Original Article

Respiratory Distress Syndrome in Neonatal Care Units in Medical City

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Summary:

Introduction:
Neonatal Respiratory distress syndrome (RDS) remains one of the major cause's neonatal morbidity and mortality despite advances in perinatal care especially in developed countries.

Objectives:
The aims of this study were to find out me risk factors of mothers and newborns (NB) which increase the incidence, morbidity, and mortality of RDS.

Patients & Methods:
A prospective descriptive cross-sectional study was conducted on 100 live NR infants born at neonatal care units in Baghdad hospital & private nursing home (medical city complex) / Baghdad in the period from the first of March to the end of June 2006. They were presented with RDS, which was diagnosed clinically and radio-graphically. The study includes preterm and mil term N8 with all birth weights.

Results:
In tins study, there was an increase in the incidence of RDS in preterm NBs 3.5 times more than in mil term, and 2.0 times more in small for gestational age (SGA) than in appropriate for gestational age (AGA). It was found that the risk of death from RDS with air leak was 11 times more than those without air leak, and from RDS with pneumonia 4.0 times more than those without pneumonia.

The risk of death among NB delivered by elective Caesarian section (C/S) was 2.4 times more than those born by emergency C/S. and 5.1 times more in NB of diabetic mothers than those without diabetes.

Conclusions:
We conclude that prematurity and SGA are risk factors for the development of RDS, and air leak and pneumonia are most important complications that increase the risk of death from RDS. So we recommend a proper and regular antenatal care and. management of high risk pregnancies to avoid premature delivery and SGA, and proper respiratory care of NB to decrease the complications of RDS especially air leak and pneumonia to decrease the risk of death.

Keywords: Respiratory distress syndrome. New-born, risk factors, incidence, risk of death.

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Introduction:

Respiratory distress syndrome (RDS) or Hyaline membrane disease (HMD) is caused by surfactant deficiency and affects mainly preterm NB. The incidence is 2-3 % of all births, but is responsible for about 50% of neonatal deaths (1, 2). It occurs in 60-80% of NB < 28 weeks (wks) of gestation, 15-30% of those < 32-36 wks. and 5% for those > 36 wks (5).

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The surfactant is present in high concentration in the fetal lung by 20 wks., but it appears in amniotic fluid by 28-32 wks. and reach mature level after 35 wks (4) . Endogenous gluco-corticoids are important stimulus for fetal lung maturation (5). The main predisposing factors for RDS are prematurity, male sex, and maternal diabetes mellitus (MDM) (6, 7). The absence of the process of labor (elective C/S) is a risk factor for RDS by many authors (8, 9).

The surfactant deficiency leads to alveolar atelectasis, hyaline membrane formation, and interstitial edema. These make the lung less

compliant that it requires higher pressure to expand. (3)

Prematurity and RDS arc the leading causes of hospitalization in neonatal intensive care units (10). RDS is defined clinically as the presence of 2 of the clinical signs of tachypnea (>60 breaths/min.), dyspnea with inspiratory subcostal, intercostals retractions, nasal flaring, expiratory granting, and cyanosis in room air (11).

Death is rare on the first day of life, and usually occurs on 2^{nd} – 7^{th} day, due to air lea, pulmonary hemorrhage, and intraventricular hemorrhage (12, 13). RDS may be complicated by air leaks (pneumothorax, pneumomediastinum, and pneumopericardium), infections, IVH, PDA, retinopathy of prematurity, and neurodevelopment impairment (14).

Prenatal prediction of RDS is done by lecithin sphingonmyelin ratio (L/S) and surfactant - albumin ratio (TDX –FML11) (14, 15, 16). Postnatal diagnosis is mainly clinical, based on the presence of respiratory distress shortly after delivery, persistent need for respiratory support for more than 24 hours, along with typical chest X-ray of RDS (diffuse reticulogranular opacities, air bronchogram, and small lung volumes) (1, 14, 17). Other investigations may also needed like biochemical, hematological, microbiological, serial pH and arterial blood gases (18).

The most important preventive measure for RDS is prevention of premature delivery by avoiding unnecessary or poorly timed C/S, appropriate management of high risk pregnancies and delivery with intrauterine acceleration of pulmonary maturation with the use of antenatal steroid, and lastly the immediate use of surfactant immediately after delivery of premature NB (1,3, 13, 14, 19).

The treatment of RDS requires monitoring of respiration, HR, PaO2. PaCO2, pH, HCO3, S.electrolytes, B.glucose, Blood pressure, Supportive care is also needed like gentle handling, avoid chilling, and supplements of calories and fluid (3,10,12).

Warmed, humidified oxygen should be sufficient to maintain PaO2 at 50-80 mmHg (14, 20). Early continuous positive airway pressure (CPAP) may reduce the need for mechanical ventilation, which may be needed when PaCO2 >55 mmHg or rapidly rising paco2 or pao2 <50mmHg or severe, recurrent apnea (14, 21).

The aims of this study were to find out the risk factors of mothers and new born babies, which increase the incidence, morbidity and mortality of RDS.

Patients and Methods:

This prospective descriptive cross-sectional study was conducted in the neonatal care units in private nursing home and Baghdad Teaching hospitals in the medical city complex, Baghdad in the period from the first of March to the end of June 2006.

Hundred alive newborn infants with clinical diagnosis of RDS, diagnosed by pediatrician and confirmed in some patients by typical chest x ray finding seen by pediatrician and confirmed by radiologist report.

The mothers' informations were taken from labor room, residents, obstetrician, mother and their relatives. These includes name, age, parity, gestational age by LMP, EDD, antenatal care, illness during pregnancy, history of twin pregnancy, RDS in siblings, lcaking liquor ± ruptured membrane, prenatal asphyxia and the mode of delivery.

The newborns informations were taken from labor room, residents, pediatrician, and case sheets of newborns in both hospitals. These includes name, sex, birth-weight, gestational age by physical appearance, need for resuscitation at birth, immediate signs and symptoms after birth, other associated abnormality, the presence of classical chest x ray finding of RDS, management, acute complications, days of hospitalization, immediate out come and cause of death if died. All live newborns of all gestational ages and birth weights were included.

The exclusion criteria were ant newborn with respiratory distress at birth which is not due to RDS, like congenital pneumonia, Meconium aspiration, congenital heart disease or other differential diagnoses .

The statistical analysis was done using SPSS version 13 computer software (Statistical package for social sciences) in association with Microsoft Excel program.

Results:

In tins study, 100 NB with RDS were studied. There were more male NBs (32%) than female with male: female ratio of 2.1:1.

There were more preterm NBs (56%) than full term (43%), and post term (1%), and more AGA (80%) than SG'A (19%), and LGA (1%).

The NBs with B.WT < 2500 grams (39%) are less than those with B.WT of > 2500 grams (Table 1).

The relative frequency of other selected variables related to NB such as other associated abnormalities (4%) classical x-ray finding of RDS (35%). Management with oxygen (96%), the need for incubators (92%), use of intravenous fluids and nutrients (96%), supportive measures for circulation (5%), treatment for infections (35%), inflections as acute complication Forty-three percent of NBs present initially with nasal flaring, (93%) with granting, (93%) with tachycardia, (47%) with cyanosis, and (63%) with retraction.

Fifty-one percent of NBs started oral feeding in < 3 days (improved RDS status), (30%) in 3-7 days, (9%) in > 8 days, and (10%) did not start feeding (died).

Eighty-two percent of NBs remain in hospital for > 8 days, while (18%) remain for <8 days.

Eighty- percent of NBs were discharged home well after treatment, (5%) were discharged against medical advice, and (10%) died.

The risk of death as an outcome by selected variables related to NB was shown in (Table 3), where the preterm NB had 3.5 times more risk of death from RDS than full-term, but the calculated odd ratio (OR) was not statistically significant. The risk of death was 2 times more in SGA than AGA NBs, but the (OR) was not statistically significant. The risk of death was 3.6 times more in NB with B.WT < 2500 grams than those > 2500 grams, but the (OR) was not statistically significant.

The risk of death was 3.2 times more in NB with positive classical x-ray findings of RDS than those with negative findings, but the (OR) was not statistically significant. Management with oxygen showed no important or statistically significant association with the risk of death among NBs.

The risk of death was 4.6 times more in NBs with infection than those without infection, and the (OR) was statistically significant (p value <0.03). The risk of death was 11 limes more in NBs with air leak than those without air leak and the (OR) was statistically significant (p value <0.049)(Table 3).

The history of mothers antenatal care, parity, use of antibiotics during pregnancy, mode of deliverv, history of pre-eclampsia (PET), had on important or statistically-significant association with the risk of death among NBs (Table 4).

The risk of death was 2.4 times more after elective C/S than after emergency C/S, but the (OR) was not statistically significant. The risk of death of infants of diabetic mothers (IDM) was 5.1 times more than those of non- diabetic mothers, but the (OR) was not statistically significant. The risk of death of NBs of mothers with renal problems during pregnancy was 9.9 times more than those without renal problems, but the (OR) was not statistically significant (Table 4).

Table 1: Frequency distribution of study sample by selected variables related to newborns.

	Selected variables related to newborns	**No.**	**%**
1	Gender:		
	Male	68	68.0
	Female	32	32.0
	Total	100	100.0
2	Gestations age at delivery:		
	Preterm	56	56.0
	Full term	43	43.0
	Post term	1	1.0
	Total	100	100.0
3	Birth weight for age:		
	AGA	80	80.0
	SGA	19	19.0
	LGA	1	1.0
	Total	100	100.0
4	Birth weight (gms):		
	1000-1499	8	8.0
	1500-2499	31	31.0
	2500-3999	58	58.0
	4000 or more	3	3.0
	Total	100	100.0

Table 2: The relative frequency of other selected variables related to newborns.

	Other selected variables related to newborns	No.	%
1	Other associated abnormalities	4	4.0
2	Classical Chest X-ray finding of RDS	35	35.0
3	Management with O2	96	96.0
4	Need for incubator	92	92.0
5	Use of IV fluid and nutrients	96	96.0
6	Supportive measures for circulation	5	5.0
7	Treatment of infection	35	35.0
8	Infection as an acute complication	28	28.0
9	Air leak as acute complication	4	4.0

Table 3: The risk of death as an outcome by selected independent variables related to newborns.

	Selected independent variables	Alive		Dead		OR	95% CI	P (Fishers exact)
		N	%	N	%			
1	Gender: Male Female Total	 61 29 90	 67.8 32.2 100	 7 3 10	 70.0 30.0 100	 1.1 Reference	 (0.27-4.6)	 0.60 {NS}
2	Preterm Baby: Positive Negative Total	 48 42 90	 53.3 46.7 100	 8 2 10	 80.0 20.0 100	 3.t Reference	 (0.7-17.4)	 0.10 {NS}
3	SGA Baby: Positive Negative Total	 16 74 90	 17.8 82.2 100	 3 7 10	 30.0 70.0 100	 2.0 Reference	 (0.5-8.5)	 0.29 {NS}
4	Birth weight (gm): 1000-1499 1500.2499 2500 or more Total	 6 26 58 90	 20.0 50.0 30.0 100	 2 5 3 10	 6.7 28.9 64.4 100	 6.4 3.7 Reference	 (0.9-46.5) (0.8-16.7)	 0.10 {NS} 0.08 {NS}
5	Other associated abnormalities: Positive Negative Total	 4 86 90	 4.4 95.6 100	 0 10 10	 0.0 100 100	 **	 **	 0.65 {NS}
6	Classical X-ray finding of RDS: Positive Negative Total	 29 61 90	 32.2 67.8 100	 6 4 10	 60.0 40.0 100	 3.2 Reference	 (0.8 – 12.1)	 0.08 {NS}
7	Management with O2: Positive Negative Total	 86 4 100	 95.6 4.4 100	 10 0 10	 100 0.0 100	 **	 **	 0.65 {NS}
8	Need for incubator: Positive							

	Negative Total	82 8 90	91.1 8.9 100	10 0 10	100 0.0 100	**	**	0.42 {NS}
9	Use of IV fluid and nutrients: Positive Negative Total	86 4 90	95.6 4.4 100	10 0 10	100 0.0 100	**	**	0.65 {NS}
10	Supportive measures for circulation: Positive Negative Total	4 86 90	4.4 95.6 100	1 9 10	10.0 90.0 100	2.4 Reference	(0.2 – 23.7)	0.42 {NS}
11	Treatment for infection: Positive Negative Total	30 60 90	33.3 66.7 100	6 4 10	60.0 40.0 100	4.6 Reference	(1.2-17.9)	0.03 {S}
12	Infection as an acute complication: Positive Negative Total	22 68 90	42.2 75.6 100	6 4 10	60.0 40.0 100	4.6 Reference	(1.2-17.9)	0.03 {S}
13	Air leak as an acute complication: Positive Negative Total	2 88 90	2.2 97.8 100	2 8 10	20.0 80.0 100	11.0 Reference	(1.4-88.9)	0.049 {S}

{NS} = Not significant
{S} = Significant

Table 4: The risk of death as an outcome by selected independent variables related to mothers during pregnancy

	Selected independent variables	**Alive**		**Dead**		**OR**	**95% CI**	**P (Fishers exact)**
		N	**%**	**N**	**%**			
1	Parity: Multipara Primipara Total	60 30 90	66.7 33.3 100	7 3 10	70.7 30.0 100	Reference 0.9	(0.2-3.6)	0.57 {NS}
2	History of antenatal care: Positive Negative Total	83 7 90	92.2 7.8 100	9 1 10	90.0 10.0 100	Reference 1.3	(0.2-11.9)	0.58 {NS}
3	Use of Tonics: Positive Negative Total	41 49 90	45.6 54.4 100	3 7 10	30.0 70.0 100	Reference 2.0	(0.5-8.0)	0.28 {NS}
4	Use of antibiotics: Positive Negative Total	17 73 90	18.9 81.1 100	2 8 10	20.0 80.0 100	Reference 0.9	(0.2-4.8)	0.61 {NS}
5	Use of steroids: Positive Negative	5 85	5.6 94.4	0 10	0.0 100.0	**	**	0.58 {NS}

	Total	90	100	10	100			
6	Mode of Delivery: C/S NVD Total	 72 18 90	 80.0 20.0 100	 8 2 10	 80.0 20.0 100	1.0 Reference	(0.2-5.1)	1.0 {NS}
7	Type of C/S: Positive Negative Total	 51 21 72	 70.8 29.2 100	 4 4 8	 50.0 50.0 100	Reference 2.4	(0.6-10.6)	0.12 {NS}
8	History of DM during pregnancy: Positive Negative Total	 7 83 90	 7.8 92.2 100	 3 7 10	 30.0 70.0 100	5.1 Reference	(1.1-24.1)	0.06 {NS}
9	History of PET during pregnancy: Positive Negative Total	 12 78 90	 13.3 86.7 100	 1 9 10	 10.0 90.0 100	0.7 Reference	(0.1-6.2)	0.62 {NS}
10	History of renal problem during pregnancy: Positive Negative Total	 1 89 90	 1.1 98.9 100	 1 9 10	 10.0 90.0 100	9.9 Reference	(0.6-171.9)	0.19 {NS}
11	Twin pregnancy: Positive Negative Total	 8 82 90	 8.9 91.1 100	 0 10 10	 0.0 100.0 100	**	**	0.42 {NS}
12	History of RDS in siblings: Positive Negative Total	 5 85 90	 5.6 94.4 100	 0 10 10	 0.0 100.0 100	**	**	0.58 {NS}
13	History of PROM or leaking liquor: Positive Negative Total	 10 80 90	 11.1 88.9 100	 0 10 10	 0.0 100.0 100	**	**	0.33 {NS}

NS = Not Significant

Discussion

In this study, the RDS is more common in male NBs (68 %) than female (32%), which is similar to Sweden study by Bjog in April 2003 in which (60%) were boys and (40%) were girls. The release of catecholamine during labor is an important defense mechanism by hypoxic fetus. Preterm females have significantly higher catecholamine level than males, which explain the better outcome in females after hypoxic event (22).

In this study, there is an increase in the incidence of RDS in preterm NBs 3.5 times more than full term, which is similar to that reported by Madar J Richmonds in 1999. This is also related lo the fact that surfactant system undergoes an important maturation in term of increased production and changed composition during the period of late gestation (23, 24).

In this study, the risk of death of SGA NBs was 2 times more than AGA, but it is not statistically significant, probably because of small sample size. However other studies have found, either no difference or an increased incidence and severity of RDS in SGA NBs (25, 26). The concept was supported by demonstrating improved biochemical pulmonary profile in growth of the babies (27).

In this study, the risk of death of NBs with air leak is statistically significant (p value <0.03). This result agrees with Marisa A.A study in Vienna in 2003, in which showed that using appropriate lung volume without overexpansion reduce the development of pneumothorax from 24.5% in the group that received high PEEP to 8% in the group that received lower PEEP (28).

In this study, pneumonia may coexist with RDS or be associated with the presence endotracheal tube. RDS with pneumonia is 4.5 times more than RDS without pneumonia, and is statistically significant (p value < 0.03). The general deterioration, development of patchy opacity on chest x-ray with positive blood culture, help to make the diagnosis. Appropriate antibiotic treatment is then necessary to decrease the death of premature NBs with RDS and pneumonia (1).

In this study, the results of the use of steroids in pregnant women were not important or statistically significant, probably because most of mothers were not present in the NICU, and their relatives did not know the exact prenatal history. But it is well known previously that giving mothers 2 doses of betamethasone 48 hours before premature labor (24-34 wks), significantly reduce the incidence, morbidity and mortality of RDS (19).

The risk of death of NBs with elective C/S is 2.4 times more than those with emergency C/S, but the (OR) was not statistically significant, probably because of small sample size. The absence of labor has been shown to be a risk factor for RDS by many authors (23, 24). The stress of labor is beneficial for maturation of the surfactant system. Babies born by elective C/S before onset of labor had significantly lower L/S ratio than those babies delivered vaginally or by emergency C/S (21, 30).

The risk of death of NBs with history of maternal DM during pregnancy is 5.1 times more than in NBs of non-diabetic mothers, but the (OR) was not statistically significant. RDS found previously to occur 21 times more in NBs of DM mothers than in non diabetics. Babies born to diabetic mothers were of significantly lower mean gestational age than those born to non diabetics. Provided the diabetes is controlled and fetal welfare is ensured in later delivery, and following documentation of lung maturity, may lower the incidence of RDS, and therefore lower the perinatal morbidity and mortality (31).

In this study, the history of PET during pregnancy is not important or statistically significant, which is similar to that reported by Siba BM.Kaol in university of Tennessee, USA, 1096 (32).

We conclude that prematurity and SGA are important risk factors for the development of RDS, and air leak and pneumonia as acute complications increase the risk of death from RDS. So we recommend good, regular antenatal care and management of high risk pregnancies to decrease the incidence of premature delivery & SGA to decrease RDS, and proper postnatal respiratory care to decrease complications as air leak and pneumonia, to decrease risk of death from RDS.

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