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Causes and Outcomes of Respiratory Distress in Neonates Hospitalized in the Neonatal Intensive Care Unit of Be'sat Hospital in Hamadan, Iran

*Mohammad Kazem Sabzehei[1], Behnaz Basiri[1], Maryam Shokouhi[1], Afshin Fayyazi[1]

[1]Department of Pediatrics, Hamadan University of Medical Sciences, Hamadan, IR Iran.

Abstract

Background

Neonatal respiratory distress is one the most common problems in the first few day of neonatal life. The present study intended to determine the frequency of the causes and outcomes of respiratory distress in neonates hospitalized in the neonatal intensive care unit (NICU) in Hamadan city, Iran.

Materials and Methods

In this descriptive and cross-sectional study, all the neonates with respiratory distress (RD), who were hospitalized in the NICU of Be'sat Hospital in Hamedan city, Iran, during 2014 to 2015, entered the study. The required demographic information was extracted from patients' dossiers. The collected data were analyzed using SPSS version 16.0.

Results

The mean neonatal age upon admission, mean gestational age and mean birth weight were 5.22±7.18 days, 36.58±3.54 weeks and 2743.9±727.9 grams, respectively. According to the results, intercostal retraction (75.3%), tachypnea (67.7%), and grunting (61.3%) were the most common symptoms of neonatal respiratory distress (NRD), while respiratory distress syndrome (RDS) (36.6%), pneumonia (30.1%), and transient tachypnea of the newborn (TTN) (%14), were the most common causes of respiratory distress. Furthermore, about 19.3% of the neonates died of the disease. The results of logistic regression for the independent risk factors associated with RD outcomes showed that the death rate of neonates with RD had a significant correlation with respiratory failure requiring mechanical ventilation (odds ratio[OR]: 33.49, 95% confidence interval [CI]: 6.95-161.38), and incidence of apnea (OR: 5.87, 95% CI: 1.072-32.167).

Conclusion

It was found that RDS is the most common cause of respiratory distress in the hospitalized neonates. Moreover, infant mortality rate increased due to respiratory failure requiring mechanical ventilation and occurrence of apnea.

Key Words: Neonate, Outcomes, Respiratory Distress.

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Corresponding Author:

Mohammad Kazem Sabzehei, Department of Pediatrics, Hamadan University of Medical Sciences, Hamadan, Iran. Tel: +98-32640064

E-mail: mk_sabzehei@yahoo.com

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1- INTRODUCTION

Neonatal respiratory distress (NRD) is one the most common problems in the first few day of neonatal life which is diagnosed with the presence of one or more symptoms of tachypnea, intercostal muscle retraction, grunting, nasal flaring and cyanosis. NRD has been reported to be prevalent in %5 to 29% of the NICU-hospitalized neonates (1-3). The risk factors of NRD include prematurity, cesarean delivery, meconium stained amniotic fluid, gestational diabetes, preeclampsia, multiple pregnancies, chorioamnionitis, oligohydramnios and structural disorders of lung (4, 5).

Neonatal respiratory distress may root in pulmonary and extrapulmonary disease or has a benign cause such as transient tachypnea of the newborn (TTN) rather than a symptom of a serious infection, encephalopathy or congenital anomalies. A wide range of NRD causes include respiratory distress syndrome (RDS), transient tachypnea of the newborn (TTN), meconium aspiration syndrome (MAS), sepsis, pneumonia, early asphyxia, congenital heart disease (CHD), pulmonary anomalies etc. (6, 7). However, the general principles of care are the same in all cases regardless of NRD causes. Therefore, early diagnosis and timely treatment of NRD is of utmost importance; otherwise, it may cause respiratory failure as one of the most important causes of infant mortality i.e. it accounts for %15 of the total infant mortality (8).

It is highly important to understand the exact history of NRD-associated factors such as complete history of pre-birth, whilst-birth and post-birth delivery along with having a complete physical examination and reviewing laboratory and radiological findings in order to investigate the causes of neonatal respiratory distress (9). First, the neonates should undergo chest radiography. Other effective laboratory studies include arterial blood gas (ABG) analysis, complete blood count (CBC) and blood culture. The present study intended to determine the frequency of the causes and outcomes of respiratory distress in neonates hospitalized in the NICU in Hamadan since having an idea of the common causes of respiratory distress in a particular unit is significant to help better treatment of NRD in future planning.

2- MATERIALS AND METHODS

2-1. Study design and population

In this descriptive and cross-sectional study, 93 neonates with respiratory distress who were hospitalized in the NICU of Be'sat Hospital (neonatal referral center) in Hamadan during Apr. 2014 to Feb. 2015, entered the study

2-2. Methods

Neonatal respiratory distress was diagnosed with the presence of one or more symptoms of tachypnea, intercostal muscle retraction, grunting, nasal flaring and cyanosis (3). The outcomes of NRD led to either hospital discharge with complete improvement of respiratory symptoms or death. Disease history and patient examination carried out to find different causes of respiratory distress.

2-3. Measuring tools

The required demographic information was extracted from patients' dossiers about the conditions of the selected neonates in terms of neonatal age upon admission, birth weight, gender, gestational age, birth order, type of delivery, multiple birth, time of read-only memory (ROM), maternal disease, causes of respiratory distress, need for surfactant administration, need for mechanical ventilation, results of chest radiography, cardiac echocardiography, duration of hospitalization and outcomes of NRD using a researcher-made questionnaire.

2-4. Ethical consideration

Before conducting the present study, it was approved by the ethics committee of Hamadan University of Medical Sciences**.**

2-5. Inclusion and exclusion criteria

All newborn infants with respiratory distress who were hospitalized in NICU with a birth age up to 28 days, of both sexes, with any gestational age and birth weight, were included. Infants with post-operative respiratory distress, syndromic infants and congenital anomalies were excluded from the study

2-6. Data Analyses

The collected data were analyzed using SPSS version 16.0 software. In order to estimate the probable risk factors in both groups, Chi-square and t-test were used. Logistic regression analysis was performed for multivariate tests. The significance level was calculated at 95%CI.

3- RESULTS

About 67.7% of 93 neonates with RD were male. The mean neonatal age and mean birth weight were 5.22±7.18 days and 2743.9±727.9 grams, respectively. The minimum birth weight was 850 grams while the maximum was 4,500 grams. According to the results, intercostal muscle retraction (75.3%), tachypnea (67.7%), grunting (61.3%), cyanosis (45.2%), apnea (18.3%), and nasal flaring (16.1%), were the most common symptoms of NRD while RDS and TTN were the most common causes of respiratory distress syndrome. Furthermore, about %19.3 of the neonates died of the disease (**Table.1**). **Table.2** shows that the outcomes of NRD had a significant correlation with respiratory failure requiring mechanical ventilation, apnea, multiple and concurrent of respiratory symptoms and mean duration of hospitalization ($p<0.05$). Therefore, the variables that significantly correlated with infant mortality entered logistic regression model.

Table.3 presents the results of logistic regression for the likelihood of mortality in neonates with respiratory distress. To this end, the variables associated with the survival or death of the infants entered logistic regression as forward likelihood ratio (LR); subsequently, three variables entered the model in three steps, respectively. In terms of duration of hospitalization ($\beta= - 0.204$), prolonging the duration to one more day decreased the rate of mortality by 18.5 percent. In terms of the need for mechanical ventilation ($\beta= 3.511$), the likelihood of mortality in patients requiring mechanical ventilation increased to 33.497 times. In terms of apnea ($\beta= 1.711$), the likelihood of mortality increased to 5.87 times in in patients with apnea symptoms.

Table-1: Demographic features of infants with respiratory distress

Variables		Frequency	Percentage
Gender	Male	63	67.7
	Female	30	32.3
Causes of NRD	RDS	34	36.6
	TTN	13	14
	MAS	7	7.5
	Pneumonia	28	30.1
	CHD	8	8.6
	Diaphragmatic Hernia	1	1.1
	Lobar Emphysema	1	1.1
	Asphyxia	1	1.1
Mean (± SD) neonatal age (days)			5.22 ± 7.18
Mean (± SD) birth weight (gr)			2743.9 ± 727.9

Birth weight	≤ 2,500 gr	≤1000 g	2	2.2
		1001 to 1500 g	4	4.3
		1501 to 2500 g	26	28
	> 2,500 gr	2501 to 4000 g	58	62.4
		≥ 4000 g	3	3.2
Mean gestational age (weeks)				36.58±3.54
Gestational Age	Preterm	< 28 weeks	2	2.2
		28 to 32 weeks	16	17.2
		33 to 36 weeks	11	11.8
	Term	≥ 37 weeks	64	68.8
Type of Delivery		Vaginal	37	39.8
		Cesarean	56	60.2
Maternal Diseases		Diabetes	2	2.2
		Pre-eclampsia	4	4.3
		PPROM	14	15.1
		Other	12	12.9
		No Disease	61	65.5
Multiple Pregnancy		Singleton	89	95.7
		Twin	3	3.2
		Triplet	1	1.1
Surfactant Administration		Yes	12	12.9
		No	81	87.1
Respiratory Failure Requiring Mechanical Ventilation		Yes	25	26.9
		No	68	73.1
Mean duration of hospitalization (days)				8.74±5.35
Outcomes of NRD		Discharge	75	80.6
		Death	18	19.4

RDS: Respiratory Distress Syndrom; TTN: Transient Tachypnea of the Newborn; MAS: Meconium Aspiration Syndrome; CHD: Congenital Heart Disease; NRD: Neonatal Respiratory Distress.

Table-2: Comparison of infants with respiratory distress in terms of the outcomes of NRD

Variables		Discharge	Death	OR	95% CI		P-value
		Frequency (%)	Frequency (%)		Min.	Max.	
Gender	Male	52(82.5)	11(17.5)	1.439	0.495	4.183	0.504
	Female	23(76.7)	7(23.3)				
Causes of NRD	RDS	28(82.4)	6(17.6)	1.381	0.985	1.936	0.061
	TTN	13(100)	0(0)				
	MAS	6(85.7)	1(14.3)				
	Pneumonia	22(78.6)	6(21.4)				
	CHD	5(62.5)	3(37.5)				
	Other	1(33.3)	2(66.7)				
Multiple Pregnancy	Singleton	72(80.9)	17(19.1)	1.412	0.138	14.424	0.771
	Multiple	3(75)	1(25)				
Type of Delivery	Vaginal	29(78.4)	8(21.6)	0.788	0.279	2.228	0.653
	Cesarean	46(82.1)	10(17.9)				
Maternal Diseases	Diabetes	2(100)	0(0)	1.208	0.499	2.925	0.676
	Pre-eclampsia	4(100)	0(0)				
	Other	8(66.7)	4(33.3)				
	No disease	61(81.3)	14(18.7)				
Surfactant administration	Yes	9(75)	3(25)	1.467	0.354	6.079	0.598
	No	66(81.5)	15(17.5)				

Respiratory Failure Requiring Mechanical Ventilation	Yes	10(40)	15(60)	32.5	7.958	132.728	0.000
	No	65(95.6)	3(4.4)				
Granting	Yes	49(86)	8(14)	0.424	0.149	1.206	0.108
	No	26(72.2)	10(27.8)				
Retraction	Yes	56(80)	14(20)	1.187	0.348	4.51	0.784
	No	19(82.6)	4(17.4)				
Cyanosis	Yes	30(71.4)	12(28.6)	3	1.015	8.864	0.074
	No	45(88.2)	6(11.8)				
Tachypnea	Yes	50(79.4)	13(20.6)	1.3	0.417	4.055	0.651
	No	25(83.3)	5(16.7)				
Apnea	Yes	9(52.9)	8(47.1)	5.867	1.836	18.745	0.003
	No	66(86.8)	10(13.2)				
Nasal flaring	Yes	12(80)	3(20)	1.05	0.263	4.144	0.945
	No	63(80.8)	15(19.2)				
Multiple Concurrent of Respiratory Symptoms	1	4(100)	0(0)	2.533	1.301	4.933	0.006
	2	15(83.3)	3(16.7)				
	3	43(89.6)	5(10.4)				
	4	11(61.1)	7(38.9)				
	5	2(40)	3(60)				
Mean gestational age		36.73±0.37	35.94±1.12	0.942	0.821	1.081	0.396
Mean neonatal age		5.63±0.86	3.5±1.33	0.949	0.865	1.041	0.27
Mean birth weight		2789.2±79.12	2555.6±207.77	1	0.999	1	0.223
Mean duration of hospitalization		9.37±0.59	6.11±1.37	0.855	0.745	0.98	0.025

RDS: Respiratory Distress Syndrom; TTN: Transient Tachypnea of the Newborn; MAS: Meconium Aspiration Syndrome; CHD: Congenital Heart Disease; NRD: Neonatal Respiratory Distress.

Table-3: Results of logistic regression for the rate of mortality in neonates with respiratory distress

Step	Variables	β	Standard Error	P-value	OR	95% CI	
						Min.	Max.
1st Step	Need for mechanical ventilation	3.481	0.718	0.000	32.5	7.958	132.728
	Constant value	-3.076	0.591	0.000	0.046		
2nd Step	Duration of hospitalization	-0.171	0.075	0.022	0.843	0.728	0.976
	Need for mechanical ventilation	3.702	0.776	0.000	40.544	8.860	185.529
	Constant value	-1.801	0.764	0.018	0.165		
3rd Step	Duration of hospitalization	-0.204	0.084	0.016	0.815	0.691	0.962
	Need for mechanical ventilation	3.511	0.802	0.000	33.497	6.953	161.385
	Apnea	1.770	0.868	0.041	5.873	1.072	32.167
	Constant value	-1.927	0.796	0.016	0.146		

β: Standardized coefficient; OR: Odds Ratio; 95% CI: 95% confidence interval.

4- DISCUSSION

Considering the prevalent causes of respiratory distress, the present study found that RDS, pneumonia, transient tachypnea of the newborn (TTN), meconium aspiration syndrome (MAS), congenital heart disease (CHD), diaphragmatic hernia, lobar emphysema, and asphyxia were respectively known as the most common causes of NRD. Septicemia, birth asphyxia, RDS and TTN were found to be the most common causes of NRD in Adebami's et al. study (10). Sauparna et al. (11) reported pneumonia, RDS, MAS, TTN, CHD, diaphragmatic hernia and pulmonary hemorrhage respectively as the most common causes of hospitalization for NRD. Swarnkar at al. (12), and Kommawar et al. (13), found TTN, RDS, asphyxia and MAS as the common causes of NRD.

In Parkash's et al. (14) study, RDS, TTN, pneumonia and MAS were considered as the most common causes of hospitalization for NRD. Comparing the results of the present study with other studies, it was approved that RDS, TTN, MAS and pneumonia, with different frequencies, were found as the most common causes of hospitalizing infants with respiratory distress in NICU of most centers. With regard to the symptoms of respiratory distress, the present study showed that 75.3% of infants had intercostal muscle retraction, 67.7% had tachypnea, 61.3% had grunting, 45.2% had cyanosis and 16.1% suffered from nasal flaring. Swarnkar et al. (12), found that intercostal muscle retraction, tachypnea, feeding impairment, grunting, nasal flaring, cyanosis were the most prevalent symptoms of neonatal respiratory distress. According to Parkash et al. (14), the most common NRD symptoms were tachypnea, retraction, nasal flaring by 100 % frequency, than grunting and cyanosis by 60.9% and 40% frequency, consequently. In a study by Barkiya et al. (15), tachypnea, retraction, and nasal flaring were prevalent in more than 80% of infants while grunting and cyanosis were frequent in 41% of infant with respiratory distress. Regarding the results of the aforesaid studies, it can be concluded that tachypnea and intercostal muscle retraction, were considered as the most common symptoms of respiratory distress. Nevertheless, Swarnkar et al. (12) showed that amongst the respiratory symptoms, grunting and nasal flaring had higher specificity for neonatal respiratory distress while tachypnea, retraction and feeding impairment had higher sensitivity for the diagnosis of NRD.

With respect to the outcomes of the NRD, the present study found that 19.3% died of NRD. Furthermore, RDS, pneumonia and CHD were the most common causes of infant mortality, respectively. Adebami et al. (10) reported that 36.6% of infants with NRD died of the disease. Tochie et al. (3) who found sepsis and RDS as the most common causes of hospitalization for NRD stated that 24.5% of infants died of NRD due to neonatal infection, prematurity and RDS. On the contrary, Rao et al. (16) reported infant mortality by 2.5% due to RDS and congenital diaphragmatic hernia indicating that 100% of infants with diaphragmatic hernia (2 cases) died. In the present study, one case of diaphragmatic hernia died of the disease. Kommawar et al. (12) reported infant mortality by 21.5% due to RDS (61.6%) as the most cause of death. In Swarnkar'set al. (12) study, 22.8% of infants died of NRD due to RDS (62.5%) as the most common cause.

Abdelrahman et al. (17) found that 36% of infants died due to RDS (86.7%) as the most common cause of infant mortality. The importance of NRD is that infants with respiratory distress have 2-4 times greater risk of death than the infants without respiratory distress (12). It was found that the reason for the high

frequency of RDS as the most common cause of infant mortality was prematurity, low birth weight and neonatal infection (14). In all the aforesaid studies, the best outcome of NRD was related to infants with TTN. Considering the risk factors of NRD outcomes, the results of the present study showed that the outcomes of the NRD had a significant correlation with respiratory failure requiring mechanical ventilation, apnea and mean duration of discharge. Moreover, 26 % (25.93) of infants needed mechanical ventilation especially infants with RDS (44%) and about 60% of infants requiring mechanical ventilation died of the disease. Sauparna et al. (11) showed that 41% of infants with respiratory distress required mechanical ventilation and in general 41% of infants died. John et al. (18) also demonstrated that 49% of the infants requiring mechanical ventilation died. Other studies have shown that the need for mechanical ventilation was the most important risk factor of mortality in infants hospitalized in NICU (19-21).

In the study of Panda et al. (22) apnea attack was recognized as a predictor of infant mortality. Sathenahalli et al. (23) found that apnea was a poor outcome of neonatal respiratory distress. Ogunlesi et al. (24) showed that respiratory distress was an independent risk factor of apnea and 82.2% of the infants with apnea died of the disease due to different causes. It was recommended that apnea and infant mortality can be reduced through early respiratory support of infants with respiratory distress.

4-1. Limitations of the study

The sample size in our study was small compared to other studies and long-term outcome was not evaluated, therefore large sample size study with long term follow-up is suggested to assess the morbidity and mortality of infants with respiratory distress.

5- CONCLUSION

It was found that RDS is the most common cause of respiratory distress in the hospitalized neonates. The mortality rate was 19.3%; moreover, infant mortality rate increased due to respiratory failure requiring mechanical ventilation and occurrence of apnea. In finale, it was concluded that improving the care of newborns requires mechanical ventilation and prevention of apnea lead to better outcomes and reduced infant mortality rate.

6- CONFLICT OF INTEREST

The author declares no conflict of interest.

7- ACKNOWLEDGMENT

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