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Original Research Article

Study on etiological profile of respiratory distress in new borns in a teaching hospital

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ABSTRACT

Background: The aim is to study the various risk factors associated with development of severe respiratory distress in the new born.
Methods: This was a prospective study of 200 new-borns with respiratory distress. Clinical details, etiology for the respiratory distress, system-wise factors responsible for the distress, severity and duration of respiratory distress, oxygen therapy, type of treatment, mortality, maternal and antenatal risk factors, radiological findings were noted in all the cases and were analysed.
Results: Of the 200 cases with respiratory distress, 118 (59%) had severe respiratory distress. 154 cases with distress were of respiratory system in origin out of which 45% (70 out of 154) were due to Meconium aspiration syndrome, 42% (64 out of 154) were due to Respiratory distress syndrome, 12% (18 out of 154) were due to transient tachypnea of new-born and 2% were due to congenital pneumonia. More number of female patients had severe respiratory distress. Mortality was 2.5%.
Conclusions: Meconium aspiration syndrome is the most common cause of respiratory distress in new born. Almost 60% of new borns with respiratory distress developed severe respiratory distress who required intensive monitoring. Risk factors like meconium stained liquor, vaginal delivered new borns, preterm gestation age, and female gender of new born were associated with severe respiratory distress in new borns.

Keywords: Maternal risk factors, Meconium aspiration syndrome, Respiratory distress in new born

INTRODUCTION

Respiratory distress (RD) is a challenging problem and is one of the most common causes of admission in neonatal intensive care unit (NICU).[1] The neonatal mortality rate varies by state and overall it is reported to be 39 in1000 live births in India.[2] The common causes of RD in neonates includes transient tachypnea of the new born (TTN), hyaline membrane disease (HMD), birth asphyxia, pneumonia, meconium aspiration syndrome (MAS), and other miscellaneous causes.[3,4] There has been tremendous advancement in the management of RD which has improved the outcome in these neonates, like mechanical ventilation with different modes such as CPAP, ultra, high-frequency jet ventilation, liquid ventilation; surfactant replacement therapy; extra corporeal membrane oxygenation and sophisticated equipment for monitoring.

Despite these advancements, respiratory distress is responsible for high mortality in perinatal period. Kommawar et al in their study observed neonatal mortality of 21.5% attributable to respiratory distress in new borns.[5]

The objectives were to study the various risk factors associated with development of severe respiratory distress in the new born, to assess the clinical outcome of respiratory distress in new-born and to study the usefulness of chest x-ray to identify the cause of respiratory distress in neonate.

METHODS

The study was carried out in the Department of Paediatrics, Malla Reddy Medical College for Women, Telangana. This was a prospective study of 200 new-borns with respiratory distress who were admitted in the Paediatrics ward between July 2018 to January 2019.

Inclusion criteria

- All new-borns due to respiratory distress within 24 hours of birth.
- Babies included were both term and preterm babies.

Exclusion criteria

- All new-borns admitted to NICU with onset of respiratory distress after 24 hours of birth.

Data was collected for all new borns included in the study with respiratory distress. General information, socioeconomic status, history and clinical examination findings of the patients was documented. Time of onset of distress and the severity of the distress was documented and the severity was assessed by using Downes clinical scoring X-rays were done for all patients and were reported by the radiologist for abnormal findings. Depending on the clinical diagnosis of respiratory distress, relevant investigations were sent and the new borns were managed as per protocol. Duration of oxygen therapy, intervention done in the form of surgical/ ventilator/ surfactant therapy/ treatment and mortality was documented to assess the clinical outcome against the final diagnosis.

Statistical analysis

Chi square test was used to analyse the data. SPSS 20 was used to analyse the data.

RESULTS

In the present study 200 cases of new borns with respiratory distress were studied.

Etiology of respiratory distress

The cause of the respiratory distress could be attributed to the respiratory system and central nervous system in 154 (77%) and 37 (18.5%) cases respectively. The cardiovascular system was responsible in 7 (3.5%) cases and diaphragmatic hernia in 2 (1%) cases.

Causes of distress attributed to respiratory system

There were 154 cases with distress of respiratory system origin, out of which 70 (45%) were due to meconium aspiration syndrome, 64 (42%) were due to Respiratory distress syndrome, 18 (12%) were due to Transient tachypnea of new-born and 2% were due to congenital pneumonia.

Table 1: Final diagnosis versus severity of respiratory distress.

Diagnosis	No. of cases (n=200)	No. of cases with severe distress (n=118)	Percentage of cases with severe distress
Meconium aspiration syndrome	70	45	64.2%
Respiratory distress syndrome	64	47	73.4%
Transient tachypnoea of new born	18	3	16.6%
Congenital pneumonia	2	2	100%
Perinatal asphyxia	37	16	43.2%
Congenital heart disease	7	3	42.8%
Congenital diaphragmatic hernia	2	2	100%

Table 2: Final diagnosis versus duration of respiratory distress.

Final diagnosis	Total no. of cases	Distress <3 days	Distress for 4-7 days	Distress for 8-10 days
Meconium aspiration syndrome	70	49	20	1
Respiratory distress syndrome	64	13	50	1
Perinatal asphyxia	37	29	7	1
TTNB	18	18	-	-
Congenital diaphragmatic hernia	7	-	7	0
Congenital pneumonia	2	-	1	1

Table 3: Duration of oxygen therapy versus severity of respiratory distress.

Final diagnosis	Frequency n=200	Severe distress	No. of days on oxygen		
			1-3 days	4-7 days	8-10 days
MAS	70	45	49	20	1
RDS	64	47	13	50	1
TTNB	18	3	18	-	-
Congenital pneumonia	2	2		1	1
Perinatal asphyxia	37	16	29	7	1
CHD	7	3	-	7	-
Congenital diaphragmatic hernia	2	2	2	-	-

Table 4: Severity of respiratory distress and oxygen therapy.

No. of days oxygen required	No. of cases n=200	Severe distress	Mean	Standard deviation	Minimum	Maximum
1-3 days	111	51	2.354	0.6933	1.0	3.0
4-7 days	85	63	4.494	0.7867	4.0	6.0
8-10 days	4	4	8.500	1.000	8.0	10.0
Total	200	118				

Duration and oxygen required in days: r* was 0.331, p value was 0.0001: statistically significant.

Table 5: Treatment intervention.

Diagnosis	No. of cases (n=200)	Surgical intervention	Mechanical ventilation	Surfactant therapy	CPAP
MAS	70	-	-	-	-
RDS	64	-	6	10	4
Perinatal asphyxia	37	-	-	-	-
TTNB	18	-	-	-	-
CHD	7	-	-	-	-
CDH	2	1	1	-	-
Congenital pneumonia	2	0	0	0	0

All the cases of new borns diagnosed as congenital diaphragmatic hernia and congenital pneumonia had severe distress (Table 1).

Duration of distress

Out of total 200 cases 111 (55.5%) cases had distress for 1 to 3 days, 85 (42.5%) cases had distress for 4-7 days and only 4 (2%) cases had distress for 8-10 days. All the patients (100%) with TTNB, 78% with perinatal asphyxia, 70% with MAS and 21% with RDS had distress for less than 3 days (Table 2).

Majority (55.5%) of new borns with respiratory distress required oxygen treatment for less than 3 days. Requirement of oxygen was less than two days in all cases of TTNB in spite of severe respiratory distress (Table 3).

Out of the total 200 new borns with respiratory distress all the babies required oxygen, in view of their distress. It was observed that the more severe was the distress the more was the duration of oxygen requirement and was statistically correlated (Table 4).

Surgical intervention was done in one case of congenital diaphragmatic hernia. 6 cases of RDS required surfactant with mechanical ventilation and 4 cases required surfactant and CPAP support (Table 5).

Mortality

In the present study mortality was 2.5% (5 out of 200 cases) of which 3 cases were of RDS and 2 cases were CDH.

Risk factors for development of severe respiratory distress related to liquor

Out of total 200 cases, 118 had severe respiratory distress. Clear liquor was present in 130 cases and meconium stained liquor was seen in 30 cases. Of the 118 patients, 73 (56.1%) had clear liquor and 45 (64.2%) had meconium stained liquor.

P value was 0.265 and Chi square value was 1.24 which were statistically not significant but there was a percentage difference. 64.2% of new borns (45 out of 70) born to mothers with meconium stained liquor developed severe respiratory distress compared to 56.1% of the new borns (73 out of 130) born to mothers with clear liquor.

Mode of delivery

For the total 200 cases, caesarean section was done in 76 cases and vaginal delivery in the remaining 124 cases. For the 118 cases of severe respiratory distress, 36 (47.3%) had undergone caesarean section and 82 (66.1%) had undergone vaginal delivery. P value was 0 .009 and was significant. There was association between type of delivery and development of severe distress. 66.1% of new borns (82 out of 124) born by normal vaginal route developed severe respiratory distress compared to 47.3% of the new borns (36 out of 76) born by caesarean section.

Mode of delivery in MAS babies

Out of 70 babies with MAS, 46 (66%) were delivered by normal vaginal delivery and 24 (34%) were delivered by caesarean section.

Gestational age of the baby

There were 64, 134 and 2 cases respectively of preterm, term and post-term deliveries. Severe distress (n=118) was seen in 48 (75%), 68 (50.7%) and 2 (100%) cases of preterm, term and post-term deliveries respectively. P value-0.003 and Chi-square-11.937 was statistically significant. That is 75% of preterm new borns (48 out of 64) developed severe respiratory distress compared to 50.7% (68 out of 134) term babies and 2 post term new borns had severe distress.

Gender distribution

Of the 200 cases, there were 128 males and 72 females. Of the 118 cases of severe respiratory distress, 70 (54.6%) were males and 48 (66.6%) were females. P value of 0.098 was statistically not significant.

Maternal risk factors

For the 200 cases, maternal risk factors were present in 82 cases and were absent in 118 cases. For the 118 cases with severe distress, maternal risk factors were present in 67 (81.7%) cases and were absent in 51 (43.2%) cases. χ^2=6.801, P=0.0091 was highly significant. Out of total 200 babies 82 (41%) babies had antenatal risk factors. Out of 82 babies with antenatal risk factors 26 mothers had pregnancy induced hypertension (PIH), 12 mothers had oligohydramnios, 12 had premature rupture of membranes (PROM), 5 had antepartum haemorrhage (APH), 5 had twin gestation, 4 mothers were positive for HBSAg, 3 had fever, 3 had hypothyroidism, 3 had polyhydramnios, 2 were HIV positive, 2 cases had gestational diabetes mellitus (GDM), 1 case each had eclampsia and anemia complicating pregnancy, 2 mothers had heart disease complicating pregnancy (tetralogy of Fallot and rheumatic heart disease).

Table 6: Antenatal risk factors versus final diagnosis.

Antenatal risk factors	No. of cases	MAS	RDS	TTNB	Perinatal asphyxia	Congenital pneumonia	CHD	CDH
PIH	26	4	17	1	4	-	-	-
Oligohydramnios	12	7	2	-	1	-	2	-
PROM	12	7	2	-	1	-	2	-
APH	5	1	3	1	-	-	-	-
Twin gestation	5	-	4	-	1	-	-	-
HBSAg positive	4	2	-	-	1	-	1	-
Polyhydramnios	3	-	2	-	-	-	1	-
Fever	3	1	2	-	-	-	-	-
Hypothyroidism	3	1	-	-	2	-	-	-
HIV	2	1	-	1	-	-	-	-
Eclampsia	1	-	1	-	-	-	-	-
Anemia	1	1	-	-	-	-	-	-
Hyperthyroidism	1	-	-	-	1			
Heart disease	2	-	1	1	-	-	-	-
GDM	2	1	-	1	-	-	-	-
Total	82	26	34	5	11	-	6	-

Out of 26 mothers with PIH complicated pregnancy 17 (64%) babies developed RDS, 4(13.8%) babies each developed distress due to perinatal asphyxia and MAS and 1(3.8%) baby had distress due to TTNB. Out of 12 mothers with oligohydramnios complicated pregnancy 7 babies had distress due to MAS, 2 babies each had distress due to RDS and CHD, 1 baby had distress due to perinatal asphyxia (Table 6).

Table 7: Abnormal radiological findings.

Diagnosis	No. of cases (n=200)	Cases with abnormal findings	Percent
MAS	70	70	100
RDS	64	64	100
TTNB	18	8	44.4
Congenital pneumonia	2	2	100
Perinatal asphyxia	37	0	-
CDH	2	2	100
CHD	7	5	71.4
Total	200	151	75.5

In 75.5% of new borns with respiratory distress, abnormal chest X-ray findings were reported. All (100%) of the new borns with MAS, RDS, congenital pneumonia and CDH, had abnormal X-ray findings. None of the new borns with perinatal asphyxia had abnormal chest X-ray chest findings. In MAS out of 70 cases 52 (74.2%) cases had hyper inflated lungs and 18 (25.7%) cases had infiltrates. In RDS out of 64 cases 47(73.4%) cases had bilateral reticulogranular pattern and 13(20.3%) cases had low volume lungs. In TTNB out of 18 cases 2 had bulging fissure, 5 cases had hilar vessel prominence and 1 case had cardiomegaly (Table 7).

DISCUSSION

Assessment of clinical outcome

Early diagnosis of new-born distress is very important for its management and good clinical outcome. In this study authors attempted to identify the causes of new-born distress by clinical assessment of its severity, risk factor association and abnormal radiological findings.

Maternal risk factors

In the present study out of total 200 cases, 82 (41%) cases had antenatal risk factors and 118 cases had no antenatal risk factors (Table 6). Out of 82 babies with antenatal risk factors 26 mothers had PIH, 12 mothers had oligohydramnios, 12 had PROM, 5 had APH, 5 had twin gestation, 4 mothers were positive for HBSAg, 3 had fever, 3 had hypothyroidism, 3 had polyhydramnios, 2 were HIV positive, 2 had GDM, 1 case each had eclampsia and anemia complicating pregnancy, 2 mothers had heart disease complicating pregnancy.

Out of 12 mothers with oligohydramnios complicated pregnancy, 7 babies had distress due to MAS, 2 babies each had distress due to RDS and CHD, 1 baby had distress due to perinatal asphyxia. Out of 5 mothers with multiple gestation 4 babies developed distress due to RDS, and 1 baby had distress due to perinatal asphyxia. In a study done by Bassey et al over a period of 5 years, they observed that the commonest intrapartum complication was foetal distress in 42.86% cases.[6] Unbooked status was significantly associated with perinatal asphyxia. Bassey et al observed fetal distress in 42.8% of total multiple gestation pregnancy unlike present study the above study has not analyzed the etiology of distress, but they observed that perinatal asphyxia as a cause of distress significantly associated with unbooked cases.[6]

Fetal risk factors and gestational age

In the present study out of 200 cases, 134 (67%) were term babies, 64 (32%) were preterm and 2 cases (1%) were post term. 75% of preterm new-borns (47 out of 64) developed severe respiratory distress compared to 50.7% (68 out of 134) in term new-borns. In a study by Santhosh et al in 2011, they observed severe distress was more common in preterm babies than term babies.[7] Other workers have also observed in their studies that preterm babies were more likely to develop respiratory distress when compared to term babies.[8,9]

Liquor

In the present study out of 200 cases 130 (65%) babies were born with clear liquor and 70 (35%) were born with meconium stained liquor. 64.2% of new-borns (45 out of 70) born to mothers with meconium stained liquor developed severe respiratory distress compared to 56.1% of the new-borns (73 out of 130) born to mothers with clear liquor. Similar results were observed in the study done by Rygal et al where meconium stained liquor had more chances of developing respiratory distress, 58.8% when compared to 21.14%.[10] In the present study all the babies born with meconium stained liquor were of full term and post term gestational age. Monen et al in their study concluded that meconium-stained amniotic fluid was more prevalent with increasing term gestation.[11]

Mode of delivery

In the current study among 200 babies 124 (62%) were delivered by normal vaginal delivery and 76 (38%) were delivered by caesarean section. 66.7% of new borns (82 out of 124) born by normal vaginal route developed severe respiratory distress compared to 47% of the new borns (36 out of 76) by caesarean section.

A study conducted by Santhosh et al in 2013 showed that majority of preterm babies that were delivered vaginally developed severe RDS.[7] In present study all the babies with TTNB were delivered by caesarean section. In a

study done by Tudehope et al it was observed that TTNB was more common in babies born by caesarean section.[12]

Gender ratio

In the present study it was seen that out of 200 babies 128 were males and 72 were females. 66.6% of the new born (48 out of 72) female babies developed severe respiratory distress as compared to 54.60% (70 out of 128) male babies. Lureti et al reported that the frequency of neonatal respiratory distress was higher in males as compared to females.[9] Miller et al also observed that the incidence of severe respiratory distress was almost three times higher among males than females.[13] The discrepancy in the present study was due to associated maternal risk factors.

Etiology and diagnosis

In the present study out of 200 cases identified with respiratory distress, 77% were of respiratory system origin, 18% were of CNS system origin, 4% were of CVS causes, and 1% was due to CDH. The commonest cause among respiratory system origin was meconium aspiration syndrome (35%) followed by RDS (32%) and transient tachypnoea of newborn (9%). The only surgical cause for respiratory distress in the present study was CDH (1%) (Table 1 and 2). In a study done by Kumar et al it was seen that RDS was found to be the commonest (42.7%) cause of respiratory distress followed by TTNB (17.0%), MAS (10.7%), sepsis (9.3%) and birth asphyxia (3.3%).[14] Similarly Nagendra et al also observed that the commonest cause for respiratory distress in neonates was RDS (18.8%) followed by TTNB (14%) and MAS (12.5%).[15] This variability in the present study was due to increased number of term babies in the study and referral cases with meconium stained liquor.

Radiological diagnosis

In the present study out of 200 cases with respiratory distress 151 (75.5%) had abnormal radiological findings and 49 (24.5%) cases had normal X-ray findings (Table 7). All (100%) of the new borns with MAS (70 out of 70), RDS (64 out of 64), congenital pneumonia (2 out of 2) and CDH (2 out of 2), had abnormal X-ray findings compared to 44.4% (8 out of 18) of new borns with TTNB. 71.4% of new borns with congenital heart disease had abnormal X-rays. Study done by Dawei et al shows that serial X-rays are required to help in the management of respiratory distress.[16] However, Heinonen et al showed that diagnoses of respiratory distress agreed in 95% of the cases and that the first chest radiograph taken early during the course of the disease had the greatest impact in the care of neonates with mild respiratory distress.[17] Similarly, Kurl showed that the first chest radiograph taken early during the course of the disease had the greatest impact in the care of neonates with mild respiratory distress.[18] In a study done by Shahri et al in 2014, diagnostic utility of chest X-rays in neonatal respiratory distress showed that 79.4% of clinically diagnosed cases were confirmed by radiographs.[19]

Treatment intervention

Surgical intervention was done in one case of congenital diaphragmatic hernia (CDH). One case with CDH was operated within 48 hours and required ventilator care post-operatively (Table 5). Despite the advances in neonatal care, such as high-frequency oscillatory ventilation, inhaled nitric oxide, and ECMO, the mortality rate of isolated CDH remains substantial.[20]

Mc Honey et al in a study in 2015 observed that permissive hypercapnea and minimal ventilation have made the most significant impact on survival in modern era.[21] High-frequency oscillatory ventilation (HFOV), inhaled nitric oxide (iNO), treatment of pulmonary hypertension, and ECMO are used in a somewhat stepwise manner for stabilisation. Delayed surgery has become established later in management plan. The impact of individual therapies (e.g. HFOV, iNO, ECMO) on outcome is difficult to ascertain.[21] In this study, 9% of RDS babies required mechanical ventilation with surfactant and 6% babies were given surfactant and CPAP. Urs et al in their study observed that in preterm infants with respiratory distress syndrome (RDS), the application of continuous positive airway pressure (CPAP) is associated with benefits by way of reduced respiratory failure and reduced mortality.[22] A study done by Ma et al in 2012 showed that early surfactant instillation demonstrated greater impact in reducing the risk of RDS and its related complications.[23]

Duration of oxygen therapy

In present study majority of the cases (95%) required oxygen for more than 24 hours which implied O2 requirement depends on the severity of respiratory distress (Table 3 and 4). Escobar et al studied the neonates born with respiratory distress requiring supplemental oxygen and it was seen that 80% required supplemental oxygen for at least an hour.[24] Bhutta et al studied 200 babies born out of which 81 were diagnosed with respiratory distress.[25] It was seen that these babies required supplemental oxygen while in NICU. But unlike the present study the above study has not analysed O2 requirement depending on the cause of respiratory distress which would help to determine clinical outcome.

Mortality

Mortality in the present study was 2.5% (5 out of 200) of which 3 cases died due to severe RDS and 2 cases due to CDH. Kamath et al in 2011 showed that with the advent of CPAP and mechanical ventilation, mortality in pre-terms reduced to less than 5%.[26] In a study done by Santhosh et al in 2013 on respiratory distress, 70 (92%) babies survived and 6 expired i.e mortality was 8%.[7]

Burgos et al in their study showed that children with prenatally diagnosed CDH represent a population with a more severe condition compared to infants diagnosed after birth.[27]

Mortality due to RDS

In the present study, out of 5 expired cases, 3(60%) cases were due to RDS. In study done by Santhosh et al out of 6 deaths, 4(66.6%) deaths were due to pre-terms with hyaline membrane disease.[7] Malhotra et al also observed that 88% mortality was due to respiratory distress syndrome.[28] In the present study, among 6 cases ventilated for RDS, 3(50%) cases expired. Similar findings were reported by Santhosh et al where 5(31.2%) cases expired among 16 cases that were ventilated for RDS.[7] Kulkarni et al observed that mortality in ventilated cases was 49%.[29]

CONCLUSION

Meconium aspiration syndrome is the most common cause of respiratory distress in new born. Almost 60% of new borns with respiratory distress developed severe respiratory distress who required intensive monitoring. Risk factors like meconium stained liquor, vaginal delivered new borns, preterm gestation age, and female gender of new born were associated with severe respiratory distress in new borns. Immediate clinical outcome of neonatal respiratory distress in terms of mortality rate is variable and depends on the cause of the distress. Chest radiograph taken early during the course of the respiratory distress in neonates is an important diagnostic tool for early identification of the cause of the distress.

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