Annals of Clinical and Analytical Medicine
Original Research

Risk factors for neonatal respiratory distress : Moroccan retrospective study

Latifa Mochhoury[1], Fatima Dahmani[2], Touria Essayagh[1], Ikram Marc[1], Amina Barkat[3]
[1] Department of science Laboratory of Health Sciences and Technologies, Higher institute of Health Sciences, Hassan First University, Settat
[2] Department of Hematology, Faculty of Medicine and Pharmacy Research Team in hemalology, Mohammed V. University, Rabat
[3] Department of Neonatology Research Team in Maternal and Child Health and Nutrition, Faculty of Medicine and Pharmacy, Mohammed V University, Rabat, Morocco

Abstract

Aim: The aim of the study was to determine the risk factors for neonatal respiratory distress.

Material and Methods: This retrospective analytical study was conducted at the National Reference Center for Neonatology and Nutrition at Children's Hospital, University Hospital Centre IbnSina of Rabat from January 1, 2021 to December 31, 2022.

During the study period, 630 newborns who met the inclusion criteria were included in 2 groups: neonates with respiratory distress (n=421) and neonates without respiratory distress (n=209). The identification of risk factors was carried out using bivariate as well as multivariate analyses

Results: 630 births were collected during this period Neonatal respiratory distress was multifactorial. Statistical analysis could reveal mostly maternal anemia (OR = 18.10; CI95 (7.5 -43.55); p < 0.05), diabetes (OR = 3.65; CI 95 (1.98-6.72); p = 0.001), caesarean section (OR = 4.23; CI 95 (1.54-11. 59); p = 0.001), prematurity (OR = 2.45; CI 95 (1.41-4.26); p =0.01).

Discussion: Screening, management, and reduction of neonatal respiratory distress remain a crucial challenge, requiring early coordination between pediatricians and obstetricians to obtain reliable data and identify newborns at risk.

Keywords

Neonatal Respiratory Distress, Maternal Anemia, Diabetes, Prematurity

DOI: 10.4328/ACAM.21998 Received: 2023-09-27 Accepted: 2023-11-06 Published Online: 2023-12-06 Printed: 2024-03-01 Ann Clin Anal Med 2024;15(3):154-159

Corresponding Author: Latifa Mochhoury, Department of science Laboratory of Health Sciences and Technologies, Higher institute of Health Sciences, Hassan First University, Settat Morocco.

E-mail: latifa.mochhoury@uhp.ac.ma P: +212 620 303 5 82

Corresponding Author ORCID ID: https://orcid.org/0000-0002-5019-2296

This study was approved by the Ethics Committee of CERB of the Faculty of Medicine and Pharmacy (Date: 2021-24-02, No: C64/20)

Introduction

The birth of newborns is associated with intrinsic and extrinsic alterations that ensure the transition from the intrauterine to the extrauterine environment particularly at the pulmonary and cardiovascular levels. At times Generally, the newborn adapts naturally to extra-uterine conditions. However, in some cases, this naturaladaptation fails, leading to cardiac arrest associated with hypoxia and severe neurological damage, requiring immediate and rapid management [1].

Neonatal respiratory distress is caused by a deficit in oxygen supply leading to a change in the physiologic state of the newborn. This incident compromises the vital prognosis of the infant in particular by alternating phases of hypoxia and acidosis. Additionally, neonatal respiratory distress is often the product of a number of vectors such as hyaline membrane disease, late amniotic fluid resorption, prematurity, fetal asphyxia and neonatal infections. In underdeveloped countries, neonatal respiratory distress is more common given lower socioeconomic conditions and more prevalent risk factors leading to perinatal complications such as poor or absent infrastructure [2] that threaten maternal and fetal survival.

In addition to the lack of research, there is a lack of information on this syndrome in Morocco, so we aimed this study to provide valuable data in order to help identify the frequency of respiratory distress and the risk factors associated with this major public health problem in newborns in the neonatal unit of Children's Hospital of Rabat.

In Morocco, Neonatal Respiratory Distress Syndrome (NRDS) is recognized as a major public

health problem and a constant concern in neonatology units due to its frequency and severity.

Our results highlight the importance of specific risk factors in the development and severity of

NRDS and can be used to inform evidence-based NRDS management protocols in the Neonatal

Intensive Care Unit (NICU), develop strategic planning for obstetric management, and hopefully set the basis for further epidemiological studies.

Material and Methods

Study Population and Design

This retrospective analytical study was conducted at the National Reference Center for Neonatology and Nutrition at Children's Hospital of Rabat from 1 January 2021 to December 31, 2022. The study concerned hospitalized newborns for neonatal respiratory distress. As a tertiary hospital, the neonatal unit of Children's Hospital of Rabat is one of the main neonatal units in Morocco. Through consecutive convenience sampling, we included all complete and eligible files of newborns admitted within the early neonatal period (first seven days of life). Data were extracted from the files into a case record form.

Study variables

Data collection was carried out by a documentary technique consisting of studying the medical records of each neonate. All data were entered using an information sheet containing the following sections:

- Maternal and obstetrical characteristics
- Characteristics of the newborn
- Evaluation of the patient
- Dependent variable: neonatal respiratory distress
- Independent variables:

▸ Socio-demographic characteristics: age, residence, marital status, educational and socioeconomic status of the mother, gestational age and area of origin

▸ Obstetrics-related factors: gravidity, parity, current mode of delivery.

▸ Newborn characteristics (sex, birth weight, Apgar score, Silverman score, and time to respiratory distress> or <3 hours.

▸ Immediate resuscitation at birth.

▸ Amniotic rupture.

▸ Maternal pathologies during pregnancy (gestational diabetes, pre-eclampsia, goiter, asthma and anemia)

▸ Evaluation of the severity is based on a Silverman score, which is composed of inspiratory and expiratory categories of movements.

The scale of the Silverman score ranges from 0 to 2:

- Neonatal moderate respiratory distress corresponding to Silverman ≤4
- Intense Neonatal Respiratory Distress corresponding to Silverman between 4 – 6
- Very intense Neonatal Respiratory Distress corresponding to Silverman >6

Inclusion Criteria:

Symptomatic or asymptomatic neonates hospitalized for clinical management of neonatal respiratory distress were included.

Exclusion Criteria:

- All newborns with congenital malformations
- Incomplete data sheets
- Respiratory distress of surgical origin.

Definitions of used terms:

- neonatal respiratory distress is defined by the presence of at least one of the following elements: abnormal respiratory rate (tachypnea > 60 breaths/min; bradypnea < 30 breaths/min; respiratory pauses, or apnea) or signs of labored breathing (expiratory grunting, nasal flaring, intercostal recessions, xyphoid recessions or thoracoabdominal asynchrony)) = •

Silverman's score = A score greater than 7 indicates that the baby is in respiratory failure.

•Delay of care at birth: refers to the time it takes to seek care after the onset of labor that is longer than 1 hour.

•Primimarous: a woman pregnant for the first time

•Multiparous: a woman who has had multiple births

•Premature rupture of membranes (PROM) is a rupture (breaking open) of the membranes (amniotic sac) before labor begins.

Data Analysis

•The descriptive analysis of the variables was based primarily on class size ; proportions. Mean and standard deviations were used as measures of central tendency and dispersion. Qualitative variables were compared using the chi-square test or Fisher's exact test.The Kolmogorov-Smirnov test was used for the study of the distribution of the variables. Pearson's correlation test was performed to understand the relationships between

quantitative variables. Comparisons of means of quantitative variables for different classes of qualitative variables were performed using the Student's t-test for independent samples. After verification of the different conditions of the test for all statistical tests, p <0.05 was considered significant.

Ethical Approval

• This study was approved by the Biomedical Research Ethics Committee CERB of the Faculty of Medicine and Pharmacy on (Date: 2021-24-02, No: N/R : File n° C64/20).

• This study is a part of the research project "Near Miss Neonatal in Morocco"

Results

We included 630 newborns, among whom 421 had neonatal respiratory distress symptoms NRDS.

Table 1 shows that the median maternal age was 35 years (Q1-Q3: [22, 36]). The distribution according to educational level was dominated by illiteracy and secondary education with respective percentages of 48.2% and 44.2%, p<0.05. On the other hand, the university level was only 7.6% of the population. The mean gestational age of the newborns was 36.8 ± 8.86 gestational weeks; socioeconomic status was low in 54.2% of the cases and medium in only 45.8%, p<0.05.

Table 2 indicates that among 421 neonates with neonatal respiratory distress, 190 were female and 231 were male, with a sex ratio of 1.21; the sex of the neonate had no effect on neonatal respiratory distress in our study (p=0.62), the mean birth weight was 3000g (Q1-Q3: [2100; 4050]).

The cesarean section prevailed in 80.5% of cases, with a significant statistical difference p<0.05; early rupture of membranes >12 hours was 84.1% and aspect of amniotic fluid (55.1%) p<0.0

The main maternal and neonatal pathologies associated with respiratory distress were anemia (p<0.05), pre-eclampsia (p=0.02), maternal infection (p<0.05) and gestational diabetes (p<0.05). The main identified causes of respiratory distress were transitory tachypnea (16.5%), maternal-fetal infection (19.6 %), hyaline membrane disease (30. 1%) and prematurity (54%).

Multiple regression statistical analysis primarily incriminated anemia (OR = 18.10; 95 CI (7.5 -43.55); p <0.05), diabetes (OR = 3.65; 95 CI (1.98-6.72); p = 0.001), cesarean section (OR = 4.23; 95 CI (1.54-11.59); p = 0. 001), prematurity (OR = 2.45; 95 CI (1.41-4.26); p = 0.01), appearance of amniotic fluid (OR = 27.9; 95 CI (13.46-55.34); p < 0.005); premature rupture of membranes (OR = 5.40; 95 CI (2.58-11.29); p < 0.05), and early resuscitation at birth (OR = 30.95; 95 CI (13.65-70.13); p < 0.05), (Table 3).

Discussion

In this study, we registered 420 newborns with respiratory distress (66.6%); several risk factors for respiratory distress have been identified.

Age was a determinant of neonatal respiratory distress in our study. We found that the median age of our patients was 35 years (Q1-Q3: [22; 36]). Indeed, maternal age between 30 and 40 is well known to be associated with morbidity and neonatal respiratory distress, which may be explained by the increased risk of chronic diseases such as diabetes and hypertension at this age [3, 4].

In our sample, there is a relationship between low maternal education and neonatal respiratory distress. Indeed, low level of education seems to be a factor limiting perinatal health care and the use of medical services due to the lack of awareness and information.

Many studies have shown that the rate of fetal respiratory

Table 1. Patients' characteristics

Patients' characteristics		Neonates without respiratory distress	Neonates with respiratory distress	p
		N=209 ( ) %	N= 421( ) %	
Age (year)	< 21	(577) 36.8	(42)10.0	<0.05*
	21-35	(34)16.3	(126)29.9	
	> 35	(98)46.9	(253)60.1	
Parity	Primiparous	(139)66.5	(216)51.3	<0.05*
	Multiparity >2	(70)33.5	(205)48.7	
Provenance	outborn	(86)41.1	(212)50.4	<0.05*
	inborn	(123)58.9	(209)49.6	
Socioeconomic Level	<3000dh	(49)23.4	(228)54.2	<0.05*
	>3000dh	(160)76.6	(193)45.8	
Level of education	Primary school	(74)35.4	(203)48.2	<0.05*
	Secondary school	(118)56.5	(186)44.2	
	university	(17)8.1	(32)7.6	
antenatal consultations	< 3CP	(196)93.8	(365)86.7	<0.05*
	>3CP	(13)6.2	(56)13.3	
Preterm or Term (wk)	Preterm	(58)27.8	(228)) 54	<0.05*
	28-35			
	Terme	(126)60.3	(60)14.3	
	36-40			
	Term >40	(25)12.0	(133)31.6	

* Significant (P < 0.05). Quantitative variables were expressed as average ± standard deviation and qualitative variables were expressed in numbers and percentages

distress is inversely proportional to the mother's level of education [6]. This could be due to a better diet, better hygiene and the greater use of health services by educated women.

In Morocco, lack of access to emergency neonatal care is widespread among women living in rural and isolated communities, therefore women are far from medical facilities.

54.9% were male with a sex ratio of 1.21; Our results are not significant regarding the association between neonatal respiratory distress and gender. That's contradictory,because male gender is a risk factor for respiratory distress due to the frenative effect of androgens on surfactant synthesis, which delays lung maturation in males compared to females [7]. Conversely, female fetuses produce surfactant earlier and have more developed lung parenchyma and airways [8, 9].

The average weight was 3000g (Q1-Q3: [2100; 4050]); neonatal respiratory distress was higher in newborns weighing less than 2500g; thus, 54.4% of newborns were hypothrophic, 13.5% eutrophic and 32.1% macrosomia. Our study is in agreement with study [10], which explains that hypotrophy is secondary to chronic hypoxia induced by hypertension and to nutrient delivery to the fetus due to decreased uteroplacental perfusion. Thus, Doppler velocimetry analysis of umbilical artery blood flow correlates with increased respiratory complications in neonates of hypertensive mothers [11].

Oxygen therapy is systematically used in all cases of respiratory distress and in all newborns (full term or premature). Our study reports that a majority (94.4%) of newborns were not resuscitated at birth (oxygen therapy; artificial ventilation).

This confirms that the management at birth of the newborns in our sample presents major difficulties. Indeed, newborns come from peripheral health centers and district hospitals; therefore, referrals are made by poor quality and non-medical transport. Alamneh et al. identified that the main risk factors for birth asphyxia were fetal distress, instrumental delivery, low birth weight, non-cephalic presentation, preterm, prolonged labor, co-morbidity during pregnancy and Meconium-stained amniotic

Table 3. Multivariate analysis of risk factors for neonatal respiratory distress

	OR IC 95			p
Cesarean	4.23	[1.54 ;	11.59]	.005*
Prematurity	2.45	[1.41 ;	4.268]	.001*
Diabetes	3.65	[1.98 ;	6.727]	.000*
Maternal Anemia	8.10	[7.52 ;	43.55]	.000*
Resuscitation at birth	30.95	[13.65 ;	70.13]	.000*
PROM	5.40	[2.58 ;	11.29]	.000*
A F A	27.29	[13.46 ;	55.34]	.000*

*Significant, OR: Odds ratio; a p-value < 0.05 was considered significant. PROM: Premature rupture of membranes. AFA: amniotic fluid appearance

Table 2. Obstetrical neonatal Characteristics and associated maternal pathologies

Obstetrical Characteristics		Neonatal respiratory distress		p
		Neonates without respiratory distress N=219 ( ) %	Neonates with respiratory distress N=421 ( ) %	
Delivery mode	Low way	(75)35.9	(82)19.5	<0.05*
	Cesarean	(134)64.1	(339)80.5	
Membrane rupture (hour)	> 12	(189)90.4	(354)84.1	<0.05*
	<12	(20)9.6	(67)15.9	
Amniotic fluid	Clear	(187)89.5	(189)44.9	<0.05*
	meconium	(22)10.5	(232)55.1	
associated maternal pathologies				
Asthma	(196) 93.8		(378) 89.8	0.09
Goiter	(199) 95.2		(391) 92.9	0.2
Preeclampsia	(154) 73.7		(274) 65.1	0.02*
Infections	(173) 82.8		(275) 65.3	<0.05*
Maternal Anemia	(197) 94.3		(241) 57.2	<0.05*
Gestational			(377)89.5	<0.05*
Diabetes	(123) 58.9			
Neonatal characteristics				
Birth weight				
Normal	(129)61.7		(57)13.5	
hypotrophy	(51)24.4		(229) 54.4	<0.05*
Macrosomia	(29)13.9		(135)32.1	
Prematurity	(56)26.8		(230)54	<0.05*
Silverman score				
>4	(209)100		(1)0.2	
4.6	----------		103)24.5	0.05*
>6	.....		(317) 75.3	

*Significant (P < 0.05). Quantitative variables were expressed as average ± standard deviation and qualitative variables were expressed in numbers and percentages

fluid (MSAF). Most of these factors are preventable through holistic care for pregnancy, labor and delivery. Therefore, to reduce neonatal mortality associated with birth asphyxia, attention should be paid to holistic pregnancy care services, labor and delivery care. Furthermore, intervention strategies aimed at reducing birth asphyxia should target the identified factors [12].

We can say that neonatal respiratory distress is closely related to cesarean section, which is consistent with the study that showed a ten times higher incidence of neonatal airways . In theory, the delay in resorption of alveolar fluid when adapting to the extrauterine environment during a programmed caesarean section induces hormonal imbalance of catecholamines and a defect of maturation of the fetal lungs leading to neonatal respiratory distress [13, 14].

Theoretically, the delay in resorption of alveolar fluid during adaptation to the extra-uterine environment during a programmed caesarean section induces a hormonal imbalance in the catecholamines released and a defect in the maturation of the fetal lungs [15].

The relationship between maternal diabetes mellitus (DM) and neonatal respiratory distress syndrome (RDS) has long been recognized.

Our results are in line with meta-analysis suggesting that maternal DM is linked to an increased risk of neonatal RDS, especially when diabetes is not well controlled, maternal hyperglycemia causes a disorder of carbohydrate metabolism in the developing embryo with alterations in various metabolic pathways that create oxidative stress [16].

Our result is in line with studies [17], which showed that serious complications lead to intensive care unit admission, causing a serious burden on healthcare units. Paying more attention to the healthcare needs of pregnant women can help identify preeclampsia earlier and minimize the complications associated with it.

High blood pressure and high proteinuria are two main characteristics of preeclamptic patients, affecting the organs of the mother and fetus [18].

Our results confirm that anemia was a global problem with serious consequences for mothers and their babies. Even though anemia in pregnancy is readily treatable, data from several studies show an association between maternal anemia and severe adverse maternal and perinatal outcomes [19, 20]. We are confident that our findings are a robust demonstration of an independent link between severe anemia and SDR. Although our results do not explain a direct maternal cause of anemia ; iron and folic acid deficienciescan be incriminated, probably due to both inadequate nutrition and low socio-economic status. Prevention and treatment of anemia during pregnancy and post-partum should remain a global public health and research priority.

Conclusion

Neonatal respiratory distress is multifactorial and requires special attention. This study highlighted the seriousness of this syndrome. It also showed that the main risk factors are prematurity, cesarean section, gestational diabetes, anemia and pre-eclampsia.

Consequently, a thorough understanding of these factors enables us to implement preventive strategies.

We can propose the following recommendations:

- Strengthening the technical and human resources of the neonatology department, referral hospitals and provincial hospitals.
- Training in neonatal resuscitation techniques during classes.
- Early medical referral of severe cases is essential.
- Improving the health status of mothers and newborns

Limitations of this work:

Our study was retrospective and our database was limited and many parameters are missing. We conducted this study during COVID-19, thus, access to different unit was not free.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or compareable ethical standards.

Funding: *None*

Conflict of Interest

The authors declare that there is no conflict of interest.

References

1. Zec SL, Selmanovic K, Andrijic NL, Kadic A, Zecevic L, Zunic L. Evaluation of drug treatment of bronchopneumonia at the pediatric clinic in Sarajevo. Med Arch. 2016;70(3):177-81.

2. Nascimento-Carvalho AC, Ruuskanen O, Nascimento-Carvalho CM. Wheezing independently predicts viral infection in children with community-acquired pneumonia. Pediatr Pulmonol. 2019;54(7):1022-8.

3. Abdelgabar SA, Babikr WG, Elhussein AB, Hummeida ME. Risk of respiratory morbidity in term infants delivered by elective cesarean delivery. Int J Med Sci Public Health. 2016;5:973-7.

4. Wyckoff MH, Aziz K, Escobedo MB, Kapadia VS, Kattwinkel J, Perlman JM, et al. Neonatal resuscitation: 2015 American Heart Association Guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. Pediatrics. 2015;136(Suppl.2):S196-218.

5. Timofeev J, et al. Obstetric complications. neonatal morbidity, and indications for cesarean delivery by maternal age. Obstet Gynecol. 2013;122(6):1184-95.

6. Beaujouan É, Reimondos A, Gray E, Evans A, Sobotka T. Declining realisation of reproductive intentions with age. Hum Reprod. 2019;34(10):1906-14.

7. Bongen E, et al. Sex Differences in the Blood Transcriptome Identify Robust Changes in Immune Cell Proportions with Aging and Influenza Infection. Cell Rep. 2019;29(7):1961-73.e4.

8. Silveyra P, Fuentes N, Rodriguez Bauza DE. Sex and gender differences in lung disease. Adv Exp Med Biol. 2021;1304:227-58.

9. Shibata M, Ogawa K, Kanazawa S, Kawasaki M, Morisaki N, Mito A, et al. Association of maternal birth weight with the risk of low birth weight and small-for-gestational-age in offspring: a prospective single-center cohort study. PLoS One. 2021;16(5):e0251734.

10. Barreto CTG, Tavares FG, Theme-Filha M, Farias YN, Pantoja LN, Cardoso AM. Low birthweight, prematurity, and intrauterine growth restriction: results from the baseline data of the first indigenous birth cohort in Brazil (Guarani Birth Cohort). BMC Pregnancy Childbirth. 2020;20(1):781.

11. Mehari M, Maeruf H, Robles CC, Woldemariam S, Adhena T, Mulugeta M, et al. Advanced maternal age pregnancy and its adverse obstetrical and perinatal outcomes in Ayder comprehensive specialized hospital, northern Ethiopia, 2017: A comparative cross-sectional study. BMC Pregnancy Childbirth. 2020;20(1):60.

12. Alamneh YM, Negesse A, Aynalem YA, Shiferaw WS, Gedefew M, Tilahun M, et al. Risk Factors of Birth Asphyxia among Newborns at Debre Markos Comprehensive Specialized Referral Hospital, Northwest Ethiopia: Unmatched Case-Control Study.Ethiop J Health Sci. 2022;32(3):513-22.

13. Tefera M, Assefa N, Mengistie B, Abrham A, Teji K, Worku T. Elective Cesarean Section on Term Pregnancies Has a High Risk for Neonatal Respiratory Morbidity in Developed Countries: A Systematic Review and Meta-Analysis. Front. Pediatr. 2020;8:286.

14. Saddi YIA, Baythoon MB, Tahir AG. The timing of elective caesarean deliveries and early neonatal respiratory morbidity in term neonates. J Faculty Med. 2018;60:38-42.

15. Raveloharimino H. Fiangoa F. Ratianarison F. Rabesandratana HN. Epidemio-clinical profile of respiratory distress seen at the CME CHU PZAGA Mahajanga. Rev Malg Ped 2018;1:34-41.
16. Li Y, Wang W, Zhang D. Maternal diabetes mellitus and risk of neonatal respiratory distress syndrome: A meta-analysis. Acta Diabetol. 2019;56:729-40.
17. Khan B, Allah Yar R, Khakwani AK, Karim S, Arslan Ali H. Preeclampsia Incidence and Its Maternal and Neonatal Outcomes With Associated Risk Factors. Cureus. 2022;14(11):e31143.
18. Mou AD, Barman Z, Hasan M, Miah R, Hafsa JM, Das Trisha A. Prevalence of preeclampsia and the associated risk factors among pregnant women in Bangladesh. Sci Rep. 2021;11(1):21339.
19. Kadhim Jasim S, Al-Momen H, Al-Asadi F. Maternal Anemia Prevalence and Subsequent Neonatal Complications in Iraq. Open Access Maced J Med Sci. 2020;8:71-5.
20. Menon KC, Ferguson EL, Thomson CD, Gray AR, Zodpey S, Saraf A, et al. Effects of anemia at different stages of gestation on infant outcomes. Nutrition. 2016; 32(1):61-5.

How to cite this article:
Latifa Mochhoury, Fatima Dahmanı, Touria Essayagh, Ikram Marc, Amina Barkat. Risk factors for neonatal respiratory distress : Moroccan retrospective study. Ann Clin Anal Med 2024;15(3):154-159

This study was approved by the Ethics Committee of CERB of the Faculty of Medicine and Pharmacy (Date: 2021-24-02, No: C64/20)