

Evaluation of acid base status and outcome of neonatal respiratory distress

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Abstract

Objective: Both pulmonary and extra pulmonary causes could present as tachypnea and respiratory distress. We have planned a study to evaluate acid base status and outcome of neonatal respiratory distress. **Methods:** A prospective study carried on neonates admitted in intensive care unit from 1st November 2014 to 31st October 2015 in Department of Paediatrics of a tertiary care centre of UP. Ethical Clearance was taken by Ethics Committee of the college. Newborns brought to our NICU with respiratory distress were included in study randomly. After detailed clinical history, examination, arterial blood was taken in all the babies for ABG analysis with necessary precautions along with other routine investigation and stabilization of the baby. **Results:** A total of 115 neonates with respiratory distress were selected for study, out of these about 24.34% had normal pH, 45.21% had metabolic acidosis, 21.73% neonates had respiratory acidosis and 8.69% had mixed pH disorder. Neonates having respiratory distress with normal pH 85.71% were discharged from the hospital, 7.14% went LAMA and 7.14% expired during the treatment. Neonates having respiratory distress with abnormal pH 77.01% were discharged from the hospital, 2.29% went LAMA and 20.68% expired during the treatment. **Conclusion:** The expiry rate was significantly higher in neonates having abnormal pH with respiratory distress than in neonates with normal pH with respiratory distress ($p < 0.05$).

Keywords: Neonatal respiratory distress, Acid base abnormality, Meconium aspiration syndrome, Transient tachypnea of newborn.

Introduction

Neonatal respiratory distress is a heterogeneous group of illness with varying incidence, underlying etiology, clinical course and outcome. It is one of the commonest disorders encountered within the first 48-72 hours of life. It occurs in approximately 0.96%-6% of live births, and is responsible for about 20% of neonatal mortality [1]. Respiratory distress is a common reason for a neonate seeking medical attention. The clinical features of tachypnea, intercostal retractions, grunting or cyanosis could be the manifestations of a variety of etiological causes. Both pulmonary and extra pulmonary causes could present as tachypnea and respiratory distress [2].

Respiratory distress due to either medical or surgical causes occurs commonly in neonates. It is the most common cause of admission to a neonatal surgical intensive care facility in a tertiary care hospital [3]. Blood gas measurements and complementary, noninvasive monitoring techniques provide the clinician with information essential to patient assessment, therapeutic decision making, and prognostication. Blood gas measurements are as important for ill newborns as for other critically ill patients, but rapidly changing physiology, difficult access to arterial and mixed venous sampling sites, and small blood volumes present unique challenges [4].

Considering above facts the present study was planned with aims and objective of

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1. To see incidence of various causes of respiratory distress in newborns
2. To see acid base status of neonates with respiratory distress
3. To see the outcome of abnormal acid base neonates with distress

Material & Methods

The present study carried out on neonates admitted in intensive care unit from 1st November 2014 to 31st October 2015 in Department of Paediatrics, M.L.B. Medical College, Jhansi UP. Ethical Clearance was taken by Ethics Committee of the college. Newborns brought to our NICU with one or more of following for more than two hours would be considered to have respiratory distress and included in study-

- Respiratory rate > 60/min
- Respiratory grunting

Results

A total of 115 neonates admitted in SNCU with respiratory distress were taken in to this study. A total of 115 neonates with respiratory distress were selected for study randomly who met the inclusion criteria. Out of above 85(73.91%) babies were male and 30(26.08%) were female. The mode of delivery was normal for 48(41.73%) babies and Caesarian for 67(58.26%) babies.

- Intercostal / subcostal retraction
- Xiphoid retraction
- Sub sternalin drawing
- Flaring of alae nasi
- Cyanosis in room air

Exclusion criteria

- Babies more than 28 days.
- Babies weight less than 1000gm
- Babies less than 28 weeks of age.

After detailed clinical history, examination, arterial blood was taken in all the babies for ABG analysis with necessary precautions along with other routine investigation and stabilization of the baby. Informed consent was taken in the cases. The sealed syringe taken to blood gas analyzer immediately or otherwise within 30 minutes it should be always analyzed.

Table I: Distribution of neonates with causes of respiratory distress in relation to gestational age

Gestational Age	Total	RDS	MAS	TTN	PNM	HIE	Others
28-30Weeks	8	7	0	0	1	0	0
30-32Weeks	4	3	0	0	1	0	0
32-34Weeks	20	11	3	3	2	1	0
34-36Weeks	30	7	6	5	6	5	1
36-38Weeks	40	5	8	8	10	5	4
38-40Weeks	11	0	3	4	4	0	0
>40Weeks	2	0	1	1	0	0	0

(RDS- Respiratory distress syndrome, MAS- Meconium Aspiration Syndrome, TTN- Transient Tachypnea of Newborn, PNM- Pneumonia, HIE- Hypoxic Ischemic Encephalopathy)

We observed as shown in Table I that Respiratory distress syndrome is the most common cause of respiratory distress in early gestational age group. In gestational age 28-30wks Respiratory distress syndrome 87.5% is the most common cause followed by pneumonia 12.5%. In gestational age 30-32wks Respiratory distress syndrome 75% is the most common cause followed by pneumonia 25%. In gestational age 32-34wks Respiratory distress syndrome 55% is the most common cause followed by TTN 15%, MAS 15%, pneumonia 10%, and HIE 5%. In gestational age 34-36wks Respiratory distress syndrome 21.21% is the most common cause followed by PNM 18.18%, MAS 18.18%, TTN 16.66%, HIE 16.66%, and others 3.33%.

In gestational age 36-38wks PNM 25% is the most common cause followed by TTN 20%, MAS 20%, RDS 12.5%, HIE 5% and others 10%. In gestational age 38-40 weeks PNM and TTN 36.36% each is the most common cause followed by MAS 27.27%. In gestational age >40wks we observed that MAS and TTN are the more predominant causes. We have observed that as the gestational age advances TTN and Pneumonia were the common causes while RDS was most commonly seen in lesser gestational age.

Table II: Incidence of acid base disturbance in neonates with respiratory distress

Total	Normal	Metabolic acidosis		Respiratory acidosis		Mixed
n=115	28 (24.34%)	52(45.21%)		25(21.73%)		10(8.69%)
		Partially compensated	Uncompensated	Partially compensated	Uncompensated	
		29(25.21%)	23(20%)	11(9.56%)	14(12.17%)	

Out of 115 neonates included in the study about 24.34% had normal pH, 45.21% had metabolic acidosis, 21.73% neonates had respiratory acidosis and 8.69% had mixed pH disorder. None of them had metabolic and respiratory alkalosis. Neonates with metabolic acidosis again divided into partially compensated and uncompensated. 25.21% had partially compensated and 20% uncompensated metabolic acidosis. Neonates with Respiratory acidosis again divided into partially compensated and uncompensated. 9.56% had partially compensated, 12.17% uncompensated metabolic acidosis. About 8.69% had mixed type of pH disorder. We observed that metabolic acidosis was the most common pH disorder in newborns with respiratory distress.

Table III: Comparison outcomes of neonates with acid base abnormality and without acid base abnormality with symptoms & signs of respiratory distress

	Total	Discharge	LAMA	Expiry
Normal pH	n=28 (24.34%)	24(85.71%)	2(7.14%)	2(7.14%)
Abnormal pH	n=87 (75.65%)	67(77.01%)	2(2.29%)	18(20.68%)

By ABG analysis in the neonates with respiratory distress observed that about 24.34% had normal pH and 75.65% had abnormal pH. Neonates having respiratory distress with normal pH 85.71% discharged from the hospital, 7.14% went LAMA and 7.14% expired during the treatment. Neonates having respiratory distress with abnormal pH 77.01% discharged from the hospital, 2.29% went LAMA and 20.68% expired during the treatment. The discharge and expiry of neonates with and without normal pH was statistically significant (p value 0.0124) by Fisher's exact test.

Discussion

Respiratory distress in a newborn is a challenging problem. It accounts for significant morbidity and mortality. Respiratory distress in newborn is one of the commonest conditions contributing to 30-40% of admissions in NICU. Respiratory distress occurs in 2.2% of all newborns and in almost 60% of the infants below 1000gms (ELBW infants). Maintaining acid base balance presents a considerable challenge to the neonate[5]

Out of 115 patient included in the study 73.91% (85) are male and 26.09% (30) females. From this study we observed that there is a male predominance. Male to female ratio is 2.83:1. Lekhvani S et al [6] also did a study in in 2010 and found the male-to-female ratio was 4.56:1 (41 males to 9 females). Male ratio is greater than female ratio because female fetal lung produces surfactant earlier in gestation than the male fetal lung. Seaborn T et al in 2010[7], Bresson E. et al in 2010[8] also reported similar reason for male and female lung maturation. **Santosh S et al in 2013[9] studied that respiratory distress accounts most common cause of all**

NICU admissions and preterm babies were more in number with male predominance.

In our study 41.73% (48) are born by normal vaginal delivery and 58.26% (67) are born by LSCS. We observed that predominant mode of delivery is LSCS. Jing Liu et al [10] in 2014 conducted a study and stated that cesarean section and male sex are at risk for respiratory distress. We found most common cause for respiratory distress was Respiratory Distress Syndrome about 28.69%, followed by pneumonia 20.86%. Lekhvani S et al [6] found that acid-base status is major pathological disorders in birth asphyxia, bronchopneumonia, sepsis, and diarrhea, but they have included infants also not only neonates as in present study.

Anitha B, Sethi et al [11] in 2015 studied the acid base disturbances in sick neonates admitted in NICU and they also found metabolic acidosis was the most common acid base disorder. In our study, we also observed similar findings.

In our study the neonates having respiratory distress with normal pH 85.71% discharged from the hospital and 7.14% expired during the treatment as compared to abnormal pH 77.01% discharged from the hospital and 20.68% expired during the treatment. This is statistically significant with p value 0.0124 by Fisher's exact test. Lekhvani S et al also found increased mortality in babies with abnormal acid base status.

Conclusions

We concluded that neonatal respiratory distress is more common in male babies and babies born by caesarian delivery. Most common cause for respiratory distress was Respiratory Distress Syndrome about 28.69% followed by Pneumonia in 20.86 %.As the gestational age advances most common cause for respiratory distress in a neonates was TTN.

Near term neonates most common cause was pneumonia. While in lower gestational ages Respiratory Distress Syndrome was the most common cause. Neonates with respiratory distress had 24.34% normal pH and 75.64% abnormal pH. The expiry rate was significantly higher in neonates having abnormal pH with respiratory distress than in neonates with normal pH with respiratory distress ($p < 0.05$).

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