Original Research Article

A prospective study on risk factors and outcome of management of respiratory distress syndrome among preterm babies in rural tertiary care hospital in South India

Haricharan KR[1*], GP Chandran[2], D Anwar Basha[2],Rajendra Naidu[3]

[1]Professor, Department of Paediatrics, P.E.S.Institute of Medical Sciences and Research, Kuppam,India
[2]PG Resident, Department of Paediatrics, P.E.S.Institute of Medical Sciences and Research, Kuppam,India
[3]Professor, Department of Paediatrics, P.E.S.Institute of Medical Sciences and Research, Kuppam,India
[4]Professor, Department of Paediatrics, P.E.S.Institute of Medical Sciences and Research, Kuppam,India

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Abstract

Background: RDS is one of the common causes of admission to NICU. Half of the neonates born at 26-28 weeks gestation ,whereas less than 30% of preterm at 30-31 weeks gestation develop RDS. The main risk factors were prematurity, perinatal asphyxia, maternal diabetes, lack of labor, absence of antenatal steroid administration to the mother, male gender. Hence, our study was intended to assess the risk factors and RDS outcome among preterm babies.**Materials and Methods:** A prospective study was conducted in a tertiary hospital in a rural area within a period between January 2019 to June 2020. Preterm babies (<37weeks) with RDS admitted in NICU were included. Preterm with congenital anomalies, Meconium Aspiration syndrome were excluded. The Sample size was 114 done by purposive sampling. Data recorded from maternal records, Neonatal history and detailed examination. This study's data were subjected to standard statistical analysis using the SPSS ver.20.**Results**: Out of 114 study subjects, 20% mothers were diagnosed with diabetes, and 91(80) doesn't have diabetes. Most of the mothers 60.52% does not taken steroids during Antenatal period. Most of babies were within 30-33 weeks(64%). Out of 114, only 40% required surfactant. About 75%required CPAP, 25% preterms required mechanical ventilation. Most commonest complications of preterm was PVL, PDA, pneumonia respectively. Out of 23 maternal diabetes,56.5% had severe RDS and it is statically significant. Out of 45 Mothers with antenatal steroid, 73.3% stayed <13 days, was statistically significant. Out of the total of 11 deaths, 10 were born to mothers who didn't receive antenatal steroid. **Conclusion**: We observed that with lower gestational age, maternal diabetes, mothers who did not received steroids the risk of RDS is very high. Emphasis should be geared towards preventing and reducing preterm delivery, control of asphyxia, and neonatal sepsis to reduce neonatal mortality in our country..

Keywords: respiratory,syndrome

Introduction

Respiratory distress syndrome is also known as Hyaline Membrane Disease, Infant Respiratory Distress Syndrome, Surfactant Deficiency. It is a respiratory disorder of neonates that manifests itself within few hours after birth. It is one of the common causes of admission to neonatal intensive care unit (NICU) and respiratory failure in neonates[1].Averagely 50% of the neonates born at 26-28 weeks gestation develop respiratory distress syndrome, whereas less than 30% of preterm at 30-31 weeks gestation develop the condition.

In one report, the incidence rate of respiratory distress syndrome was 42% in infants weighing 500-1500grm, with 71% reported in infants weighing 500-750 kg, 54% reported in infants weighing 750-1000grm, 36% reported in infants weighing 1000-1250grm, and 22% reported in infants weighing 1250-1500kg, among the 12 university hospitals participating in the National Institute of Child Health and Human Development (NICHD) Neonatal Research Network[2].

Preterm is defined Preterm as live Babies born before 37 completed weeks. The Preterm classified based on gestational age: Extremely preterm (< 28 weeks of gestation), Very preterm (between 28 to 32 weeks of gestation),Moderate to late preterm (between 32 to 37 weeks of gestation)[3].As per WHO, Every year, an estimated 1.5 core babies are born preterm (before 37 completed weeks of gestation), and this number is increasing. Preterm birth complications are the leading cause of death among children under five years of age, responsible for approximately 10 lakhs deaths in 2015. 3/4th of these deaths could be prevented with current, cost-effective interventions. According to the American Academy of Pediatrics (AAP), nearly 1% requiring extensive resuscitation, with upto 10% of neonates required some assistance to begin breathing at birth. Respiratory diseases are the leading cause of early neonatal morbidity and mortality and the most frequent indication for both preterm and term neonates admission to the special care nursery. Neonates with respiratory distress have 2–4 times more susceptibility to death than neonates without respiratory distress[4].Metabolism of surfactant is slower in newborns, especially preterm than in adults. Which start to produce surfactant at approximately 20 weeks gestation[5].Inadequate surfactant leads to reduced pulmonary compliance and increased surface tension. This results in an increased risk of alveoli collapse at expiration, followed by a decreased in total surface area for gaseous exchange, and the alveolar-capillary diffusion capacity. Hypoxia and hypercapnia develop. The risk and severity of hyaline membrane disease are inversely proportional to the gestational age of the neonate at birth. In fact, prior to introducing surfactant, RDS was considered the leading etiology of mortality in preterm infants[6].

**Correspondence*
Dr.Haricharan KR
Professor, Department of Paediatrics, P.E.S. Institute of Medical Sciences and Research, Kuppam
E-mail: dr.haricharan@gmail.com

RDS signs manifest within minutes after birth, and it may not be identified for several hours in larger premature infants until the respiration becomes rapid, shallow, and more apparent. A later onset of tachypnea should suggest other conditions.Few neonates require resuscitation at birth because of intrapartum asphyxia or severe respiratory distress. Characteristically, tachypnea, often audible grunting, intercostals and CYANOSIS, subcostal retractions, AND nasal flaring are noted. Breath sounds may be normal or diminished with a harsh tubular sounds, and on deep inspiration, may hear fine crackles. The course of untreated hyaline membrane disease is characterized by progressive worsening of hurries breathing and cyanosis. If the condition is insufficiantely treated, hypotension may occur; increase pallor and develop cyanosis, and grunting disappears or decreases as the condition worsens.[7]

The main risk factor for RDS, by far, is prematurity. Other factors that increase RDS risk include perinatal asphyxia, maternal diabetes, lack of labor, absence of antenatal steroid administration to the mother, male gender, and White race.[8]The central feature of RDS is surfactant deficiency due to lung immaturity, commonly as a result of premature birth or delayed lung maturation associated with maternal diabetes or male gender. Surfactant dysfunction can also be caused by perinatal asphyxia, pulmonary infection, or excessive fetal lung liquid due to delivery without labor.[9]Hence, our study was intended to assess the risk factors and RDS outcome among preterm babies.

Aims and Objectives:

1)To identify the risk factors associated with RDS in preterm.

2)To assess the Outcome of management of RDS among them

Materials and Methods

This study was conducted in a tertiary hospital in a rural part of Andhra Pradesh ,Kuppam.

Study Design: It is a Prospective study.

Study period: January 2019 to June 2020.

Source of data: Preterm infants born at <37 completed week admitted in PES hospital, Kuppam.

Inclusion criteria: Preterm babies(<37weeks) with Respiratory Distress syndrome.

Exclusion criteria: Preterm with congenital anomalies, Babies with Meconium Aspiration syndrome.

Sample size: 114.

Sampling technique: Purposive sampling

Procedure for data collection

Mothers of preterm with RDS were contacted in PESIMSR hospital from January 2019 to June 2020.Written informed consent was obtained. Maternal history(antenatal) and details of Past pregnancy were taken from maternal records. Neonatal history and detailed examination of the preterms were done. Gestational age was assessed by LMP and New Ballard score. While the Birth weight was measured using a digital electronic weighing scale before the first feed with clothes removed. Length and head circumference were measured using an infantometer and nonstretchable measuring tape, respectively. Laboratory investigations like complete blood picture, arterial blood gas analysis, blood glucose, serum calcium, C-Reactive protein, Blood culture and sensitivity, chest X-ray done as per protocol

Statistical analysis: This study's data were subjected to standard statistical analysis using the SPSS version.20 data processing software for windows seven. The p-value was considered significant for all tests if it was less than 0.05 at a confidence level of 95%. A Chi-square test was done for statistical analysis.

Results and analysis

Out of 114, 52 (45.61%) mothers age were between 19 to 22 years,5 (4.38%) age were above 30 years.Out of 114 study subjects, 23(20)mothers were diagnosed with diabetes, and 91(80) doesn't have diabetes. Most of the mothers 69 (60.52%) does not taken steroids during Antenatal period**,** 28(24.56%) took taken 1 dose,and 17(14.91%) took 2 doses. Majority 87 (76%) were delivered in PES Hospital (inborn), and 27(24%) were delivered outside (outborn)**.** Out of 114 study subjects ,58(51%) were delivered Vaginally, and 56 (49%) were delivered through LSCS. 9(7.9%) babies were born in <30weeks, 73(64.0%) in 30-33 weeks, and 32(28.1%) of above 34 weeks of gestation 3(2.6%). 91(79.8%) preterm cried immediately after birth, whereas 23(20.2%) preterm didn't cry immediately after birth.85(74.56%) require routine resuscitation, whereas 16(14.0%), 7(6.14%), requiring oxygen, babies Bag & mask ventilation respectively and 6(5.3%) requires ETT resuscitation. Out of 114, about46(40.3%) preterm required surfactant. Regarding assisted ventilation requirements, about 85(75%) preterm required CPAP, 29(25.44%) preterm required mechanical ventilation. Out of 114 babies, mean duration of hospital stay is 13 days, ICU stay is 10 days, oxygen requirement is 87 hours, time taken to feed establishment was around 6-7 days(Table -1). With respect to gestational age lower the gestational age, the risk of severity of RDS increases. P-value was significant. Among preterm with <30weeks of gestational age , about 77% had severe RDS. With babies >34weeks of gestation, 43.7% had mild RDS.(TABLE -2).

Out of 9 preterm with gestational <30weeks 7 required surfactant, out of 73 preterm with gestational age 30to 33.6 weeks 30 required surfactant. Out of 32 preterm with gestational >34weeks 9 required surfactant. Out of 9 preterm's with gestational <30weeks 6(66.66%) required mechanical ventilator with surfactant therapy, out of 73 preterm with gestational age 30to 33.6 weeks, 48(58.7%) required CPAP alone. Out of 32 preterm with gestational >34weeks, 19(59.37%) required CPAP alone it was statistically significant)(p value< 0.05) (Table-3).

Preterm with < 30 weeks of gestation had 6 PVL, 2 IVH, 1 PVH, 3 PDA, and 2 pneumonia. With 30- 33 weeks of gestation, there were 19 PVL, 2 IVH, 3 PVH, 3 PDA, 1 pneumothorax, and 3 pneumonia. And those with gestational age >34 weeks had 17 PVL, 2 IVH, 4 PVH, and 4 pneumonia.(Figure-1)

Table 1:Outcome of preterm babies with RDS

S. No	Variable	OBS	Mean	Std Deviation	Min	Max
1	Feed establishment	114	6.780702	1.509608	4	11
2	Oxygen requirement	114	86.8(hour)	1.785462	18(hour)	172(hour)
3	Hospital stay (days)	114	13.35965	3.682361	8	32
4	ICU STAY(days)	114	9.973684	1.610038	6	13

Table 2: Association between gestational age with surfactant requirement

Severity OF RDS	<30Week	30-33Week	>34Week	
Surfactant	7(77.77%)	30(41.09%)	9(28.12%)	P<0.0267
Non Surfactant	2(22.33%)	43(58.90%)	23(71.87%)	
Total	9	73	32	

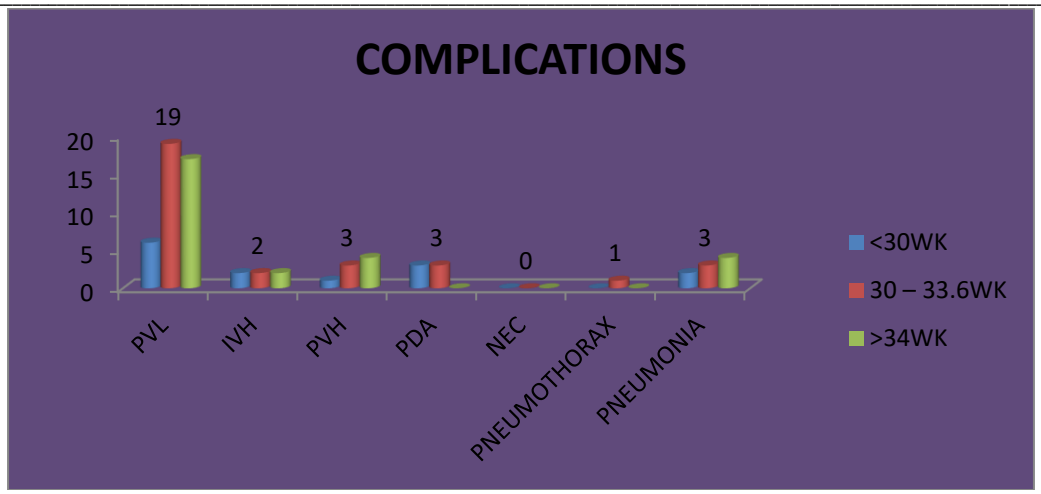

Fig 1: Association between gestational age with complications

Table 3:Association between gestational age with mode of treatment

Mode of Treatment	<30WK	30-33..6WK	>34WK	
CPAP alone	1(11.11%)	48(58.71%)	19(59.37%)	
INSURE Tec	2(22.22%)	10(15.59%)	5(15.62%)	P0.02525
VENTILATOR+SUR	6(66.66%)	15(25.6%)	8(25%)	
TOTAL	9	73	32	

Out of 64 males babies, 21(32.81%) had severe RDS, whereas among female babies out of 50, 20(40%) had severe RDS, which is statistically insignificant.

Table 4:Association between maternal diabetes with severity of RDS

Severity of RDS	Maternal Diabetes	Non-Diabetes	
Mild	8(34.1%)	28(30.76%)	
Moderate	2(15.3%)	35(38.46%)	P<0.05
Severe	13(56.5%)	28(30.76%)	
	23	91	

Out of 23 maternal diabetes, 56.5% had severe RDS and it is statically significant.(Table-4).Among 23 maternal diabetes, 8(34.78%) required a ventilator with surfactant therapy, whereas non-maternal diabetes about 21(23.07%) required a ventilator with surfactant therapy. 7(30.43%) diabetes and 10(10.98%) required CPAP with surfactant therapy. 8(34.78%) maternal diabetes and 60 (65.93%) non-diabetes required CPAP alone. This is statistically significant.Out of 23 IDM, 14(60.86%) had >9 days stay in NICU, and 9(39.13%) had stayed <9 days in NICU, whereas among non-diabetic mothers out of 91, 29(31.36%) stayed >9 days and 62(68.13%) had stayed <9 days in NICU. Out of 23 preterm born to diabetics 4(36.36%) preterm were expired. Out of 91 babies born to non-diabetics, 7(63.63%) were expired.

With mild RDS,13(46.42%),11(64.70%), and 12(17.39%) were taken single, double, and not on steroid therapy.With severe RDS 8(28.57%) were taken a single dose, 2(11.76%) double, and 31 ((44.92%) of them not taken steroid therapy.46% preterm mother's with antenatal steroids had mild RDS in preterm, where 31% of preterm mother's did not taken steroids had severe RDS in preterm.

Discussion

In our study, most of the mother's age (45.61%), range between19-22 years.YaredAsmare et al. found most of the mother's ages were between the ages of 20–34. The mean age of mothers was found to be 28 years ± 5.42 SD.In this study, the majority of them, 76%, delivered in PES Hospital (inborn).According to our findings,51% of babies were delivered Vaginally, and 49% through LSCS. In a study Koti et al. found that 80% were delivered through LSCS. Whereas in Mohammad Kazem S et al found that 39.8%)were delivered Vaginally and 60.2% delivered through caesarian section. A study by Neha Choudary et al[11] found that 54% through Caesarean section; whereas 46% were born through vaginal delivery.In this study,20.1 % of mothers were diagnosed with diabetes**.** In a study by Mohammad Kazem S et al[10] 2%mothers of preterm were diagnosed with diabetes,10% of the mothers were diagnosed with gestational DM by Brahmaiah **P** et al.In this study,7.9% of them were born in <30weeks, 64.0% in 30-33 weeks, and 28.1% of them born above 34 weeks of gestation.In a study koti et al., gestational age≤ 30weeks is 39.3%.Jing Liu et al[12](2017) found in their study that about 31.7% had RDS.In this study, out of 114 ,56% were males, and 44% were females. Our findings had 2.6% preterm with birth weight less than 1000 grams, 20%were with birth weight 1000-1499 g, 66.7% with`1500- 2499g, and 10.2%with birth weight more than 2500g. The minimum birth weight observed in my study is 890 grams, and the maximum is 3620 grams.In our study 9(7.9%) babies were born in <30weeks, 73(64.0%) in 30-33 weeks, and 32(28.1%) of above 34 weeks of gestation 3(2.6%). Keeriti Swarnkarand et al[13] observed that in RDS, 75% of cases were born of <32wks with a mean birth weight of 1256 gm; also, there was a male preponderance with a ratio of 1.5:1.In this study, about 69%, (25%), and (5.3%) belong to Appropriate for Gestational age, early for Gestational age, and Large for Gestational age. In a study, Debasish et al[14], found that 12% belonged to small for gestational age.In this study, 36% of the preterm had severe RDS, whereas 31.57% and 32.4% had mild and moderate RDS respectively. According to Rakesh B et al. 14.66% were with mild RDS, 50.68% & 34.66% with moderate and severe RDS clinically. In a study Koti et al.,

found that 53.6%, 17.9%, 28.6% of babies had mild, moderate,& severe RDS, respectively.In our study Out of 114, 33.33% had severe CXR involvement, whereas 26.31% and 40.3% had mild(grade-1&2) and moderate (grade-3) severity respectively. According to Rakesh B et al. 14.66% neonates had grade 1, 22.66%, 14.66 %& 34.67% neonates with grade 2, grade 3& grade 4 radiological involvement respectively. In the present study, the majority 60.52%didn't receive steroids during the Antenatal period**,** 24.56% received 1 dose, and only 14.91% received 2 doses. Among the preterm mothers who received antenatal steroids, Of 45, 55.55% & 31.1% of babies developed mild & moderate RDS, respectively. Only 15.5% suffered from severe RDS. Maternal corticosteroid therapy can prevent neonatal RDS when it is administered to the mother at least 24 to 28 hours before delivery, as stated by Kumar (2017) et al[15].Rakesh B et al.,61.32% of babies, received maternal antenatal steroids and out of which 82.60% babies developed mild to moderate RDS and rest had severe RDS. With regard to steroids and duration of hospital stay, In our study, out of 45 preterm with antenatal steroids, 73.33% stayed <13days and 26.66%stayed >13 days, out of 69 preterm (whose Mother didn't receive steroids) 49.27%stayed >13days and 50.72% stayed <13 days. Schmitz.Tet al[16] in their study, observed antenatal administration of a single course of corticosteroids before 34 weeks of gestation is associated in the neonatal period with a significant reduction of respiratory distress syndrome (RDS), intraventricular hemorrhage (IVH), necrotizing enterocolitis (NEC) and death. In our study, only 9%death observed in preterm with a history of antenatal steroids. The benefit of antenatal steroids on neonatal outcome was reported by Mwansa-Kambafwile et al. In our study, only 9%death observed in preterm with a history of antenatal steroids. In our study, out of 114, 40.35% received surfactant therapy. Other babies were treated with CPAP alone. Surfactant therapy plays an important role in the management of babies with RDS. The overall aim was to avoid mechanical ventilation (MV) where possible or to reduce its duration whilst administering surfactant as early as possible in the course of RDS. Mohammad K et al.12.9% of preterm's used surfactant and 87.1% didn't use surfactant therapy during the course of treatment in their study. Debashisnanda et al[14], found that out of 56 preterm, surfactant were administered for 34 babies.In this study,25.44% of preterm required a mechanical ventilator. This finding is in correspondence with a study by Mohammad KazemS et al[10] 26% of infants needed mechanical ventilation, especially infants with RDS (44%). Rakesh B et al in their study, observed that early intubation and surfactant replacement therapy followed by extubation to CPAP (INSURE method) showed good results in the form of less mortality compared to the support method. Sauparna et al. showed that 41% of infants with respiratory distress required mechanical ventilation, and in general, 41% of infants died. John et al. also demonstrated that 49% of infants requiring mechanical ventilation died. In the present study, in preterm with <30weeks of gestation, 33.3% died. Preterm with 30-33.6weeks of gestation,5.47% died. Whereas preterm with >34weeks of gestational age out of 12.5% died. In a study by Nehachoudry et al[11]90% survived &10% died. In our study, the mortality was around 9.64%. Mohammad K et al. found that 19.3% died of RDS.Adebami et al[10] reported that 36.6% died of RDS. Kommawar et al.[12] reported infant mortality by 21.5% due to RDS (61.6%) as the most cause of death. Swarnkar's et al. study, 22.8% of infants died of NRD due to RDS. Brahmaiah P et al. 83% cases were discharged, while 17% expired. Keerti S et al. observed mortality of 62.5% in RDS. Olusegun J et al[17] Mortality from hyaline membrane disease was 46.9%, perinatal asphyxia 38.9%, and meconium aspiration 40.0%. Kumar et al. who reported mortality from hyaline membrane disease to be 57.1%, meconium aspiration 21.8%, and infections 15.6%.In this study, in preterm with <30weeks of gestation,88.8% had >13 days of hospital stay. Preterm with 30-33.6weeks of gestation , 42.46% had >13 days of hospital stay. Whereas preterm with >34weeks of gestational age,78.12% had <13days of hospital stay. Mohammad Kazem S et al[10] observed the average stay was between 8.74±5.35 days.Downe's score, in our study**,** majority 83.3% had a score of 4-6, whereas 13.2% and 3.5% of the preterm had Downes score of > 7and <4 respectively. Nehachoudary et al[11] in their study, out of 200 babies with respiratory distress, 32.5%. 20.5% &14% had Downes score of 2; 3; 4 and 5 respectively.In this study concerning CPAP usage, about 75% of preterm required CPAP. NehaChoudhry et al[11] found that out of 6 babies with respiratory distress who was put on CPAP, 50%recovered & 50% were put on a mechanical ventilator due to CPAP failure. In a prospective study from South Africa, Pieper et al. studied the efficacy of nasal CPAP in infants <1200 g with RDS who were either treated with nasal CPAP or oxygen hood. They found (80%vs18%).Compared to late administration of surfactant, CPAP resulted in low rates of intubation and ventilation (RR 0.55, 95% CI 0.32–0.96). According to our findings,With regard to CPAP usage, about 75% of preterm required CPAP, and25.44% required a mechanical ventilator. Kumar et al. reported 19% mortality in India with surfactant administration and effective respiratory support. Also, the causes of death followed the variation in the etiology. While 40.2% of preterm died mainly from hyaline membrane disease, 31.3% of babies died mainly from perinatal asphyxia and meconium aspiration.Perinatal asphyxia is the leading cause of respiratory distress among term babies in the present study. Bajad et al. also found perinatal asphyxia as a major cause of respiratory distress among the Indian population after hyaline membrane disease.In our study findings, out of 12 babies born with perinatal asphyxia, 50% had severe RDS, 25%with mild, and another 25% with moderate RDS, respectively. Olusegun J et al[17], 36(21.3%) of preterm babies developed birth asphyxia.

Conclusion

Prematurity is a major contributor to the large burden of disease among infants in developing countries.RDS is one of the major problems among preterm babies and a major reason for increased morbidity and mortality among infants. We observed that with lower gestational age, the risk of RDS is very high, and the surfactant requirement increased. Those who are babies with mothers who received steroids have very less risk of RDS, and prognosis also very good. Emphasis should be geared towards preventing and reducing preterm delivery, control of asphyxia, and neonatal sepsis to reduce neonatal mortality in our country.

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