Original Research Article

Study of risk factors associated with development of severe respiratory distress in the new born

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ABSTRACT

Background: As Transient tachypnea of newborn is the most common cause of Respiratory distress and significant number of newborns with respiratory distress develops severe respiratory insufficiency requiring intensive monitoring. With these points, we undertake to identify risk factors associated with development of severe respiratory distress in the new born.
Methods: Hundred newborns that were having respiratory distress within 72 hours of birth admitted to NICU were included in the present study. The severity of respiratory distress was noted according to risk factors and clinical assessment. The details were noted in all the newborns- General information, history, risk factors and clinical examination findings of mother and newborn were documented.
Results: In the present study, 62.5% of the newborns born to Primigravida mothers developed severe respiratory distress. In the present study it was seen that 83.6% of newborns with SGA developed severe respiratory distress compared to 60% and 33.3% newborns with LGA and AGA respectively. It was seen that the risk of neonatal respiratory distress markedly increased with decreasing birth weight (p<0.001).
Conclusions: Immediate clinical outcome of newborn respiratory distress in term of mortality rate is variable and depends on the cause of newborn distress.

Keywords: New born baby, NICU, Respiratory distress, Risk factors

INTRODUCTION

Respiratory distress is diagnosed clinically by the presence of at least two of the following criteria namely, respiratory rate of >60/minute, retractions (sub costal, xiphoid and suprasternal recession), flaring of the alaenasi, expiratory grunt and cyanosis at room air on two consecutive examinations at least 1 hour apart.[1] Respiratory distress may vary from 7-8% among live births. The incidence varies from 30% among preterm's,

20% among post-terms to 4% in term babies.[1] As Transient tachypnea of newborn is the most common cause of Respiratory distress and significant number of newborns with respiratory distress develops severe respiratory insufficiency requiring intensive monitoring.

As immediate outcome of respiratory distress in newborn in terms of morbidity and mortality depends on the various risk factors and time of diagnosis and early diagnosis will help in reducing the morbidity and

mortality. Hence there is a need for the study to assess the various risk factors contributing to respiratory distress.

Underlying cause of respiratory distress in the newborn can lead to short or long-term complications which includes chronic lung disease, respiratory failure, and even death if fail to recognize symptoms.[2]

Incidence of major acute neonatal respiratory illnesses and related complications performed a multicentre prospective study by The Italian Group of Neonatal Pneumology.[3] Although the incidence of RDS is inversely related to gestational age, prematurity alone does not determine the risk of developing the disorder.[4]

Compared with adult neonatal rib cage is more cylindrical than ellipsoidal in cross section, ribs run parallel in a horizontal plane than obliquely. The inter costal and accessory muscles there is a shorter course thus less forceful contractions and less mechanical advantage for lifting the ribs for increasing intra thoracic volume during forceful inspiration. The angle of insertion of the newborn diaphragm is more horizontal than adult and results in a tendency to more inward rather than upward during respiratory contraction. The soft, pliable ribs present little resistance to inward movement. The strength and endurance that is resist to fatigue of respiratory muscle determined by the total muscle mass and oxidative capacity of their fibers.

Newborns more so preterm have low total muscle mass and low percentage of Type I fibers (slow twitch high oxidative). Respiratory muscle fatigue in hence common, the average force generated by a skeletal muscle before it becomes fatigued is inversely proportional to the number of contractions that it effects per unit time.

Elastic recoil is the main driving force during passive expiration. It depends on tissue elastic elements the surface tension produced at the air-liquid interphase and on the bony rib cage. Newborn especially preterm's have a relatively non-ossified rib cage with largely cartilaginous ribs and highly compliant chest wall. Thus very little resistance is provided against chest expansion on inspiration.

At rapid rates of breathing, resistive work is increased, whereas with large tidal volumes, elastic work is increased. In upright position - diaphragmatic contractions cause it to move downwards in a uniform way. In supine position contraction of diaphragm tends to pull the inferior rib cage posteriorly rather than upwards and the cephalad movement of the rib cage is decreased.[4]

METHODS

This is a Hospital based observational study conducted at Apollo BGS Hospital, Tertiary Health Centre, Kuvempunagar, Mysore.

Study population

Hundred newborns that were having respiratory distress within 72 hours of birth admitted to NICU

Study design

This is a one-year prospective study. The severity of respiratory distress was noted according to risk factors and clinical assessment. Sample size :100, calculated by using the formula $n = 1.96 \times 1.96 \times p \times q/ d2$ n = sample size, p = prevalence of respiratory distress in newborn (50%) q = 100 - p, d = relative precision of 20%. n = 96. Rounded to near 100.

Inclusion criteria

All newborns admitted to NICU within 72 hrs of birth due to respiratory distress.

Exclusion criteria

- All Newborns admitted to NICU with onset of respiratory distress after 72hrs.
- Outside born newborns admitted with respiratory distress.

Method of collection of data

Data was collected from newborns admitted to NICU with respiratory distress within 72 hours of birth after satisfying inclusion and exclusion criteria. A pre-structured and pre-tested proforma was used to collect data. The details were noted in all the newborns- general information, history, risk factors and clinical examination findings of mother and newborn were documented.

Depending on the clinical diagnosis of respiratory distress, relevant investigations were sent, and newborns were managed as per protocol.

Statistical analysis

Data for continuous variable will be expressed as mean, SD and frequencies or percentages for non-continuous variables. Comparison between groups will be made using student's "t" test for parametric data and chi-square test for non-parametric data. SPSS for windows (version 17.0) was employed for data analysis. $p<0.05$ was considered as significant and $p<0.01$ was considered as highly significant.

RESULTS

It was seen that in 98% of the cases of newborn respiratory distress the cause was respiratory in origin. There was one case of diaphragmatic hernia and one case of congenital heart disease (Acyanotic CHD, VSD, ASD, moderate PAH, heart failure).

Table 1: Etiology of respiratory distress.

Etiology	Frequency n=100	%
Respiratory	98	98
Cardiac	1	1
Diaphragmatic hernia	1	1

86% of the newborns (13 out of 15) born to mothers with maternal age >30 developed severe respiratory distress compared to 56 % (14 out of 25) and 35% (21 out of 60) newborns born to mothers below 21 years and between 22-30 years respectively.

Table 2: Maternal age.

Age of mothers (yrs)	Frequency n=100	Severe distress (n=48)	%
<21	25	14	56%
22-30	60	21	35%
>30	15	13	86%

X^2=7.207; p=0.0073 significant

High maternal age was found to be associated risk factor for developing respiratory distress in newborns (p=0.0073).

Table 3: Parity.

Parity	Frequency n=100	Severe Distress n=48	%
Primigravida	40	25	62.5%
Gravida 2to3	34	16	47 %
Multigravida	26	7	35%

X^2=35.3501; p=0.001 very highly significant

62.5% of the newborns (25 out of 40) born to Primigravida mothers developed severe respiratory distress compared to 47 % (16 out of 34) and 35% (7 out of 26) newborns born to 2nd and 3rd Gravid and more than 4th gravid.

Table 4: Mode of delivery.

Mode of Delivery	Frequency n=100	Severe distress n=48	%
Caesarean	75	37	49.3
Normal vaginal	25	11	44

x^2=12.208, p=0.005 highly significant

Table 5: Gestation of the baby.

Gestation	Frequency	Severe distress n=48	%
SGA	24	20	83.30%
LGA	10	6	60%
AGA	66	22	33.30%

x2=35.58; p<0.001; very highly significant

Parity was found to be highly associated risk factor for developing respiratory distress in newborns (p=0.001). In present study, primigravida shows highly associated factor.

9.3% of newborns (37 out of 75) born by caesarean section developed severe respiratory distress compared to 44% of the newborns (11 out of 25) born by normal vaginal route.

Table 6: 1 min APGAR score.

1 min APGAR score	Frequency n=100	Severe distress n=48	%
<7	72	38	53
>7	28	10	36

X^2=8.007; p=0.0047; highly significant

Mode of delivery was found to be highly associated risk factor for developing respiratory distress in newborns (p=0.005). In present study, Caesarean section shows highly associated factor.

Table 7: Birth weight.

Weight in kg	Frequency n=100	Severe distress n=48	%
<2.5	27	16	59.25%
2.5-3.5	66	30	50%
>3.5	7	2	28.50%

X^2=26.85; p<0.001 very highly significant

83.6% of newborns (20 out of 24) with SGA developed severe respiratory distress compared to 60% (6 out of 10) and 33.3% (22 out of 62) newborns with LGA and AGA respectively. Gestation was found to be highly associated risk factor for developing respiratory distress in newborns (p<0.001). Further, it was observed that SGA babies had a significantly higher association with the incidence of respiratory distress when compared to AGA or LGA babies. 53% of newborns (38 out of 72) with 1 min apgar of less than 7 developed severe respiratory distress compared to 36% (10 out of 28) with 1 min apgar more than 7. 1 min APGAR score was found to be highly associated risk factor for developing respiratory distress in newborns (p=0.0047). Further, it was observed that lower score was associated respiratory distress.59.25% of the newborns (16 out of 27) with birth weight of < 2.5 Kgs had developed severe respiratory distress compared to 50 % (30 out of 66) and 28.5% (2 out of 67) with birth weight of 2.5 -3.5 kgs and >3.5kgs respectively.

Birth weight was found to be highly associated risk factor for developing respiratory distress in newborns (p<0.001). Further, it was observed that, the risk of neonatal respiratory distress markedly increased with decreasing birth weight compared to babies weighing more than 2.5 kgs.

DISCUSSION

Etiology

In the present study out of 100 cases identified with respiratory distress, 98%were respiratory in origin.

Associated risk factors

Maternal risk factors

Maternal age

In the present study it was seen that 86% of the newborns born to mothers with maternal age >30 developed severe respiratory distress compared to 56% and 35% newborns born to mothers below 21 years and between 22-30 years respectively. Similar results were observed in the study done by Dani C et al where it was observed that mothers > 32 years of age were at a higher risk of delivering babies with respiratory distress.[5]

Whereas in another study, similar comparison was seen in the study done by Smith A et al were higher maternal age was identified as a risk factor for neonatal respiratory distress.[6] Hence, it was observed higher maternal age to be a risk factor for developing respiratory distress in newborns.

Parity

In the present study, 62.5% of the newborns born to Primigravida mothers developed severe respiratory distress when compared to 47% and 35% newborns born to 2nd and 3rd Gravida and multigravida.

Similar results were observed in the study done by Dani C et al where it was seen that the incidence of respiratory distress was more in the first pregnancy and after the fourth pregnancy. However, Mathur NB et al has shown that multigravida was a risk factors for developing respiratory distress in newborns.[5,6,7]

Lureti M however shows that there is no significant association between multiparity and the attainment of respiratory distress.[8] Prolonged labour in the primigravida may be the reason for development of respiratory distress in neonates in the present study.

Mode of delivery

49.3% of newborns born by caesarean section developed severe respiratory distress compared to 44% of the newborns born by normal vaginal route. Similar findings were observed in studies done by Dani C et al, Geller EJ et al and Gouyon JB et al where it was noticed that caesarean delivered babies have more chances of neonatal respiratory distress when compared to normal vaginal delivery.[5,9,10]

Fetal risk factors

Gestation

In the present study it was seen that 83.6% of newborns with SGA developed severe respiratory distress compared to 60% and 33.3% newborns with LGA and AGA respectively. Similar findings were observed in a study done by Lee KS et al where it was seen that SGA babies had a significantly higher association with the incidence of respiratory distress when compared to AGA or LGA babies. Dani C et al and Lureti M has also observed in their studies that SGA babies were more associated with respiratory distress when compared to AGA or LGA babies.[11,5,8]

1 min Apgar score

In the present study it was seen that 53% of newborns with 1 min apgar of less than 7 developed severe respiratory distress compared to 36% with 1min apgar more than 7. Study done by Lureti M has shown that a Low Apgar score at 1st and 5th min < 7 was associated with an increased risk of respiratory distress when compared to babies with Apgar score more than 7.9 at 1 minute of age and 8.4 for 5minutes of age. Similarly, Fidanovski D et al observed that low 1 min apgar score was more associated with respiratory distress and Prolonged NICU stay.[8,12]

However, Gouyon JB et al showed that Apgar score ≤3 at 1 min was more associated with increased respiratory distress. Study done by Linderkamp O et al showed that lower Apgar score (minutes 1 and 5) were associated respiratory distress and prolonged stay in the NICU.[10,13]

Birth weight

In the present study it was seen that 59.25% of the newborns with birth weight of < 2.5 Kgs had developed severe respiratory distress compared to 50 % and 28.5% with birth weight of 2.5-3.5 Kgs and >3.5kgs respectively. In the study done by Lureti M it was seen that the risk of neonatal respiratory distress markedly increased with decreasing birth weight compared to babies weighing more than 2500 g at birth.[8] However, in the study done by Miller HC it was seen that respiratory distress was more common in babies weighing between 1000gms-1500gmsand the risk of respiratory distress reduced with increase in birth weight.[14]

CONCLUSION

Risk factors like high maternal age, primigravida mothers, caesarean delivered new-born's, Small for gestation age, and 1 min Apgar score less than 7, and birth weight less than 2.5Kg were associated with severe respiratory distress in new-borns. Immediate clinical outcome of new-born respiratory distress in term of

mortality rate is variable and depends on the cause of new-born distress.

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REFERENCES

1. Meharban Singh. Respiratory disorder. in: Meharban singh, eds. Care of the newborn. 6th ed. New Delhi: Sagar publication; 2004:262.
2. Eren S, Ciriş F. Diaphragmatic hernia: diagnostic approaches with review of the literature. Eur J Radiol. 2005;54(3):448-59.
3. Kumar A, Bhat BV. Respiratory distress in newborn. Indian J Matern Child Health. 1996;7(1):8-10.
4. Whitsett JA, Rice WA, Warner BB, Wert SE, Pryhuber GS. Acute Respiratory Disorders. In: Taeusch HW, Ballard RA, Gleasen CA. eds. Avery's Disease of Newborn. Neonatology Pathophysiology and Management of the newborn. 8th edition. Philadelphia USA: Lippincott Williams and Willkins; 2012:553-98.
5. Dani C, Reali MF, Bertini G, Wiechmann L, Spagnolo A, Tangucci M, et al. Risk factors for the development of respiratory distress syndrome and transient tachypnoea in newborn infants. Eur Respir J. 1999;14(1):155-9.
6. Malhotra AK, Nagpal R, Gupta RK, Chhajta DS, Arora RK. Respiratory distress in newborn: treated with ventilation in a level II nursery. Indian Paedtr.1995;32(2):207-11.
7. Mathur NB, Garg K, Kumar S. Respiratory distress in newborn. Indian Paediatr. 2002;39(6):29-37.
8. Luerti M, Parazzini F, Agarossi A, Bianchi C, Rocchetti M, Bevilacqua G. Risk factors for respiratory distress syndrome in the newborn: a multicenter Italian survey. Acta Obstetricia et Gynecologica Scandinavica. 1993;72(5):359-64.
9. Geller EJ, Wu JM, Jannelli ML, Nguyen TV, Visco AG. Neonatal outcomes associated with planned vaginal versus planned primary caesarean delivery. J Perinatol. 2010;30(4):258-64.
10. Gouyon JB, Ribakovsky C, Ferdynus C, Quantin C, Sagot P, Gouyon B. Severe respiratory disorders in term neonates. Paediatr Perinata Epidemiol. 2008;22(1):22-30.
11. Lee KS, Eidelman AI, Tseng PI, Kandail SR, Lawrence M. Respiratory distress syndrome of the newborn and complications of pregnancy. Pediatr. 1976;58(5):675-80.
12. Fidanovski D, Milev V, Sajkovski A, Hristovski A, Sofijanova A, Kojić L, et al. Mortality risk factors in premature infants with respiratory distress syndrome treated by mechanical ventilation. Srp Arh Celok Lek. 2005;133(1-2):29-35.
13. Linderkamp O, Versmold HT, Fendel H, Riegel KP, Betke K. Association of neonatal respiratory distress with birth asphyxia and deficiency of red cell mass in premature infants. Eur J Pediatr. 1978;129(3):167-73.
14. Miller HC. Respiratory distress syndrome of newborn infants: statistical evaluation of factors possibly affecting survival of premature infants. Pediatr.1998;573-9.