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Study of Respiratory Distress Syndrome (RDS) in preterm neonates

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ABSTRACT

Respiratory distress syndrome (RDS) is the major cause of morbidity & mortality in preterm neonates. Newer modalities of management like surfactant therapy, mechanical ventilation, & bubble CPAP has reduced mortality in preterm neonates with RDS. The aim of this study is to see the effect of various maternal factors, neonatal factors & different management modalities on outcome of neonates with RDS. This is the retrospective study involving 72 randomly selected intramural preterm neonates with RDS admitted in NICU during 8 months, having Silverman score 3 or more. Cases of all neonates were analyzed regarding maternal risk factors, presenting clinical features, Investigations, management modalities & each neonate was followed until the ultimate outcome. Adequate antenatal care, antenatal steroids, pregnancy induced hypertension (PIH) were associated with low mortality. Mortality was inversely proportional to gestational age & weight. Mortality was 43.06% in the study.

KEYWORDS preterm neonate, RDS, risk factors, mortality

INTRODUCTION:

During fetal life lung is fluid filled organ receiving only 10 to 15% of total cardiac output. Unlike heart, lungs are not functioning during fetal life and gas exchange takes place in placenta. Soon after birth lung fluid is absorbed and lungs fill with air & adequate functional residual capacity is quickly attained in term neonates[1]. About 10 -12% of total live births are preterm births[2]. Surfactant production starts at 24 weeks of gestation & gradually increases. In preterm neonates because of lack of surfactant collapse of alveoli occurs & more proximal respiratory bronchioles lined with necrotic epithelium forms the hyaline membrane resulting in RDS which is also known as hyaline membrane disease (HMD) [3]. Many maternal & neonatal factors contribute in incidence & course of RDS[4, 5]. Newer modalities of management like surfactant therapy, mechanical ventilation, & bubble CPAP has reduced mortality in preterm neonates with RDS.

MATERIAL AND METHOD:

It is the retrospective study involving total 72 randomly selected intramural preterm (gestational age less than 36 weeks) neonates with RDS admitted in a unit of NICU having Silverman score 3 or more from July 2012 to February 2013.Gestational age was determined according to modified Bellard criteria[2]. History regarding maternal risk factors and antenatal steroids was taken. Routine investigations, septic screen & chest X ray were analyzed. Chest x ray was not possible in 11 neonates either due to early expiry or due to mechanical fault in portable x ray machine. Different modalities of treatment like; Oxygen, indigenous nasal bubble CPAP, Mechanical ventilation & Surfactant used for management were analyzed. Indigenous bubble CPAP with nasal prongs was delivered to all neonates having mild RDS who required FiO2 between 0.2 & 0.5 to maintain Spo2 88% to 95%. Mechanical ventilation was required for all neonates requiring FiO2 above 0.5 or having respiratory acidosis with PaCO2 more than 50 mm of Hg or Spo2 less than 88%[2]. It was not possible to manage all those neonates with mechanical ventilation because of either unavailability of ventilator or negative consent by the parents. Surfactant was given to 58 patients. Each neonate was followed until the ultimate outcome.

The data was analyzed and results obtained. Statistical test applied for conclusion in the study is Z test[6].

RESULTS & DISCUSSION:

Out of total 72 preterm neonates with RDS included in the study; 41 neonates were discharged & 31 expired. Mortality is 43.06% in the study.

Table 1: Effect of adequate antenatal care (ANC) of mother on outcome

Adequate ANC of mother	No. of neonates	Mortality
yes	40 (55.55%)	12 (30.00%)
no	32 (44.45%)	19 (60.00%)

Mortality is lower in neonates whose mother had taken adequate ANC (30%) as compared to those who had not (60%) & this difference is significant (Z value 2.59).

Table 2: Effect of adequate antenatal steroid injections to mother on outcome

Adequate antenatal steroids to mother	No. of neonates	Mortality
yes	12 (16.67%)	01 (08.33%)
no	60 (83.33%)	30 (50.00%)

Mortality is very low in babies whose mothers had taken adequate antenatal steroid injections (8.33%) as compared to those who had not (50%). This difference is highly significant (Z value is 4.06).

In one Cochrane Database study by Crowley P, it was seen that adequate antenatal steroids significantly reduced mortality in preterm neonates with RDS[8].

Table 3: Effect of different maternal risk factors on outcome

Maternal risk factor	No. of neonates	Mortality
Antepartum hemorrhage (APH)	03 (04.16%)	02 (66.67%)
Mother's age < 21 years	13 (18.05%)	06 (46.15%)
Multiple pregnancy	13 (18.04%)	05(38.46%)
Past history of preterm delivery	06 (08.33%)	02 (33.33%)
Premature rupture of membrane (PROM)	03 (04.16%)	01 (33.33%)
Pregnancy induced hypertension (PIH)	10 (13.88%)	03 (30.00%)

Mortality is high (46.15%) in neonates whose mothers are less than 21 years old. Mortality is significantly high (66.67%) in neonates with mother having APH. Mortality is significantly low (30%) in neonates with mother having PIH because of high corticosteroid level in them.

Table 4: Effect of mode of delivery on outcome

Mode of delivery	No. of neonates	Mortality
Vaginal delivery	61 (84.72%)	26 (42.62%)
Caesarean section	11 (15.28%)	05 (45.45%)

Mortality is 42.62% in neonates delivered by vaginal route as compared to 45.45% in neonates delivered by caesarean section but this difference is not significant (Z value 0.17%).

Table 5: Gender distribution in preterm neonates with RDS

Gender	No. of neonates	Mortality
male	46 (63.88%)	19 (41.30%)
female	26 (36.12%)	12 (46.00%)

Male gender is one of the predisposing factors for RDS in preterm neonates[2, 7]. In this study 63.88% patients are male.

Mortality in male neonates is less (41.30%) than in female neonates (46%) but this difference is not significant (Z value is 0.39).

Table 6: Distribution of preterm neonates with RDS according to birth weight

Birth weight	No. of neonates	Mortality
< 1000 gms	09 (12.50%)	08 (88.89%)
1000 to 1500 gms	46 (63.89%)	20 (43.47%)
>1500 gms	17 (23.61%)	03 (17.64%)

Mortality is 88.89% in neonates weighing less than 1000 gms as compared to 36.50% in neonates weighing 1000 gms or more. This difference in mortality is highly significant (Z value is 4.32).

Incidence of RDS is maximum (60 – 80%) if gestational age of neonate is less than 28 weeks[4].

24% of neonates having birth weight less than 1250 gms on CPAP either expired or required mechanical ventilation in the study by Ammari et al[10].

Table 7: Distribution of preterm neonates with RDS according to gestational age

Gestational age in weeks	No. of neonates	Mortality
<28 weeks	07 (09.72%)	07 (100.00%)
28 – 30 weeks	06 (08.33%)	04 (66.67%)
30 – 32 weeks	24 (33.34%)	12 (50.00%)
32 - 34 weeks	20 (27.78%)	07 (35.00%)
>34 weeks	15 (20.83%)	01 (06.66%)

Mortality is high in neonates having gestational age < 30 weeks (84.61%) as compare to others (33.89%)

This difference is significant (Z value 4.31)

Table 8: Distribution of various clinical signs in neonates with RDS within 6 hrs of admission

Sign	No. of neonates
tachypnea	34 (47.22%)
Suprasternal retraction	42 (58.33%)
Interrcostal retraction	60 (83.33%)
Subcostal (xiphoid) retraction	71 (98.61%)
grunting	67 (93.05%)
Nasal flaring	32 (44.44%)
cyanosis	21 (29.16%)

Most common signs in neonates with RDS are subcostal (xiphoid) retraction (98.61%), grunting (93.05%), and intercostals retraction (83.33%) within 6 hrs of admission.

Silverman score for RDS in preterm neonates is counted according to severity (0, 1, 2 points given) of upper chest retractions, lower chest retractions, xiphoid retraction, nasal flaring & grunting[7].

Table 9: Effect of Silverman score on outcome

Silverman score	No. of neonates	Mortality
3 to 4	28 (38.89%)	05 (17.85%)
5 to 6	22 (30.56%)	07 (31.31%)
7 to 8	12(16.66%)	10 (83.33%)
9 to 10	10 (13.89%)	09 (90.00%)

Mortality is 24% in neonates having Silverman score 6 or less as compared to 86.36% in neonates having Silverman score 7 or more. This difference is significant (Z value 6.57).

Chest X ray of RDS is graded as: GRADE 1: fine reticulogranular mottling with good lung expansion. GRADE 2: mottling with air bronchogram. GRADE 3: diffuse mottling, heart border just discernible. GRADE 4: bilateral confluent opacification of lungs (white out – ground glass appearance)[9].

Table 10: Effect of chest x ray finding on 6th hour of life on outcome

Chest X ray finding	No. of neonates	Mortality
normal	13 (21.31%)	00 (00.00%)
Reticulo granular pattern	28 (45.90%)	10 (35.71%)
Groundglass appearance	19 (31.14%)	14 (73.68%)
Air leak syndrome	01 (01.63%)	01 (100%)

Chest x ray was done in 61 neonates on 6th hour of life. There is no mortality in neonates having normal chest x ray.

Mortality is 73.68% in neonates having ground glass appearance on chest x ray as compared to 35.71% in neonates having reticulogranular pattern on chest x ray. The difference is significant (Z value 2.81).

Table 11: Distribution of different modalities of management in preterm neonates with RDS

Mode of management	No. of neonates	Mortality
O2 with hood	14 (19.44%)	01 (07.14%)
Bubble CPAP	52 (72.22)	26 (50.00%)
Mechanical ventilation	06 (08.33)	04 (66.66%)

52 neonates were managed by bubble CPAP while only 6 neonates were managed by mechanical ventilation. Mortality is very low in neonates with mild RDS who did not require CPAP or ventilator. Surfactant was given to all 58 neonates requiring CPAP or mechanical ventilation.

38% of newborns with RDS on CPAP either expired or required mechanical ventilation in the study by Boo et al[11].

Table 12: Effect of duration of CPAP on mortality

Duration of bubble CPAP (hours)	No. of neonates	Mortality
< 24	16 (30.36%)	09 (56.25%)
24 – 48	18 (34.61%)	08 (44.44%)
48 – 72	15 (28.84%)	07 (46.66%)
>72	03 (05.76%)	02 (66.66%)

Mortality is high (66.66%) if duration of CPAP increases more than 72 hours.

Table 13: Incidence of various complications and their outcome

Complication	No. of neonates	Mortality
Necrotizing enterocolitis (NEC)	03 (04.16%)	03 (100%)
Air leak syndrome (ALS)	05 (06.90%)	04 (80.00%)
Sepsis	15 (20.83%)	10 (66.66%)
Apnea	07 (09.72%)	04 (57.14%)
Persistent pulmonary hypertension (PPHN)	02 (02.77%)	01 (50.00%)
Patent ductus arteriosus (PDA)	03 (04.16%)	01 (33.33%)

Mortality is 100% in neonates developing NEC & is 80% in neonates having ALS. Mortality is 66.66% in neonates developing sepsis which is the most common complication. Hyperbilirubinemia was seen in 28 (38.88%) neonates during NICU stay but did not have any significant effect on mortality.

Table 14: Distribution of different modalities of management in neonates with RDS developing sepsis

Modality of treatment	No. of neonates with sepsis	Mortality
O2 with hood	02 (13.33%)	00 (00.00%)
Bubble CPAP	12 (73.33%)	08 (72.72%)
Mechanical ventilation	02 (13.33%)	02 (100%)

Most of neonates (13/15; 86.66%) who developed sepsis were managed with either bubble CPAP (11/15; 73.33%) or mechanical ventilation (2/15; 13.33%).

SUMMARY & CONCLUSION:

Out of total 72 preterm neonates with RDS included in the study; 41 neonates were discharged & 31 expired. Mortality is 43.06% in the study. Mortality is very low in babies whose mothers had taken adequate antenatal steroid injections (8.33%) as compared to those who had not (50%). Mortality is very low in babies whose mothers had taken adequate antenatal steroid injections (8.33%) as compared to those who had not (50%). Mortality is significantly high (66.67%) in neonates with mother having APH. Mortality is significantly low (30%) in neonates with mother having PIH. Mode of delivery does not have any significant effect on mortality in neonates with RDS. Out of total 72 neonates; 46 are males & 26 are females. Male: female ratio is 1.76:1. There is no significant effect of gender on mortality in preterm neonates with RDS. Mortality is significantly high in neonates weighing less than 1000gms (88.89%) as compared to neonates weighing 1000gms or more (36.50%). Mortality is high in neonates having gestational age < 30 weeks (84.61%) as compare to others (33.89%). Most common signs in neonates with RDS are subcostal (xiphoid) retraction(98.61%), grunting(93.05%), and intercostals retraction (83.33%). Mortality is low (24%) in neonates having Silverman score 6 or less as compared to 86.36% in neonates having Silverman score 7 or more. Mortality is high (73.68%) in neonates having ground glass appearance on chest x ray as compared to 35.71% in neonates having reticulogranular pattern on chest x ray. 58 neonates (80.55%) with RDS required higher modalities of management like bubble CPAP or mechanical ventilation. Sepsis is common (20.83%) but preventable complication in neonates with RDS associated with high mortality (66.66%). NEC & ALS though uncommon complications are associated with high mortality.

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