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ANTENATAL CORTICOTHERAPY IN THE PREVENTION OF RESPIRATORY DISTRESS SYNDROME IN PRETERM NEONATES

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Abstract: Introducction: Neonatal respiratory distress syndrome is a set of symptoms characterized by progressive respiratory distress that typically affects prematurely born newborns. It can manifest at birth or in the first hours of life and represents one of the main causes of respiratory failure and death in newborns. The underlying cause is a deficiency of pulmonary surfactant, a lipoprotein substance that coats the alveoli and prevents their collapse by reducing surface tension. **Objective:** Determine the effectiveness of the administration of antenatal corticosteroids in the prevention of respiratory distress syndrome in preterm newborns treated at the Matilde Hidalgo Specialized Hospital in Procel during the period 2021-2022. Methodology: A quantitative, non-experimental, cross-sectional and retrospective study was carried out, with a correlational approach. The sample included 110 premature neonates. **Results:** The main risk factors related to the development of respiratory distress syndrome were male sex (53.6%), gestational age between 32 to 33 weeks (36.4%), maternal age between 20 to 34 years (55.5%), cesarean section delivery (58.2%) and gynecological maternal comorbidities (22.7%). The most used corticosteroid was dexamethasone (50.9%). All patients who did not develop respiratory distress syndrome received a corticosteroid therapy regimen and the administration of complete cycles of antenatal corticosteroids was related to the absence and/or lower degree of severity of the condition. There is an inversely proportional relationship between the use of prenatal corticosteroids and the severity of neonatal respiratory distress syndrome. Conclusions: The administration of antenatal corticosteroids was associated with a better respiratory outcome in premature neonates, preventing or reducing the severity of respiratory distress syndrome. On the contrary, the lack of administration

of prenatal corticosteroids was related to a greater development of moderate to severe respiratory distress syndrome.

INTRODUCTION

Respiratory distress syndrome or respiratory distress syndrome (RDS), previously known as hyaline membrane disease (HME), is a clinical condition characterized by the presence of progressive respiratory distress secondary to poor production of pulmonary surfactant (1), which It typically affects premature newborns, the frequency increases at a lower gestational age (2), the signs and symptoms may be present at birth and/or appear in the first 72 hours of life, manifesting with frank respiratory symptoms that include tachypnea, nasal flaring, expiratory groaning and increased work of breathing (3), is classically evident on chest x-ray with a diffuse reticulogranular pattern associated with an air bronchogram (4). It can progress in severity within the first three days of life, leading to progressive hypoxia and severe respiratory failure, thus contributing to a significant increase in immediate and long-term morbidity and mortality in premature newborns, in addition to a considerable increase in costs in neonatal intensive care units (NICU). (1)

The administration of antenatal corticosteroids in pregnant women at risk of preterm birth from 24 weeks to 34 weeks is currently considered a priority intervention and one of the pillars in prenatal care, with the aim of reducing neonatal morbidity and mortality attributable to this pathology (5). This effect is due to the fact that prenatal corticosteroids promote the production of surfactant and thereby accelerate fetal lung maturation, reducing the risk of developing respiratory distress syndrome (RDS) by approximately 35-45% (6), contributing to significantly in the reduction of health expenses, a decrease in the need for neonatal intensive care, a shortening of the hospital stay and consecutively a lower social and economic impact at the family level. (7)

According to the World Health Organization (WHO), approximately 47% of deaths in children under 5 years of age occur during the neonatal stage (8), approximately 77% of these cases are secondary to respiratory difficulty and close to 50 % are attributable to SDR (9). In Ecuador, according to information presented by the National Institute of Statistics and Census (INEC) during the years 2018 and 2019, neonatal respiratory distress was the first cause of deaths in newborns, representing 16.51% and 15% of deaths. neonatal respectively (10).

According to a study carried out at the Matilde Hidalgo Specialized Hospital in Procel in 2019, around 132 preterm newborns (41.2%) were diagnosed with RDS, of which 47% (61 cases) were younger. at 34 weeks, revealing a significant incidence in this health institution (11).

The present investigation was carried out in a Hospital specialized in maternal and child health; The methodology used has a quantitative approach, non-experimental, retrospective and cross-sectional design with a correlational level. The method used was indirect observation. The sample consisted of 110 patients subject to selection criteria. The results showed that all preterm newborns who did not present respiratory distress received antenatal corticosteroid therapy (22.7%), the majority of neonates with mild RDS received corticosteroids (23.6%), while the development of moderate and severe RDS was associated with the lack of corticosteroid therapy (21.9%), demonstrating an inversely proportional relationship between antenatal

corticosteroid therapy and the severity of respiratory distress.

The objective of this study was to determine the effectiveness of the administration of antenatal corticosteroids in the prevention of respiratory distress syndrome in preterm newborns treated at the Matilde Hidalgo Specialized Hospital in Procel during the period January 2021 - December 2022.

How is the lack of prevention with antenatal corticosteroid therapy in mothers of preterm newborns under 34 weeks of gestation related to the development of respiratory distress syndrome?

Prenatal therapy with corticosteroids is recommended in women with threat of preterm birth and gestational age less than 34 weeks with the aim of accelerating fetal lung maturation and reducing the risk of developing RDS, which is why today it has become a practice. common in health systems(12).

The literature highlights that a complete course of antenatal corticosteroids (2 doses of betamethasone of 12 mg every 24 hours or 4 doses of dexamethasone of 6 mg every 12 hours administered intramuscularly) have been shown to reduce severe neonatal morbidity and mortality without long-term side effects (13). However, today there is a high incidence of respiratory distress syndrome in newborns born prematurely whose mothers have received prenatal corticosteroid therapy (14). Reason why it is important to determine its impact on the development of respiratory distress in newborns, as well as the evaluation of current adherence to antenatal corticosteroid therapy protocols in pregnancies of less than 34 weeks of gestational age (15).

Maternal administration of antenatal corticosteroids is an essential therapeutic approach in pregnant women at risk of preterm delivery from 24 to 34 weeks, the objective of which is to reduce neonatal morbidity and mortality (16). Various multicenter studies have demonstrated its effectiveness in reducing neonatal death and perinatal and neonatal complications (17). This effectiveness is due to the fact that prenatal corticosteroids promote the production of surfactant and thereby accelerate fetal lung maturation, reducing the risk of developing respiratory distress syndrome (RDS) by approximately 35-45% (18), contributing significantly in the reduction of health expenses, reduction in the need for neonatal intensive care, shortening of hospital stay and consecutively a lower social and economic impact at the family level. (19)

Currently, it is recommended that a course of prenatal corticosteroid therapy be administered in a schedule of 4 doses of dexamethasone 6 mg intramuscularly (IM) every 12 hours (total dose of 24 mg in 48 hours) or 2 doses of betamethasone 12 mg IM every 24 hours (24 mg total dose) (20). The action of corticosteroids is observed 24 hours after their administration, they reach a maximum effect after 7 days and persist until approximately 14 days after their use (21). Regarding its route of administration, most studies have been carried out with the use of corticosteroid intramuscularly, achieving favorable results and minimal or even zero side effects (22).

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maximum effect after 7 days and persist until approximately 14 days after their use (21).

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ANALYSIS OF VARIABLES

This study has a quantitative approach, with a non-experimental, correlational orientation.

Population made up of all preterm neonates treated at the Matilde Hidalgo Specialized Hospital of Procel during the period January 2021 to December 2022.

Non-randomized sample, for convenience, consisting of 110 neonates under 34 weeks treated at the Matilde Hidalgo Specialized Hospital of Procel during the period January 2021 to December 2022 subject to selection criteria.

Inclusion criteria: Neonates born before 34 weeks of gestation, Born during the period from January 2021 to December 2022 at the Matilde Hidalgo de Procel Specialized Hospital (HMHP), Complete medical history.

Exclusion criteria: Neonates with a history of fetal distress (meconium aspiration), Neonates with congenital malformations.

RESULTS

The average weight of the study sample was 1684 g, the average gestational age was 31 weeks, the average maternal age was 24 years and the number of prenatal controls was 4. In relation to the Silverman scale score The average value was 3 points with a minimum of 0 and a maximum of 8 points.
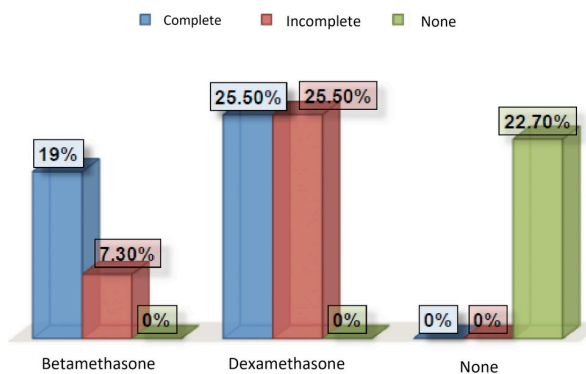
		Frequency	Percentage
Gender	Female	51	46,4
	Male	59	53,6
EG breaks	RNMP	34	30,9
	RNPE	15	13,6
	RNPM	40	36,4
	RNPT	21	19,1
Type of birth	Cesarean	64	58,2
	Vaginal	46	41,8
Breaks of maternal age	EMP	9	8,2
	EMT	24	21,8
	EMO	61	55,5
	EMA	16	14,5
Range of controls	Not acceptable	24	21,8
	Insufficient	28	22.6
	Enough	58	52,7
Types of maternal commorbities	Gynecological	25	22,7
	Endocrinological	12	10,9
	Hypertensive	24	21,8
	Infectious	18	16,4
	Others	4	3,6
	None	27	24,5
TOTAL		110	100.0

Table 2: Risk factors associated with preterm newborns

Prepared by: M. Feijóo, León

Source: Data collection matrix

The prevalent risk factors were male sex, gestational age between 32 to 33 weeks classified as moderately preterm newborns (PMN), delivery by cesarean section, optimal maternal age (MOA) included in the range of 20 to 34 years and maternal gynecological comorbidities followed by hypertensive disorders.

Elaborated by: M. Feijóo, León

Variables	Definition	Dimension	Indicators	Value scale	Type of variable	Source
Independent						
Antenatal cortiscosteroid therapy	Steroid scheme administered to pregnant women between 24 and 34 weeks of gestation with threat of pre-term delivery with the objective of accelerating fetal lung maturation and reducing neonatal morbidity and mortality.	Scheme of corticotherapy	Applied corticosteroid	Betamethasone; dexamethasone	QUALITATIVE	CLINICAL HISTORY
			Number of dosis	0; 1; 2; 3; 4	QUANTITATIVE	
			Therapy beginning	27 weeks; 28 to 30 weeks; over 31 weeks	QUANTITATIVE	
Dependent						
Neonatal respiratory distress syndrome	Respiratory distress syndrome (RDS), previously called hyaline membrane disease (HME), is a clinical condition characterized by progressive respiratory distress in preterm newborns (PNR), secondary to pulmonary surfactant deficiency as a result of prematurity	Clinical manifestations	Tachypnea Respiratory whine Nasal flaring Retraction of accessory muscles Xiphoid reaction Thoracoabdominal dissociation Hypoxemia: Saturation of 03 at 10 minutes Apgar test (one minute and five minutes)	> 60rpm Absent: audible with stethoscope; audible without stethoscope Absent: minimal; marked No retraction; barely visible; marked Synchronized: wobble inspiration delay < 85%; 86% - 94% > 95% < 3 points, 4 – 6 points; 7 points 0 points; 1 to 3 points, 4 – 6 points; > 7 points	QUANTITATIVE QUALITATIVE QUALITATIVE QUALITATIVE QUALITATIVE QUALITATIVE QUALITATIVE QUANTITATIVE	Clinical history
		Classifications according to severity	Silverman and Anderson scale Bence radiological classification	Grade 1 or mild form: Grade 2 or moderate form; grade 3 or severe form; Grade 4 or very severe form	QUANTITATIVE QUALITATIVE	
Intervener						
Risk factors	Detectable characteristics or circumstances of a person or group of people that are associated with an increase in the probability of suffering from, developing, or being especially exposed to a disease.	Maternal	Sociodemographics / Maternal Age	< 15 years; 16 to 19 years; 20 to 35 years; > 35 years	QUANTITATIVE	Clinical history
			Number of prenatal checkups	≤ 2; 3 – 4; ≥ 5	QUANTITATIVE	
			Comorbidities	Endocrinological, hypertensive, infectious, gynecological,	QUALITATIVE	
		Neonatal features	Weight (grams)	Small for gestational age (P.E.G.), suitable for gestational age (A.E.G.), large for gestational age (G.E.G.)	QUALITATIVE	
			Gender	Male / Female	QUALITATIVE	
			Gestational age (weeks)	< 28 SEG; 29 a 33 SEG; ≥ 34 SEG	QUANTITATIVE	
			Type of delivery	Vaginal / Cesarean	QUALITATIVE	

Source: Analysis of variables

Prepared by: M. Feijóo, León

	Weight	EG	Maternal age	Prenatal control number	Score: Silverman scale
Average	1684.55	31.36	24.99	4.42	3.58
Median	1550.00	32.00	24.00	4.00	4.00
Fashion	1100	34	28	6	0
standard deviation	613.026	2.183	7.310	1.993	2.680
	375801.168	4.766	53.440	3.970	7.181
Minimum	600	26	13	1	0
Maximum	2900	34	43	9	8

Table 1: Measurements of central tendency of preterm newborns under 34 weeks treated at the Matilde Hidalgo Specialized Hospital of Procel during the period 2021 -2022

Elaborated by: M. Feijóo, León

Source: Matrix of re-collection of data

EG: Pregnancy age

		Frequency	Percentage
Interpretation of the Silverman scale	No respiratory distress	25	22.7
	Mild respiratory distress	27	24.5
	Moderate respiratory distress	35	31.8
	Severe respiratory distress	23	20.9
TOTAL		**110**	**100.0**

Table 3: Respiratory evolution of preterm neonates

Elaborated by: M. Feijóo, León

		Interpretation of Silverman scale									
		No respiratory distress		Mild respiratory distress		Moderate respiratory distress		Severe respiratory distress		TOTAL	
Corticotherapy	No	0	0%	1	0,9%	14	12,8%	10	9,1%	25	22,7%
	Yes	25	22,7%	26	23,6%	21	19%	13	11,8%	85	77,3%
TOTAL		25	22,7%	27	24,6%	35	31,8%	23	20,9%	110	100%

Table 4: Preventive corticotherapy versus respiratory evolution in preterm newborns under 34 weeks treated at the Matilde Hidalgo specialized hospital in Procel, during the period January 2021 / December 2022

Elaborated by: M. Feijóo, León

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The corticosteroid most used for antenatal therapy in the study sample was dexamethasone applied in 51% of the study cases, compared to betamethasone which was administered only in 26.3% and a percentage of patients who did not receive no corticosteroid cycle in 22.7%; In relation to compliance with the prenatal corticosteroid therapy regimen, 44.5% of pregnant women completed the therapy doses, while 32.8% received an incomplete corticosteroid regimen. Betamethasone was the corticosteroid with the best adherence to compliance with the complete regimen.

In relation to the degree of severity of respiratory distress, the majority of preterm newborns presented moderate respiratory difficulty classified as a score on the Silverman scale of 4 to 6 points and a smaller percentage developed severe respiratory difficulty related to a score greater than or equal to at 7 points.

All patients who did not present respiratory distress received corticosteroid therapy, the greatest number of patients who presented mild RDS with little life risk received corticotherapy, and as the number of patients who received corticosteroid therapy decreased, the degree of severity increased. of respiratory distress in newborns. Translating that the lack of administration of antenatal corticosteroid therapy was related to the development of moderate to severe respiratory distress.

The administration of a complete regimen of antenatal corticosteroids was significantly related to the absence and/or lower degree of severity of RDS. While the application of incomplete doses was associated with a greater degree of moderate and severe respiratory difficulty.

It is evident that the use of antenatal corticosteroids was related to the absence or minimal severity of respiratory distress syndrome in a significant number of cases, compared to those who did not receive doses of corticosteroids and developed the disease in a higher proportion.

There is a statistically significant association between antenatal corticosteroid therapy and the prevention and/or reduction of the severity of RDS, since when performing the chi-square test it gave a P value of less than 0.05, so the null hypothesis is rejected and it is possible to affirm with 95% certainty that treatment with corticosteroid therapy is effective in preventing and/or reducing the severity of RDS.

	SDR (cases)	Number of SDR (controls)
Corticotherapy (exposed)	60 (a)	25 (b)
Without corticotherapy (not exposed)	25 (c)	0 (d)

Table 8: Probability ratio according to the ODDS ratio

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$$OR = (a / c) / (b / d) = (a \times d) / (b \times c)$$

$$OR = 60 \times 0 / 25 \times 25$$

$$OR = 0,0465$$

An Odds ratio (OR) less than 1 determines that there is little probability of developing RDS in those patients who were exposed to corticosteroid therapy, that is, the risk of presenting RDS is much lower in preterm newborns of mothers who were administered the regimen. of corticosteroids, compared to those who did not receive corticosteroid therapy.

DISCUSSION

The present study determined that the prevalent risk factors in the study sample were male sex with 53.6%, gestational age between 32 to 33 weeks classified as moderate preterm newborns (PMN) representing 36.4%, delivery by cesarean section. with 58.2%, optimal maternal age (MOA) included in the range of 20 to 34 years with 55.5% and

		COMPLIANCE OF TREATMENT						TOTAL	
		complete		incomplete		none			
Level of difficulty	No respiratory distress	22	20%	3	2,7%	0	0%	25	22,7%
	mild respiratory distress	15	13,6 %	11	10%	1	1%	27	24,5%
	moderate respiratory distress	10	9,1%	11	10%	14	12,7%	35	31,8%
	severe respiratory distress	2	1,8%	11	10%	10	9,1%	23	21%
TOTAL		49	44,5%	36	32,7%	25	22,8%	110	100%

Table 5: Compliance with the corticotherapy regimen

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		Prevention and reduction of severity				Total	
		No		Yes			
Corticotherapy	No	24	21,8%	1	0,9%	25	22,7%
	Yes	34	30,9%	51	46,3%	85	77,3%
Total		58	52,7%	52	47,3%	110	100%

Table 6: Corticosteroid therapy versus preventionand reduction of the severity of RDS in preterm neonates at the Procel Specialized Hospital, during the period of January 2021 / December 2022

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	Value	GL	Asymptotic significance (bilateral)	Exact significance (bilateral)	Non-exact significance (bilateral)
Pearson chi-square	24,305	1	<,001		
Continuity correction	22,110	1	<,001		
Likelihood ratio	29,356	1	<,001		
Fisher's exact test				<,001	<,001
Number of valid cases	110				

Table 7: Chi square test to verify hypotheses

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maternal gynecological comorbidities with 22.7%, followed by hypertensive disorders with 21.8%. These results are consistent with the study carried out by Palacios and Ochoa in 2020, where they identified that male sex, cesarean delivery (72.9%) and hypertensive disorders (12.8%) during pregnancy are part of the group of risk factors for developing SDR. (13)

The corticosteroid most used for antenatal therapy in the study group was dexamethasone, representing 50.9% compared to betamethasone, which was administered only in 26.4% of cases. In relation to compliance with the prenatal corticosteroid therapy regimen, 44.5% of pregnant women completed the appropriate doses, while 32.7% received an incomplete regimen. The administration of complete cycles of prenatal corticosteroids was significantly related to absence and/or lower degree of severity. of the SDR (33.6%), while the application of incomplete doses was associated with a greater degree of respiratory distress (20%). Other authors such as López Maldonado and Parra Gutiérrez in their study similarly determined that dexamethasone is the most used corticosteroid in the hospital environment, however they demonstrated that a single dose of betamethasone administered at least 3 hours before delivery reduces morbidity, mortality and the need for respiratory assistance in preterm neonates (15), results that differ from those obtained in this study.

The majority of preterm newborns presented moderate respiratory difficulty, representing 31.8%, followed by mild respiratory difficulty with 24.5%, without respiratory difficulty with 22.7%, and in a smaller number, severe respiratory difficulty with 20.9%. All RNP who did not present RDS received antenatal corticosteroid therapy, the majority of patients with mild RDS with low life risk received a complete corticosteroid

regimen, the development of moderate and severe RDS was associated with the lack of corticosteroid therapy, demonstrating an inversely proportional relationship between Antenatal corticosteroid therapy and the severity of respiratory distress. These results coincide with those of other researchers such as Pérez Ramírez et al, who in their study carried out in 2019 demonstrated that antenatal corticosteroid therapy reduces the risk of mortality in preterm newborns (11). Similarly, Escribano, Peña, López and Gómez in 2020, in their research, determined that there is a statistically significant correlation between the administration of antenatal corticosteroid therapy and the decrease in SDR in preterm newborns, translating into a decrease in neonatal morbidity and mortality. and concluding that therapy with antenatal corticosteroids reduces neonatal morbidity and mortality in general. (9)

CONCLUSIONS

The main risk factors associated with the development of neonatal RDS were male sex, gestational age between 32 and 33 weeks classified as moderately preterm newborns (PMN), delivery by cesarean section, maternal age between 20 and 34 years, and maternal comorbidities. gynecological type followed by hypertensive.

The corticosteroid most used for antenatal therapy in the study sample was dexamethasone. In relation to compliance with the regimen, betamethasone was associated with greater adherence to the complete treatment, while dexamethasone presented a complete and incomplete regimen in equal proportions.

The administration of complete cycles of antenatal corticosteroids was significantly related to the absence and/or lower degree of severity of RDS, while the application of incomplete doses was associated with the

presence of a higher degree of respiratory distress.

The majority of preterm newborns under 34 weeks under study presented moderate respiratory distress and, to a lesser extent, severe respiratory distress.

The respiratory evolution of preterm neonates who received antenatal corticosteroid therapy was related to the prevention and/or reduction of the severity of RDS.

The lack of prenatal corticosteroids was related to the development of moderate and severe RDS, determining that there is a statistically significant relationship between preventive corticosteroid therapy and the reduction of the incidence and/or severity of respiratory distress syndrome in preterm neonates under 34 weeks.

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