Journal of Cardiovascular Disease Research

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 10, 2023

Original research article

To study etiological profile and outcome of respiratory distress in distress in neonates in tertiary care center

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Abstract

Respiratory diseases are the major cause of neonatal mortality (0-7 days of age), the leading cause of morbidity in newborns, and the most common reason for admission to the special care nursery for both term and preterm infants. The aim of the study is to study different underlying causes of respiratory distress and to find out factors associated with the neonatal outcomes.

It is a hospital based observational study between June 2021 to August 2021. This study was conducted on 184 neonates at Neonatal Units of Department of Pediatric medicine, SPMCH hospital, S.M.S. Medical College Jaipur (Rajasthan). Assessing the clinical outcome may benefit from a clinical examination of severe respiratory distress using the Downes and Anderson scores for term and preterm infants, respectively. Low birth weight and a late preterm gestational period were fetal risk factors.

A better result for the newborn can be achieved with proper antenatal care, early detection of antenatal complications, and avoiding preterm deliveries. Early detection and appropriate management of the condition is essential to ensure better outcome in all the infants presenting with respiratory distress.

The same study needs to be conducted in community-based settings with additional samples from different centers, and the meta-analysis will show the full range of respiratory distress in our neighbourhood.

Keywords: Etiological, respiratory distress, neonates, tertiary care center

Introduction

Respiratory distress is one of the most prevalent illnesses in the first 48-72 hours of life [1]. Respiratory distress affects 4-7% of all infants and accounts for 30-40% of NICU admissions [2, 3]. Every year, an estimated 2.9 million babies die during the neonatal period (the first 28 days of life), accounting for more than half of all under-five child mortality in most regions of the world, and 44% worldwide [4]. Respiratory diseases are the major cause of neonatal mortality (0-7 days of age)[5], the leading cause of morbidity in newborns [6] and the most common reason for admission to the special care nursery for both term and preterm infants [7].

A group of symptoms known as respiratory distress is brought on by disease processes that interfere with gas exchange [1]. The most typical sign of infant respiratory distress is tachypnea. 40 to 60 breaths per minute are considered to be a typical respiratory rate [8]. Apnea, apnea retractions (subcostal, intercostal, xiphoid, suprasternal), grunting, nasal flaring, and cyanosis are just a few of the clinical signs of infant respiratory distress [9]. Additionally possible in the newborn are lethargy, inadequate feeding, hypothermia, and hypoglycemia [8].

The most common causes of neonatal respiratory distress are transient tachypnea of the neonate (TTNB) and respiratory distress syndrome (RDS). Pneumonia, sepsis, pneumothorax, and delayed transition are all symptoms of meconium aspiration syndrome (MAS). Choanal atresia, diaphragmatic hernia, tracheoesophageal fistula, congenital heart disease, and neurologic, metabolic, and hematologic problems are all rare causes [8].

Newborn respiratory illnesses are more likely as a result of certain risk factors. These risk factors include prematurity, meconium-stained amniotic fluid (MSAF), caesarean section birth, gestational diabetes, maternal chorioamnionitis, and prenatal ultrasonographic findings such as oligohydramnios or structural lung abnormalities [10, 11, 12, 14, 15, 16]. As a result, any health care practitioner caring for newborn infants must be able to recognize the signs and symptoms of respiratory distress, distinguish between different causes, and initiate therapeutic techniques in order to avoid significant complications or death [17]. The Downes and Silverman Anderson (SAS) ratings are two significant clinical measures for determining the

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 10, 2023

severity of respiratory distress. The Downes score is used to determine the severity of respiratory distress in term neonates, and the Silverman Anderson score is used in preterm babies [1].
The result for newborns will be significantly improved by continued efforts to avoid preterm birth, detect fetal distress early, identify maternal risk factors, and diagnose disorders in utero. Early detection and treatment of newborn respiratory illness yields outstanding results. Though treatment depends on the condition, standard treatment approaches include resuscitation, oxygenation, surfactant replacement, and ventilation. The introduction of continuous positive airway pressure (CPAP) and ventilators has transformed the outcome of neonatal respiratory insufficiency [1].
The study is carried out to gain knowledge about the demographics (including maternal and neonatal factors), and etiological factors and outcome of respiratory distress patients in a tertiary care referral center in India. The aim of the study is to study different underlying causes of respiratory distress and to find out factors associated with the neonatal outcomes.

Material and methods
It is a hospital based observational study between June 2021 to August 2021. This study was conducted at Neonatal Units of Department of Pediatric medicine, SPMCH hospital, S.M.S. Medical College Jaipur, Rajasthan. All neonates with respiratory distress admitted in the NICU of study center. Sample size is calculated at 95% confidence level, Alpha error of 0.05 expecting 12% of the Respiratory Distress in neonates due to CNS causes, as per the Reference article (Etiological study of respiratory distress in neonate).
At 5% Absolute Allowable error, the required sample size will be 170 cases of neonates with Respiratory Distress. This sample size is large enough to include all causes of Respiratory Distress among neonates.
The study was conducted according to the guidelines and approved by the institutional ethics committee. Written informed consent was obtained from all subjects at the time of enrolment.

Inclusion criteria: All neonates with Respiratory Distress (assessed by either Downes or silverman Anderson scoring system) admitted to neonatal intensive care unit of SPMCHI, SMS medical college and hospital, Jaipur.

Exclusion criteria
1. All neonates admitted in the NICU during the study period not fulfilling the criteria of Respiratory distress with either Downes or Silverman-Anderson scoring system.
2. Patient's relative not giving informed consent.
3. Age greater than 28 days of life.

Methodology
Predesign structured proforma was made for history and data collection. General information consisting of general demographic information about neonate i.e., name, age, sex, and address were noted. After taking written consent from all parents and applying inclusion and exclusion criteria, detailed antenatal and natal history was taken. Their mothers were assessed for maternal age, parity, gestation weeks by last menstrual period and expected date of delivery, pregnancy induced hypertension (PIH), gestational diabetes mellitus (GDM), Thyroid status, amniotic fluid volume, antepartum hemorrhage (APH), maternal membrane ruptured > 24 hours, urinary tract infection, antenatal steroid administration, any illness and history of drug intake during pregnancy. Neonate history included birth weight, immediately or delayed cry after birth, gestational age by Modified Ballard score, maturity either term, preterm or post term, resuscitation required or not, Apgar score 1 and 5 minute, and complete clinical examination including any congenital malformation.
Babies were observed whether the neonate is breathing comfortably or if sign of respiratory distress were present. Respiratory rate, symmetry of chest movement and synchrony with abdominal wall movement, color of neonate (pink vs cyanosis) and pulse oximeter was used to determine the oxygen saturation. Also, the shape of the chest wall was also assessed as a rounded thorax with increased anteroposterior diameter is a marker of hyperinflation. Some important signs of respiratory distress are Tachypnoea, Apnoea or gasping efforts, Nasal flaring, Grunting, Retractions or chest recessions, stridor and wheezing. After complete clinical examination, baby was assessed by respiratory severity score i.e., Silverman Anderson score for preterm infant and Downes score for term baby.

Silverman and Anderson Score [18]

Feature	Score 0	Score 1	Score 2
Upper chest retraction	Equal	Respiratory lag	See saw respiration
Lower chest retraction	None	Minimal	Marked
Xiphoid retraction	None	Minimal	Marked
Nasal flaring	None	Minimal	Marked
Expiratory grunt	None	Audible with stethoscope	Audible without stethoscope

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 10, 2023

Interpretation
Score 0-3 = Mild respiratory distress.
Score 3-6 = Moderate respiratory distress.
Score > 6 = Impending respiratory failure.

Modified Downe's scoring system [19]

Score	0	1	2
Respiratory Rate (rate/min)	<60	60-80	>80
Cyanosis	None in room air	No cyanosis with Oxygen support	Cyanosis in spite Oxygen support
Retractions	None	Mild	Moderate to severe
Grunting	None	Audible with stethoscope	Audible without stethoscope
Air entry	Good	Decreased	Barely Audible

Interpretation
0-3-No respiratory distress.
4-7-Respiratory distress.
>7-Impending respiratory failure.

Observation and Results

Table 1: Distribution of study population according to etiology of respiratory distress

Etiology	Number of patients (n=184)
RDS-HMD	62
MAS	29
Perinatal Asphyxia	41
Congenital Pneumonia	24
CHD	9
Sepsis	12
TTNB	3
Others (Prematurity, Rh incompatibility NNJ, Noonan syndrome, Intra-Cranial Hemorrhage)	4

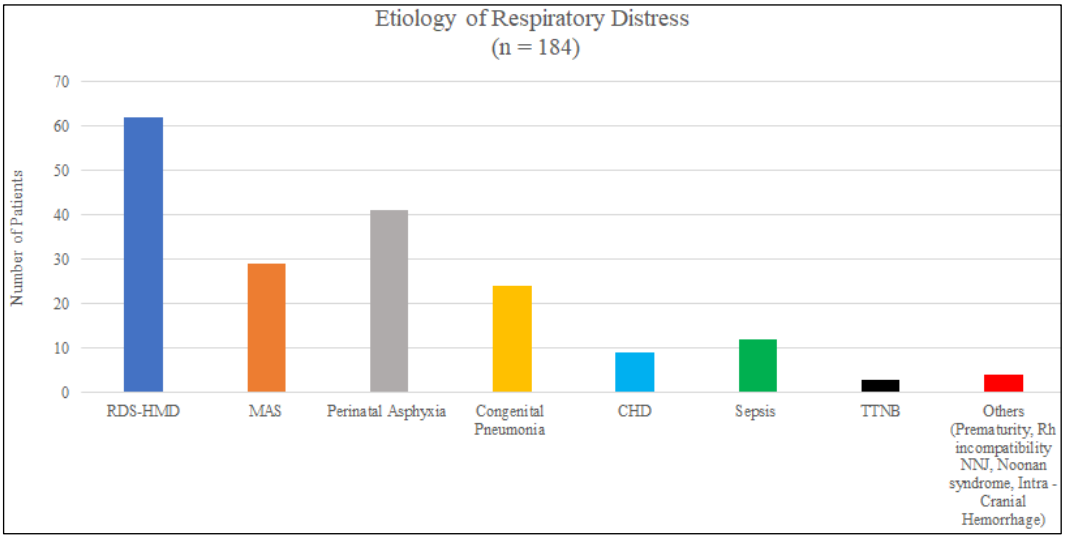

Fig 1: Etiology of Respiratory Distress

Table 2: Distribution of study population according to birth weight classification

Birth weight	Number of patients(n=184)
ELBW (< 1000 grams)	6
VLBW (1000-1500 grams)	34
LBW (1500-2500 grams)	66
NBW (2500-4000 grams)	77
HBW (> 4000 grams)	1

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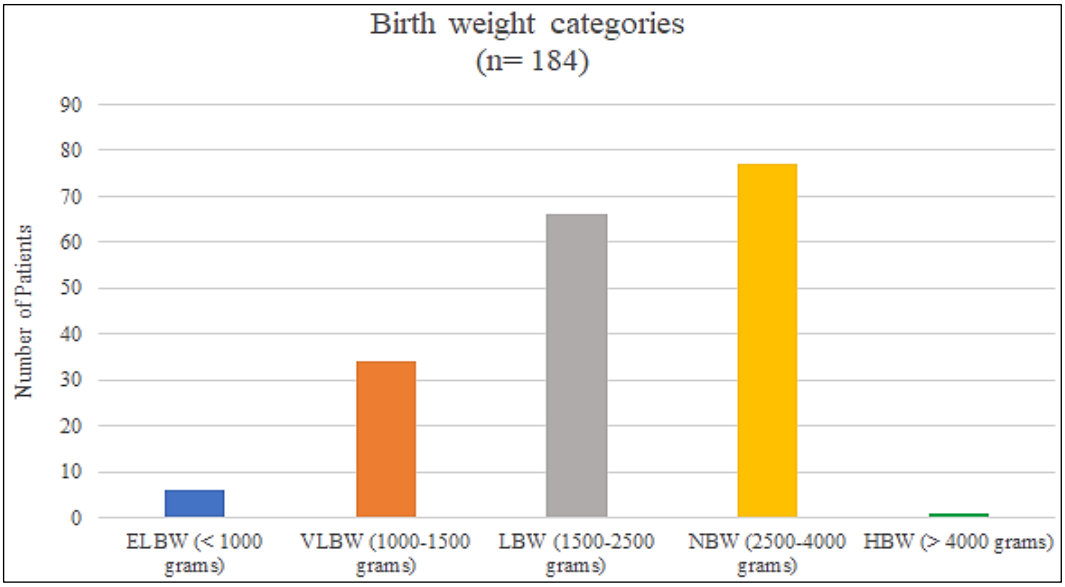

Fig 2: Birth weight categories

Table 3: Outcome of study population

Outcome	Number of patients, % (n=184)
Death	53.29%
Discharge	120.65%
LAMA	6.3%
Referred	5.3%

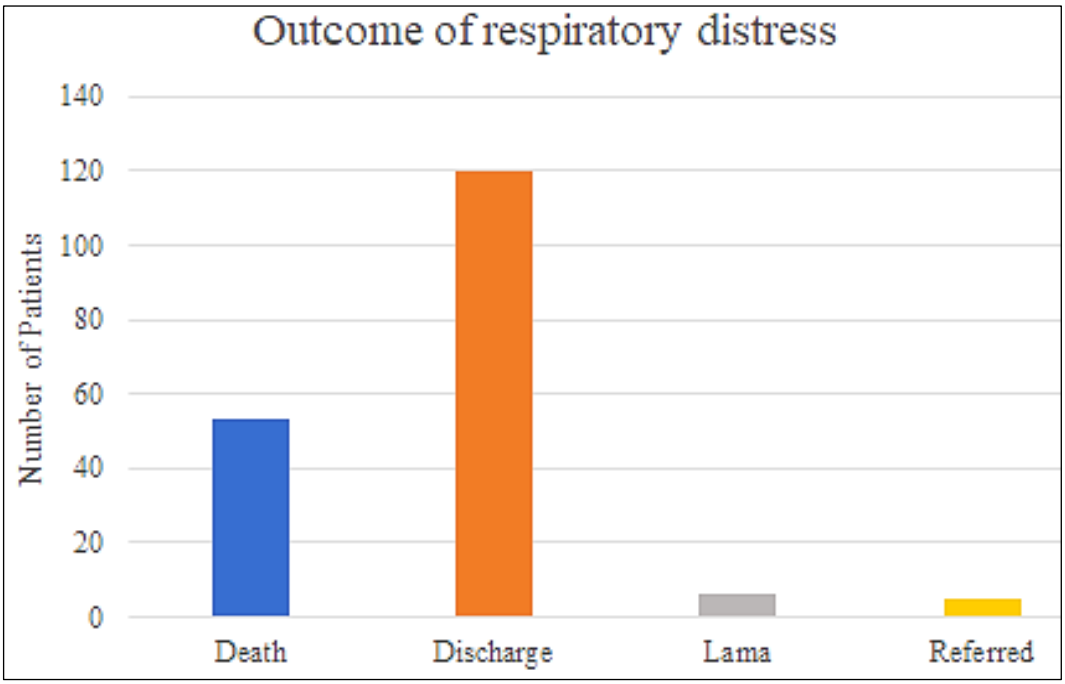

Fig 3: Outcome of respiratory distress

Discussion

National Neonatal Perinatal Database of India (NNPD) defines respiratory distress as presence of any two of the following features:

- Respiratory rate (RR)> 60/minute.
- Subcostal/intercostal recessions.
- Expiratory grunt/groaning.

Along with the aforementioned characteristics, the presence of nasal flaring, suprasternal retractions, and decreased air admission during chest auscultation also point to the existence of respiratory distress. Life-threatening symptoms include gasping, choking, or stridor (signs of upper airway blockage), apnea or

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 10, 2023

insufficient respiratory effort, bradycardia, poor perfusion, and cyanosis [20].

Respiratory distress occurs among 4-7% of all neonates and is the reason for 30-40% of admissions in the NICU [2, 3]. Neonates with respiratory distress are 2 to 4 times more likely to die than those without respiratory distress [3]. It is more common among preterm (30%) and post term (21%) than among term neonates (4.2%) [2].

Since, respiratory distress is most common cause of neonatal intensive care admissions, so it is need of the hour to find most common causes of neonatal admissions and studying the outcome of various causes associated with it.

This study was done at Neonatal Units of Department of pediatric medicine, S.P.M.C.H.I. and attached group of hospitals, S.M.S. Medical college, Jaipur. This is a tertiary care hospital center for people of Rajasthan and nearby states. This study was a prospective observational study. Our study emphasizes to gain knowledge about the demographics (including maternal and neonatal factors), etiological factors and outcome of Respiratory distress patients in a tertiary care referral centre in India.

Our study enrolled 184 neonates admitted in neonatal intensive care SPMCHI, Jaipur with respiratory distress. Among them, 97(52.72%) babies were preterm and 84(45.62%) babies were term babies and 3 babies (1.63) were post term babies.

Normal vaginal delivery was the most common mode of delivery in the study with 143 (77.71%) patients. 41(22.3%) neonates were born from caesarean section, among them 24(13%) were emergency caesarean section and 17(9.23%) from the Elective caesarean section. While in Harshini *et al*., (2020), 113 (75%) out of 150 were born through LSCS [21].

In our present study, 41.85% of the babies in the study were normal birth weight, 36% were low birth weight, 13% were very low birth weight, 3.26% were extremely low birth weight and 0.5 were high birth weight.

Brahmaiah P *et al*., 2017 study[1] the birth weight of <2.5 kg was 59%. 2.5 kg- 4.0 kg were 40%, the birth weight of 4 kg were 1%, severe respiratory distress was observed in <2.5kg birth weight babies (41.4%)

Harshini B.P. *et al*., (2020) study [22], 59% of the babies in the study were normal weight, 35% were low birth weight, 5% were very low birth weight and 1% were extremely low birth weight. Increased Respiratory Distress was observed with decrease in birth weight especially of < 2.5 kg birth weight.

Among these 184 patients, 159 (86.42%) developed respiratory distress due to respiratory causes while 25 (13.58%) newborns were having respiratory distress because of non-respiratory causes (such as clinical sepsis 12, 6.52%) congenital heart disease (9,3.26%), congenital malformations (2,1.09%), and metabolic disorders, jaundice etc. in Brahmaiah P *et al*., (2017) study[1]. Out of 200 cases of respiratory distress, 170(85%) cases were due to Respiratory causes, 24(12) cases were of CNS causes, and 6(3%) cases were due to cardiac causes.

Common causes of respiratory distress in preterm

1. RDS
2. Congenital pneumonia
3. Sepsis
4. CHD
5. MAS
6. Perinatal Asphyxia

Common causes of respiratory distress in term babies

1. MAS
2. Perinatal asphyxia
3. Congenital pneumonia
4. RDS
5. CHD

Common causes of respiratory distress in post-term babies

1. MAS
2. RDS

Among all babies, most common cause of respiratory distress was RDS (33.70%). In our study along with RDS, other causes were Perinatal Asphyxia (41,22.3%), MAS (29, 15.8%) and congenital pneumonia (24,13%). Other non-respiratory causes were congenital heart disease 9,4.9%), Sepsis (12,6.5%) and others 4,2%) including congenital malformations, jaundice and metabolic disorders.

Brahmaiah P *et al*., (2017) study [1] on 200 neonates with respiratory distress, most common cause of respiratory distress was TTNB (30%) followed by RDS (24%). In the contrary to this, in our study most common cause of respiratory distress was RDS because TTNB usually develop mild disease and get diagnosed and treated within days, mostly at the place of birth at peripheral health centers by treating pediatricians so number of referrals were less in number. Since J.K. LON Hospital is a major government

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 10, 2023

tertiary care center in Rajasthan, most of the NICU admissions are from cities and remote towns at a significant distance from the hospital. Thus, Unresolved and complicated cases such as RDS, MAS, perinatal asphyxia and congenital Pneumonia are more frequently referred to our hospital.

Nagendra K *et al*., (1999) study [23] on screening of 1986 neonates for respiratory distress, 48 out of 1986 new born developed respiratory distress after birth. Most common cause of respiratory distress was RDS. 32% of preterm developed RDS in this study. The higher incidence of RDS (89%) in our study may be due to inclusion of relatively more premature babies.

Harshini B.P. *et al*., (2020) study [22], the commonest cause of neonatal respiratory distress in this study was respiratory distress syndrome (34%), followed by Transient tachypnoea of the newborn (30%), and Meconium aspiration syndrome (22.66%). Most common cause of respiratory distress was similar in our study but incidence of RDS was high in our study due to higher number of preterm babies referred to our hospital from peripheral health centers.

In this study the greatest number of deliveries were LSCS thus incidence of TTNB was also high in this study.

Chandini P. *et al*., study [24] on 200 neonates. In the present study commonest cause of respiratory distress was RDS (40%) followed by TTNB (19%). In our study, result was similar to this study but number of patients with TTNB were less in comparison to this study because this study also enrolled inborn patients.

Cunningum MD *et al*., [25] study on 137 neonates with respiratory distress showed similar result. Most common cause of respiratory distress among all these studies was RDS. Thus, RDS is the most common etiology of neonatal respiratory distress especially in preterm babies.

Overall, a male predominance is seen in the study subjects with 129(70.10%) being Male and 55(29.90%) being Female. Similarly, Male babies were more than twice the number of females in having RDS, perinatal asphyxia, sepsis and CHD where as they were only marginally higher in MAS, congenital pneumonia and other etiologies.

Brahmaiah *et al*., (2017) study [1], males (59.9%) have increased Respiratory Distress compared to females (40.5%)

Harshini B.P. *et al*., (2020) study [21] had also similar observations. The study had male predominance was seen and severity of respiratory distress was more in male babies compared to female babies.

Hjalmarson O *et al*., (1981) study [26] depicting that the total incidence of Respiratory distress in Males (3.5%) was higher than females (2.2%). Santosh *et al*., (2013) also observed male predominance in neonates with respiratory distress [27].

Low birth weight also played a significant role in the occurrence of RDS with 48(77.42%) babies having birth weight less than 2.5kg. C. Dani *et al*., (1999) study [28] had 661(90.05%) out of 734 new born had RDS with birth weight < 2.5 kg.

In our study, almost all of the Respiratory distress patients received Antibiotics (180, 97.8%) and Oxygen therapy (183, 99.5%) via either Nasal prongs or CPAP. Mechanical ventilation was provided to moderately to severe Respiratory distress patients, among them, 33(38.8%) were discharged and 46(54.1%) died. Since CPAP has became the first line management of RDS, this approach along with early selective surfactant appears to provide a better option as illustrated in recent studies.

The longest stay in the NICU was recorded for RDS complicated with BPD (bronchopulmonary dysplasia), sepsis etc. and congenital malformation babies (26 days on average), after that congenital pneumonia patients spent most time of 18 days on average. MAS, perinatal asphyxia and sepsis patients spent 12-15 days on average, while TTNB babies spent the least of 3-5 days on average in the NICU.

During the study period, only 5(2.7%) patients were referred to a higher centre for further management such as CHD and congenital malformation patients whose surgeries weren't possible at our hospital. The outcome of MAS patients was poor (15,52% died), especially those delivered with thick meconium-stained amniotic fluid (9, 37.5%).

Berkus MD *et al*., study [29] concluded the same about bad outcome of MAS babies associated with thick meconium-stained amniotic fluid. The conclusion was that thick meconium alone should alert the physician to a high-risk fetal condition. This phenomenon requires continuous FHR monitoring and reassurance of fetal well-being by acid base assessment or the equivalent, regardless of maternal disease status or the presence of abnormal FHR tracings.

In Louis *et al*., (2014) study [30], out of 172 included neonates, 44(26%) died. This study also concluded that meconium aspiration syndrome is associated with significant morality. Myocardial dysfunction, birth weight, and initial oxygen requirement are independent predictors of morality.

Our study had high incidence of patients dying of MAS because our study enrolled neonates, all of them were out born while Louis *et al*., study had enrolled all inborn neonates as study population. So, all the sick babies referred to our hospital with complication like shock, PPHN, Pneumothorax, need of vasopressor support etc. resulting in higher mortality in comparison to other studies

Conclusion

One of the most frequent reasons for admissions to NICUs is respiratory distress. In the current study,

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 10, 2023

respiratory distress syndrome (RDS) was discovered to be the most frequent cause of respiratory distress and NICU hospitalization in newborns. Preterm infants frequently experience meconium aspiration syndrome (MAS), the most common cause of respiratory distress syndrome (RDS). Assessing the clinical outcome may benefit from a clinical examination of severe respiratory distress using the Downes and Anderson scores for term and preterm infants, respectively. Low birth weight and a late preterm gestational period were fetal risk factors. A better result for the newborn can be achieved with proper antenatal care, early detection of antenatal complications, and avoiding preterm deliveries. Early detection and appropriate management of the condition is essential to ensure better outcome in all the infants presenting with respiratory distress.

Limitations

This study had a small sample size and was only conducted in one hospital. A tertiary care hospital used 184 newborns for the current investigation. They were all referred patients from outlying facilities. The same study needs to be conducted in community-based settings with additional samples from different centers, and the meta-analysis will show the full range of respiratory distress in our neighbourhood.

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