

Factors Related to Respiratory Distress Syndrome in Neonates

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Keywords: Respiratory distress syndrome, neonatal mortality, intercostals recession, intercostals recession.

Abstract

Background: Respiratory distress syndrome of neonates (RDS) is one of the most common causes of neonatal mortality.

Objective: The purpose of this study was to investigate socio-demographic, maternal and neonatal factors related to RDS in neonates in context of tertiary level hospital.

Methods: This cross sectional study was conducted in Dhaka Medical College Hospital and Ad-din Women's Medical College and Hospital during 1st January to 31st December 2017 among 186 purposively selected neonates. Data were collected by document review and face to face interview with complete privacy using semi-structured questionnaire and check list.

Results: Regarding socio-demographic factors, Considering the maternal factors, majority of the mothers (61.3%) had taken 4 or more checkup during their antenatal period and 87.1% had institutional delivery while approximately half (52.7%) of the mothers had Caesarean delivery. Among the mothers, 17.2% had history of high blood pressure during pregnancy, 10.8% diabetes mellitus, 14% oligohydramnios and 37.1% mothers had PROM. RDS was more common in preterm neonates or below 37 weeks (85.5%) and maximum were low birth weight or below 2500 gram (90.3%), 52 babies (28%) were born of multiple pregnancy, more than half of the babies (62.4%) had moaning sound (grunting) and most of all (92.5%) had chest recession.

Conclusion: The factors related to RDS are not preventable but are predictable if ANC for all the mothers can be ensured. If the possibility of occurrence of RDS can be assumed considering these factors, necessary precautions for earlier diagnosis and adequate management can be taken which can contribute in reducing neonatal mortality rate.

Keywords: Respiratory distress syndrome, neonatal mortality, intercostals recession, intercostals recession.

Introduction

Infections and complications during the first 28 days of life are responsible for approximately 1.5% of total child deaths. Within this period of life 7% to 50% of neonates are likely to suffer from RDS. Among them 3 to 4 out of 10 requires admission¹. Statistics show that even in USA every year 20,000 to 30,000 neonates suffer from RDS and about 1% pregnancies have got the possibility to have this complication.

RDS is the second most common reason for the respiratory distress in newborns and those who suffer from respiratory distress are 2 to 4 times more prone to death from those who do not².

About 10-12% of total live born babies are born before completion of their full term gestation³. Globally, in 2010 more than one out of 10 babies was born before completion of 37 weeks of intrauterine life. Again, in the same year around one million babies died due to

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this preterm condition⁴. At present, preterm delivery is the second leading cause of death among under 5 children and the single most important cause of neonatal death⁵. About 50% of babies who are born at 26–28 weeks of gestation are likely to develop RDS while the risk is about only 25% at 30–31 weeks of gestational age. Among the neonates born in 37 weeks of gestation, only 7.8% suffer from RDS⁶.

Birth weight of the baby is considered to be another important concern regarding development of RDS. Different studies found that among the babies born with a weight of 2500 gram or more proportion of developing RDS varies from 9.9%⁶ to 11.5%⁷. Moreover, a previous study shows that proportion of developing RDS is inversely related to the birth weight of the newborns⁸.

Again, according to Nelson Text Book of Paediatrics⁹ not only neonatal factors but also some maternal factors influence in both occurrence and outcome of RDS. The second born of preterm twins⁹, mature neonates with meconium aspiration syndrome¹⁰, delayed crying or perinatal asphyxia (hypoxic ischaemic encephalopathy)¹¹, congenital anomalies¹⁰, IDM (Infant of diabetic mothers)¹², delivery by LUCS, particularly in absence of labour¹³ are commonly documented risk factors in developing RDS among the neonates found in different countries in different studies.

Apnea (cessation of breathing), cyanosis (bluish or blackish discolouration of body), grunting (a moaning sound at expiration), inspiratory stridor, nasal flaring, poor feeding, tachypnea (respiratory rate 60 or more), lower chest wall indrawing (intercostal, subcostal, or suprasternal recession) are considered as the more commonly presented features in a neonate suffering from RDS. A neonate suffering from RDS may present with any one or more than one of the aforesaid clinical manifestations either just after birth or within a very short time after birth, usually with increasing severity with the course of time, reaching the worst peak within the first 48-72 hours of life¹⁴.

Despite all new options like mechanical ventilators and continuous positive airway pressure (CPAP), mortality rates still remain as high about 36%. In a retrospective study carried out in Neonatal Intensive Care Unit (NICU) of Ad-din Hospital from July 2013 to June 2014, it was found that among all indications for mechanical ventilation, RDS contributed to the maximum which was 62% followed by 23% mortality

rate¹⁵. In another retrospective study conducted from December 2014 to November 2015 at the neonatal unit of North East Medical College and Hospital in Sylhet, Bangladesh, it was observed that RDS was responsible for 0.6% of admission into hospital and contributed to 16.7% of the total mortality rate¹⁶.

In a bulletin of the World Health Organization, neonatal deaths presently contribute to more than two-thirds of under-one mortality and for about half of all deaths in children under-five years of age¹⁷. Neonatal mortality rate (NMR) is 28 per 1,000 live births in Bangladesh¹⁸. So, proper measures must be taken to promote the survival of children under five years of age because by signing in SDG, the Government of Bangladesh has declared the vision of decreasing the mortality of children below five years of age by two thirds.

A previous study in Bangladesh¹⁵ stated that although RDS is the most common reason for cardio-respiratory failure in newborns, it also provides with the best prognosis compared to the other reasons if measures can be taken timely. Early intervention can significantly decrease the complications, severity, requirement for oxygen therapy and ventilation, duration of hospital stay¹⁹ and ultimately treatment cost.

Methods:

This cross sectional study was done from 1st January to 31st December 2017, which was approved by the ethical review board of National Institute of Preventive and Social Medicine. Data was collected through face to face interview from purposively chosen 186 mothers of admitted newborn babies diagnosed as RDS into Dhaka Medical College Hospital and Ad-din Women's Medical College and Hospital. Document review was done to collect the data about ANC visits and obstetric history of the mothers as well as the health related events of the neonates since birth. Confidentiality of the respondents was maintained with outmost care and treatment of the neonates in acute condition was ensured prior the data collection.

Statistical Package for Social Science (SPSS) version 20 for windows was used to analyze the data. Associations among qualitative and quantitative variables of various socio-demographic, maternal and neonatal factors were studied by using chi-square test and t-test where appropriate. To assess the independent relationship within the factors, logistic regression analysis was performed. A p value < 0.05 was considered to be significant.

Results:**Table I:** Distribution of the neonates by baseline characteristics and various neonatal factors (n=186)

Gestational Age	Frequency (n)	Percent (%)
24-27 weeks	9	4.8
28-30 weeks	37	19.9
31-32 weeks	37	19.9
33-34 weeks	38	20.4
35-36 weeks	38	20.4
37-39 weeks	27	14.5
Total	186	100.0
Birth weight in gram		
<750	4	2.2
750-1499	61	32.8
1500-2499	103	55.4
2500-3900	18	9.7
Total	186	100.0
Sex		
Male	128	68.8
Female	58	31.2
Cyanosis at Birth		
Present	97	52.2
Absent	74	39.8
Record not Found	15	8.1
Grunting		
Present	116	62.4%
Absent	70	37.6%
Subcostal Recession		
Present	172	92.5%
Absent	14	7.5%
History of delayed cry after birth		
Yes	34	18.3
No	150	80.6
Record not found	2	1.1
Respiratory rate of the baby on admission		
Absent/gasping	5	2.7
<60/minute	55	29.6
>60/minute	126	67.7
Less Foetal Movement		
Yes	34	18.3
No	150	80.6
Don't know	2	1.1
Treatment modality used for giving oxygen		
Room air	32	17.2
Oxygen with nasal prong	11	5.9
Oxygen with face mask	71	38.2
Oxygen with hood	37	19.9
Bubble CPAP	17	9.1
Mechanical ventilation	18	9.7
Severity of RDS		
Less Severe	151	81.2%
More Severe	35	18.8%

Table II: Distribution of the mothers by socio-demographic characteristics and maternal factors (n=186)

	Frequency (n)	Percent (%)
Maternal Age in years		
Below 19	40	21.5
20-24	63	33.9
25-29	45	24.2
30-34	25	13.4
35-39	12	6.5
40-45	1	0.5
Educational qualification of mothers		
Below Primary	42	22.6
Below Secondary	69	37.1
Higher Secondary and Under	45	24.2
Graduate		
Graduate and Post Graduate	30	16.1
Occupation		
Home maker	127	68.3
Teacher	16	8.6
Service Holder	21	11.3
Business	11	5.9
Others	11	5.9
Area of Residence		
Rural	103	55.4%
Urban	83	44.6%
Number of antenatal check up during pregnancy		
No ANC	1	0.5
<4	71	38.2
4 or more	114	61.3
Place of Delivery		
Institution	162	87.1%
Home	24	12.9%
Mode of Delivery		
Spontaneous vaginal	30	16.1
Assisted vaginal	58	31.2
Caesarean	98	52.7
Maternal Factors		
PIH	32	17.2%
GDM	20	10.8%
Oligohydramnios	26	14%
PROM	69	37.1%
Pre-eclampsia	24	12.9%
Placenta Praevia	7	3.8%
Abruptio Placenta	4	2.2%
Multiple Pregnancy	52	28%

Table III: Multivariate Analysis to see the relationship between the socio-demographic variables and number of ANC

Variable	B	P Value	OR	95% C.I. for OR
Rural versus Urban	1.038	0.004	2.823	1.390-5.736
Group of income	-0.185	0.658	0.831	0.367-1.882
Category of occupation	0.034	0.936	1.035	0.453-2.360
Educational Status	1.254	0.003*	3.505	1.543-7.960
Constant	-0.336	0.425	0.715	

*Statistically significant

Discussion

Among the 186 babies, there were 85.5% preterm (below 37 weeks) and 14.5% term neonates (above 37 weeks). So it does not correspond with the traditional saying "RDS only occurs in preterm neonates"¹⁹.

A retrospective case-control study conducted by Liu J *et al*²⁰ showed that elective LUCS, severe perinatal asphyxia, PROM (Premature Rupture of Membrane), male sex, GDM (Gestational Diabetes Mellitus), LBW (Low Birth Weight), IUGR (Intra Uterine Growth Retardation) and maternal-fetal infection are associated with developing RDS in term newborns. Also, Ghafoor T *et al*²¹ conducted a prospective study which revealed that 93.61% preterm and 6.38% term neonates developed RDS. The frequency of RDS was, 100% at 26 or less weeks of gestational age, 57.14% at 32 weeks, and 3.70% at 36 weeks of gestational age. Another retrospective cohort study conducted by Mehrabadiet *al*²² revealed that the rate of RDS per 1000 live births, among live born newborns whose gestational age was <32 weeks and among newborns whose gestational age was 39 weeks or more were 6.4, 113.2 and 1.6 per 1000 live births correspondingly. These results have similarity with the present study that RDS can occur also among term newborns.

More than half (55.4%) weighed between 1500-2499 gram, 61 babies (32.8%) weighed between 750-1499 gram, 18 babies (9.7%) weighed between 2500-3900 gram and only 4 babies (2.2%) weighed <750 gram. In a report prepared by Pramanik A K⁸, the incidence rate of RDS in neonates with birth weight 501-1500g, 501-750g, 751-1000g, 1001-1250g, and 1251-1500g were 42%, 71%, 54%, 36% and 22% correspondingly.

More than two third (68.8%) was boys and 31.2% were girls. This finding corresponds to the result of a study conducted by Ghafoor T *et al*²¹ which found

that 34.04% were girls and 65.95% were boys. Also, a survey conducted by Luerti M *et al*²³ revealed that the risk of RDS was more in males than in female neonates.

The more than half of the babies (62.4%) had grunting and the majority (92.5%) had chest recession. A retrospective study conducted by Desai *et al*²⁴ also supports this finding which revealed that most common clinical manifestations in neonates with RDS are subcostal (xiphoid) recession (98.61%), grunting (93.05%) and intercostal recession (83.33%).

The mean age of the mothers was 24.45 ± 5.627 years and 63 mothers (33.9%) were in the age group of 20-24 years of age. Age specific fertility rate of Bangladesh is maximum (143/1000 women) in this age group¹⁸.

Mothers were almost all educated and among them 37.1% were educated up to secondary level of education. This may be due to the fact that educated mothers are more conscious and more likely to take their babies to the hospital than the mothers educated below the secondary level. More than two third of the mothers (68.3%) were home makers. This reflects the common picture of the females in Bangladesh¹⁸. Most of the above data depict that the sample is similar to national population. Among 186 mothers, maximum proportion i.e. 103 (55.4%) resided in rural area and the rest 83 (44.6%) were inhabitants of urban area. Antenatal care (ANC) from a medically-trained health care provider is essential to evaluate the status of a pregnancy, identify the complications related to the pregnancy and prevent unwanted situations. The present study shows that the majority (61.3%) mothers had taken 4 or more ANC which corresponds with the normal scenario of the women in Bangladesh which states that the majority of women (64 percent) received ANC¹⁸.

Although in Bangladesh, only 38 percent delivery occurs in a health facility, and 62 percent at home¹⁸, this study shows that among the 186 participants, majority (87.1%) of the mothers had institutional delivery whereas only 12.9% had home delivery. This may be due to the fact that those mothers who conduct their delivery at institution have their babies early diagnosed and are conscious enough to bring their child to hospital.

More than half (52.7%) of the mothers had LUCS whereas among the rest 31.2% mothers had assisted vaginal delivery and 16.1% mothers had spontaneous vaginal delivery. Although in Bangladesh, 23 percent of births are found to be delivered by LUCS¹⁸, which implies that six in ten births in a health facility are delivered by C-section. This may be due to the fact that RDS is more prevalent in babies born by LUCS. This finding is supported by the multiple logistic regression statistical method by Bryan H *et al*²⁵ which revealed that the risk of RDS is more with LUCS in absence of labor pain compared to NVD ($p = 0.03$). This result is also similar to a retrospective study conducted by Wu XJ *et al*.²⁶ which revealed that severe RDS can occur in term newborns after elective LUCS. In another study conducted by Goldberg JD *et al*²⁷ among 236 newborns delivered by LUCS, the presence of labour before LUCS did not decrease the risk of RDS significantly, although a trend, not statistically significant, was noted in this direction.

Another hospital-based case-control study conducted by Khalid A. Y²⁸ revealed that the likelihood of LUCS was nearly twice as high among neonates diagnosed with HMD compared to the non-HMD control group. All these information suggest that the chance of RDS is associated with LUCS. Physiology also supports that the vaginal route of delivery is till now known as a better option for enhancement of neonatal cardio-respiratory adaptation²⁸.

This study has also found that out of 186 mothers, 32 (17.2%) mothers had history of PIH, 20 (10.8%) mothers had history of GDM, 26 (14%) mothers had history of oligohydramnios, 69 (37.1%) mothers had history of PROM and 52 babies (28%) were born of multiple pregnancy. This finding is supported by the results of another prospective, descriptive, cross sectional hospital based study, conducted by Swarnkar K and Swarnkar M² which revealed that maternal causative factors like PROM (25.9%), PIH

(16.7%), diabetes mellitus (4.2%) and twin pregnancy (16.7%) were present in cases of RDS. Bowen JR *et al*.²⁹ showed by a case control study that the rate of RDS was more among neonates of mothers with PIH comparison to controls (60% versus 33%; $p = 0.001$).

Besides, the number of ANC visits, education level and wealth status have a positive relationship with the likelihood of delivering in a health facility¹⁸. In Bangladesh half of women who have secondary or higher education and those who are in the higher socio-economic group undergo delivery by LUCS¹⁸.

By logistic regression analysis, the educational status of mothers independently predicted the variation of number of ANC ($p=0.003$, $OR=3.505$), place of delivery ($p=0.020$, $OR=15.925$), and mode of delivery ($p=0.003$, $OR=3.505$).

To determine the factors influencing the course of RDS, the babies who required mechanical ventilation or bubble CPAP were graded as more severe and the babies who were kept in room air, face mask or oxyhood were graded as less severe RDS. By logistic regression analysis, category of mothers according to income independently predicted the variation of severity of RDS ($p=0.021$, $OR=0.379$).

Conclusion

This study found that mothers of neonates with RDS share some certain socio-demographic characteristics such as mostly residing in rural area, belonging to lower socio-economic group, educated below secondary level and mostly home maker in occupation. Certain pregnancy associated complications such as diabetes, PIH, oligohydramnios and PROM were common. RDS was more prevalent among male newborns than female ones and neonates born of multiple pregnancy. So as soon as a pregnant mother is diagnosed to have a male foetus or multiple gestation or any of the above mentioned factors she and her family must be prepared for emergency management of the newborn after delivery and transport facilities to higher referral centre must be ensured.

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