7,8}.

Although this was not the primary aim of the study, previous evidence has highlighted potential motor benefits of magnesium sulfate in infants. Moreover, a literature review concluded that gestational

age influences the outcomes of magnesium sulfate in newborns, indicating that the more premature the infant, the greater the benefit associated with this therapy; this factor may represent a limitation of the present study⁹. Accordingly, the current findings showed no statistically significant reduction in neurological complications or mortality in preterm infants following the use of magnesium sulfate, contrasting with earlier research that found a significant decrease in mortality among infants born between 26 and 27 weeks of gestation¹⁰.

However, as noted in previous studies, there is no consensus on the ideal gestational age cutoff or the appropriate dosage of magnesium sulfate to be administered to pregnant women^{2,11}. Therefore, our findings may have been affected by this lack of standardization. Further research is urgently needed to establish a consensus and clinical protocol for the use of this promising intervention, as the variability in recommendations has hindered its international acceptance as a preventive strategy. Regarding fetal mortality, our findings are consistent with two previous studies that also found no significant impact of magnesium sulfate on preterm infant mortality rates^{11,12}. Although not the focus of the present article, a cohort study reported improvements in both motor and cognitive neurodevelopment up to 36 months of age in infants treated with magnesium sulfate compared to those who were not¹³. This suggests that the benefits of this intervention may extend beyond neonatal outcomes, positively influencing the infant's long-term development.

In cases of anticipated preterm delivery, the use of corticosteroids to promote fetal lung maturation can significantly improve neonatal outcomes¹—a conclusion supported by our study. The reduced rate of mechanical ventilation among preterm infants exposed to corticosteroids reinforces the understanding that these medications accelerate fetal lung development³. Furthermore, our findings showed that corticosteroid use was strongly associated with a lower need for neonatal intensive care unit admission and reduced dependence on mechanical ventilation. These findings underscore the importance of early intervention in managing preterm birth and position corticosteroids as an essential strategy for improving respiratory and overall clinical outcomes in newborns. The present findings align with a 2022 Cochrane systematic review on the use of systemic corticosteroids in the postnatal period, which showed that, in addition to improving lung function, these medications play a significant role in preventing bronchopulmonary dysplasia — a serious and frequent complication in extremely preterm infants¹⁴. Another 2022 Cochrane systematic review evaluated different types of antenatal corticosteroid regimens, further confirming their effectiveness in promoting pulmonary maturation and improving neonatal respiratory outcomes⁴. The agreement across studies strengthens the scientific evidence and reinforces the clinical importance of corticosteroids as a therapeutic tool in early neonatal care.

Regarding adverse outcomes, only 4.5% of mothers who received corticosteroids had newborns admitted to the NICU, compared to 20.8% among those who received no therapy. Additionally, 18.1% of infants who benefited from corticosteroid use required mechanical ventilation, while 37.5% of those who did not receive the treatment needed mechanical ventilation.

Despite the positive results of corticosteroid use demonstrated in this study, it is important to note that other evidence suggests maternal conditions—such as diabetes, chorioamnionitis, and fetal growth restriction—may influence the outcomes associated with corticosteroid administration. For example, previous studies have shown that glucocorticoids may have hyperglycemic effects, potentially exacerbating respiratory morbidity in fetuses of mothers with diabetes¹⁵. Therefore, the presence of such specific subgroups in the current sample may have affected the study results.

The benefits of antenatal corticosteroids for preterm infants have been recognized for decades. However, further research is needed to evaluate their effects in full-term or late preterm infants, as existing studies show conflicting results. Some evidence suggests that as gestational age increases, the

benefits of this intervention may be offset by risks for the newborn¹⁶. Conversely, other sources indicate that prophylactic glucocorticoid therapy may be feasible for late preterm and early-term infants¹⁷.

Although not the focus of this study, the reduced need for NICU admission may also translate into a decreased likelihood of complications across multiple systems in the newborn, suggesting indirect benefits in various areas of health. This finding is relevant not only to individual patients, but also to public health. It is worth noting that the present study had a small sample size, which may have influenced the reported outcomes. Nevertheless, the findings underscore the importance of corticosteroids and magnesium sulfate in improving perinatal outcomes. Further studies are needed to clarify and confirm the role of these medications in reducing morbidity and mortality in preterm births.

Therefore, the results presented here support the use of corticosteroids and magnesium sulfate in clinical practice for the management of extremely preterm births as a means to reduce adverse outcomes associated with prematurity. This study thus offers valuable contributions to the clinical practice of healthcare professionals responsible for managing preterm labor.

CONCLUSION

This study demonstrated that corticosteroids, whether used alone or combined with magnesium sulfate, had a positive impact on NICU admission and the need for mechanical ventilation. The simultaneous use of corticosteroids and magnesium sulfate significantly reduced both NICU admissions and the need for mechanical ventilation. However, outcomes related to neurological impairment did not show statistical significance.

These findings suggest that the use of corticosteroids in combination with magnesium sulfate in preterm births provides fetal health benefits and may be incorporated into clinical practice to reduce adverse outcomes such as NICU admission and the need for mechanical ventilation. The reduction of such interventions has broader public health implications, potentially lowering healthcare system costs.

Therefore, the practice examined in this study may positively affect not only newborn health but also the overall public health system. Additionally, this study is particularly important for future medical practice, given that most existing research on the topic consists of systematic reviews of previous studies. As an updated cross-sectional analysis, our study provides relevant new evidence. Nevertheless, further research is necessary to define a standardized protocol and establish a consensus regarding the optimal dosage and timing of this therapy.

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