ORIGINAL RESEARCH

Factors associated with respiratory distress syndrome in the newborn at the José Carrasco Arteaga Hospital: A case-control study.

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Abstract

Introduction: Respiratory Difficulty Syndrome (RDS) is the most frequent cause of morbidity and mortality in newborns. Its pathology and associated factors must be known for timely and effective management. The aim of this study was to determine the factors associated with RDS in newborns at the "José Carrasco Arteaga" Hospital in 2018.

Methods: A case-control study with a ratio of 1: 2 matched with respect to sex and month of birth was conducted. Weight, maternal age, Apgar, prenatal controls, gestational age, type of delivery, maternal pathology, presence of meconial fluid, and antenatal use of corticosteroids were compared. The association was evaluated by OR (95% CI) and significance was tested with the chi-square test; Statistical significance was set at $P<0.05$.

Results: A case-control study with a ratio of 1: 2 matched with respect to sex and month of birth was conducted. Weight, maternal age, Apgar, prenatal controls, gestational age, type of delivery, maternal pathology, presence of meconial fluid, and antenatal use of corticosteroids were compared. The association was evaluated by OR (95% CI) and significance was tested with the chi-square test; Statistical significance was set at $P<0.05$

Conclusions: The major factors associated with RDS were low weight and macrosomia, together with the presence of meconium fluid.

Keywords: Respiratory distress syndrome. Newborn. Associated factors.

Introduction

Respiratory distress syndrome (RDS) is one of the leading causes of respiratory failure and neonatal death. According to the World Health Organization (WHO) [1], RDS represents 47% of deaths in children under 5 years of age.

Prematurity is considered to be the main risk factor for RDS, but perinatal asphyxia, the absence of antenatal administration of corticosteroids, male sex, cesarean delivery, and factors inherent to the mother such as gestational hypertension, maternal diabetes, and lack of prenatal checkups also influence its presentation.

Most preventable neonatal deaths are often associated with quality of care at the time of delivery and are potentially preventable or treatable. The WHO suggests that intensifying care for mothers and newborns (NBs) during the critical time after birth could prevent two-thirds of deaths [2].

Health policies are aimed at protecting the child from conception via adequate control of pregnancy and birth under the best conditions. However, factors such as an unfavorable work situation for the pregnant woman, the additional burden established by sociocultural elements related to the role of women, lack of access to health services, work situations of health personnel, infrastructure conditions and equipping services, and changes in the natural practice of processes such as childbirth influence whether such health policies can be effectively implemented.

Health institutions are responsible for knowing and identifying the causes and factors that contribute to the occurrence of this pathology, to initiate primary and secondary prevention, and to provide quality care to both the mother and the newborn. The objective of this research was to determine the factors associated with the Respiratory Distress Syndrome in newborns at the "José Carrasco Arteaga" Hospital in the city of Cuenca-Ecuador in 2018.

Population and methods

Type of study

The present investigation is a case-control study. The match was made by sex and month of birth.

Study area

The study was carried out in the Maternal and Child Area of the José Carrasco Arteaga Hospital (HJCA), of the Ecuadorian Institute of Social Security of Cuenca - Ecuador.

Universe and sample

The universe included all newborns in the HJCA from January to December 2018. The cases were newborns who presented with RDS and had it registered in their medical history. The controls were the newborns who did not present with RDS. The sample was probabilistic and was calculated in the EPIDAT 3.1 program based on the following restrictions: the proportion of exposed cases: 10.24%, the proportion of exposed controls: 4%., and the expected OR: 2.74 (based on a study carried out at the Vicente Corral Moscoso Hospital in 2004 with respect to the adolescent mother factor associated with the newborn's respiratory distress). The ratio of controls to cases was 2: 1. The confidence level was set at 95%, and for a power of 80% the required number of cases was calculated to be 550.

Participants

Inclusion criteria for the group of cases

Neonates born at the institution, with a diagnosis of RDS registered in the medical history, of either sex were considered in this group.

Inclusion criteria for the group of controls

Neonates born in the HJCA without RDS recorded in the clinical history during their hospitalization, of the same sex and born the same month as their comparison case, were considered.

Exclusion criteria for cases and controls

Patients with confirmed heart disease and incomplete information records were excluded.

Variables

Dependent variable: respiratory distress syndrome. Independent variables: newborn weight, mother's age, Apgar, number of prenatal check-ups, gestational age, type of delivery, use of antenatal corticosteroids, presence of meconium fluid, gestational hypertension, gestational diabetes, and maternal anemia.

Procedures, techniques, and instruments.

A review of the medical records was carried out in the digital medical system (AS400), we proceeded to randomly identify those who presented with RDS and a sample was obtained for the study. Two controls were selected for each case and the information on the study variables was collected in a form designed for this purpose by the authors.

Statistic analysis

The quantitative variables: maternal age, gestational age, number of controls, birth weight, and Apgar were analyzed with measures of central tendency, dispersion, and range. To evaluate the normality of the distribution, the Kolmogorov - Smirnov test was used. The qualitative variables: use of antenatal corticosteroids, gestational hypertension, gestational diabetes, maternal anemia, type of delivery, and characteristics of meconium were treated with absolute and relative frequencies.

To determine the association, the variables were dichotomized, the dependent variable was the presence or absence of RDS, and the independent variables were each of the risk factors to be studied. The Odds Ratio was obtained as a measure of association. Conclusive associations were considered when the 95% confidence intervals (CI) for each OR excluded the unit.

Statistical significance was determined using the Chi-square test or Fisher's Exact Test, if applicable. A P value of <0.05 was considered statistically significant.

Results

General characteristics of the patients.

564 patients entered the study: 188 patients in the case group and 376 controls. The groups were comparable in month of birth and sex (Table 1). Pulmonary maladaptation was the main cause of RDS with 95/188 cases (50.53%), transient tachypnea in 69/188 cases (36.70%), the presence of hyaline membrane 10/188 cases (5.32%), aspiration syndrome meconium 7/188 cases (3.72%), congenital pneumonia 6/188 cases (3.19%), and congenital diaphragmatic hernia 1/188 case (0.53%).

Table 2 Clinical characteristics of the patients.

Table 1 Clinical characteristics of the study groups.

	RDS group n=188	Control Group n=376	P
Male sex	106 (56.38%)	215 (57.18%)	0.86
January	18 (9.57%)	36 (9.57%)	1.0
February	26 (13.83%)	52 (13.83%)	1.0
March	40 (21.28%)	79 (21.01%)	1.0
April	27 (14.36%)	55 (14.63%)	1.0
May	12 (6.38%)	24 (6.38%)	1.0
June	15 (7.98%)	30 (7.98%)	1.0
July	23 (12.23%)	46 (12.23%)	1.0
August	7 (3.72%)	14 (3.72%)	1.0
September	9 (4.79%)	18 (4.79%)	1.0
October	5 (2.66%)	10 (2.66%)	1.0
November	1 (0.53%)	2 (0.53%)	1.0
December	5 (2.66%)	10 (2.66%)	1.0

Main results

Table 2 shows the associated factors. Low weight and macrosomia, prematurity and postmaturity, cesarean delivery, presence of meconium fluid, gestational hypertension, and maternal anemia were identified as risk factors for the presence of RDS in the newborn; while the use of corticosteroids was a protective factor.

Resuscitation occurred in 18.90% of the cases and 0.53% of the controls.

Discussion

Neonatal RDS has a high impact on the morbidity and mortality of this vulnerable group of patients, and also involves a high material, economic, and human resources cost, since it can lead to a prolonged hospital stay. This in turn, has an emotional impact on the family environment.

In this research, the study sample consisted of 188 cases and 376 controls. The risk factors associated with RDS were low weight and macrosomia, prematurity and postmaturity, cesarean delivery, the presence of meconium amniotic fluid, gestational hypertension and maternal anemia; the use of corticosteroids was a protective factor.

The causal dynamics in medicine tend to modify the consistency of the statistical relationship; some factors remain while others modify their association with the problem under study. New research tends to configure the current panorama, in order to guide medical criteria based on preventive actions.

Variables	RDS group n=188	Control Group n=376	OR	95% CI		P
Low and very low Apgar	4 (2.1%)	1 (0.3%)	8.15	0.91	73.46	0.05
Amniotic fluid with fluid or thick meconium	32 (17.0%)	14 (3.72%)	5.30	2.75	10.22	<0.001
Diabetes in the mother	6 (3.2%)	4 (1.1%)	3.07	0.86	11.00	0.09
Cesarean delivery	137 (72.9%)	186 (49.5%)	2.74	1.88	4.01	<0.001
Low weight and macrosomia	37 (19.7%)	35 (9.3%)	2.39	1.45	3.94	<0.001
Gestational hypertension	24 (12.8%)	23 (6.1%)	2.25	1.23	4.10	0.01
Prematurity and postmaturity	41 (21.8%)	45 (12%)	2.05	1.29	3.27	<0.001
Gestational anemia	42 (22.3%)	46(2.2%)	2.06	1.30	3.27	<0.001
Number of controls not optimal	56 (29.8%)	86 (22.9%)	1.43	0.96	2.12	0.07
Teen and old mothers	26 (13.8%)	46 (12.2%)	1.15	0.69	1.93	0.59
Use of antenatal corticosteroids	25 (13.3%)	18 (4.8%)	0.33	0.17	0.62	<0.001

RDS: Respiratory Difficulty Syndrome. OR: Odds ratio

Low weight is a factor that has been widely associated with the presence of RDS, however both an excess and a noticeable deficiency in weight can generate respiratory distress. In our study, low weight showed a conclusive relationship with RDS, which is in line with previous research. For example, Fehlmann, et al., [3] studied 5,991 NBs with a weight <1500 grams at the 20 units of the South American Neonatology Network (Neocosur) between 2002 and 2007 and found 74% incidence of RDS among those with very low weight. A similar study was carried out by Wen, et al., [4] in 2019 in Taiwan, they reported 28.9% RDS in a total of 13,490 very low-weight NBs. Furthermore, Liu, et al. [5] in China, identified a significant relationship (OR 2.32; 95% CI 1.33 - 4.06) between low weight and RDS, also concluding that babies who weighed between 1000 and 1499 grams had a risk 3 times greater than those who weighed between 1500 and 2499 gr, who, in turn, presented a 2.5 higher risk. Condò, et al. [6], also worked with underweight children and established the relationship with RDS in three strata: early / moderate premature (OR 3.00; 95% CI 2.60 - 3.4); late (OR 2.5; 95% CI 1.60 - 3.70); at term (OR 47.90%; 95% CI 29.40 - 78.00) among children who weighed between 1500 and 2499 gr; NBs from 2500 to 3999 gr obtained OR and 95% CI of 0.2 (0.1 - 0.3), 0.5 (0.4 - 0.6) and 0.2 (0.1 - 0.2), respectively. Finally, Condò et al. [6] showed that, beyond gestational age, an inappropriate weight

for the NB places him in conditions of greater susceptibility.

Both prematurity and postmaturity in the newborn are risk factors for RDS and the present study showed a significant relationship between these factors and RDS (OR 2.05; 95% CI 1.29 - 3.27; P<0.001). This finding is in line with previous research: Guerrero 2018 [7], found that in 47 children who presented RDS, 54% were premature; Ramos 2018 [8], found a significant association between prematurity and RDS, (P<0.001) in a study of 216 children; and Fehlmann, et al. [3], found that the main risk factor for RDS was lower gestational age (P<0.001).

Birth by cesarean section was also identified as a risk factor in our study. This is in agreement with previous studies where a cesarean delivery has been shown to increase the risk for RDS by 3.5 times in a prospective study with 269 patients (Linares et al.,)[9]. A positive association between cesarean section and RDS has also been reported [4, 5, 10, 11] illustrating that this association is consistently observed. Furthermore, López et al., [12] compared the prevalence of RDS in neonates born by vaginal delivery and by elective cesarean section and concluded that term newborns born by planned cesarean section have a 3.5 times higher risk of presenting with RDS than those with a normal delivery. The same association was made by

Condó, et al., [6] where they found that elective cae-sarean section showed a higher risk in late preterm in-fants and in term newborns. While these studies all found an association, the strength of the association varied across studies, this could be due to the fact that natural delivery is promoted in our environment, unlike elective caesarean section by the mother which is more prevalent in other countries. As a corollary, it is clear that the natural conditions at birth are the ones that must be maintained.

In the present work, the association between the presence of meconium amniotic fluid and respiratory distress syndrome in newborns was confirmed. Simi-larly, Macías [13], when analyzing the histories of 150 newborns, determined that 13.3% presented with RDS after meconium aspiration.

Our findings show that gestational hypertension doubles the risk of developing RDS. This finding sup-ports previous work, for example, Liu, et al., [5] who worked only with term children, found a significant as-sociation between the presence of a hypertensive mother and RDS (P= 0.02); Wen, et al., [4] also reached the same conclusion. In the present study, when ges-tational age is considered as a confounding variable and only term newborns are included, the OR is 1.69 (95% CI 0.80 - 3.54; P = 0.16) and the association is lost, however, it would be interesting to carry out new stud-ies that include this variable to determine its behavior.

Gestational anemia has not been widely studied in previous research. In the current work, the relationship between this maternal pathology and the presence of RDS in the newborn increased the risk of RDS by 2.06 times; conclusions similar to those reported by Mon-tano, [14] (OR 4.86; IC 1.77-13.4; P= 0.001). Furthermore, De Sá, et al., [15] 2015, reported that 50% of newborns born to anemic mothers, presented with Neonatal RDS. However, there is currently little research investi-gating this association, therefore these results should be viewed with caution.

The administration of corticosteroids under the threat of preterm delivery has been a favorable ther-apeutic approach for lung maturity. In the present work, the antenatal use of corticosteroids as a protec-tive factor for RDS was confirmed [3, 16] also affirmed this by associating these variables [(OR 0.59; 95% CI 0.49 - 0.72); (OR 0.46; 95% CI 0.34 - 0.64)]. Wen, et al, [4] concluded that the use of prenatal steroids in two doses was considered protective against the develop-ment of severe RDS [OR (95% CI), 0.8 (0.69-0.93).

The variables number of prenatal check-ups and gestational diabetes did not show a relationship with RDS, this can be attributed to the fact that maternal pathology is undervalued, and is not recorded in the clinical history.

Conclusions

The major factors associated with RDS were low weight and macrosomia together with the presence of meconium fluid.

Abbreviations

NBs: newborns. RDS: Respiratory Difficulty Syndrome. OR: Odds ratio. WHO: World Health Organization.

Authors' contributions

JAPS: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Writing – orig-inal draft.
TMOB: Supervision, Validation, Visualization, Software, Writing – review & ed-iting. All authors read and approved the final version of the manuscript.

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Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available due participant confidentiality but are available from the corresponding author on reasonable request.

Ethical statements

This protocol was approved by the bioethics commission of the Faculty of Medical Sciences of the University of Cuenca.

Protection of persons

The authors declare that the procedures followed were in accordance with the ethical standards of the responsible human experimentation committee and in accordance with the World Medical Association and the Declaration of Helsinki.

Confidentiality of the data

The authors declare that they have followed the protocols of their work center on the publication of patient data.

Consent for publication

The authors have obtained the informed consent from the caretakers of the patients referred to in the article. This document is in the possession of the corresponding author. The parents have signed the authorization for publication of this article.

Competing interests

The authors have no competing interests to declare.

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