

Management of Respiratory Distress Syndrome with a Single Dose of Surfactant; A Study of Early Rescue Therapy

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Abstract

Background: Deficiency of pulmonary surfactant is the primary cause of neonatal respiratory distress syndrome which leads to progressive respiratory failure. Two fundamental hindrances to ideal utilize were non affordability by the patient and non-accessibility during crisis hours. Distinctive procedures of surfactant instillation incorporate prophylactic methodology and early rescue approach. The present study was designed to survey and offer our experience of early rescue surfactant use in babies with respiratory distress syndrome. **Subjects and Methods:** Exosurf was administered over a period of five to ten minutes through a side port adapter. FiO₂ and ventilator settings were immediately adjusted to maintain adequate blood gases (PaO₂ 50-70 mm Hg, PaCO₂ 40-50 mm Hg and pH>7.25) with the lowest possible peak inspiratory pressures and FiO₂. After surfactant administration for the first six hours, routine endotracheal tube suctioning was avoided. Blood gases are done thirty minutes post surfactant and thereafter for change in ventilator parameters or as per clinical requirement. **Results:** ABG parameters although showed an improved trend before and after surfactant therapy but was not statistically significant. Among 42 neonates on surfactant therapy 8 neonates could not survived. Mortality was 100% for the neonate less than 28 wks. However, overall mortality was 19.04% and was inversely related to gestational age. FiO₂ requirement at 24 hr was significantly lower in survivor group. Mean duration of ventilation was 104.9±21.8 and 24% of mother received antenatal steroid in survivor group. Sepsis was the major complication leading to mortality. **Conclusion:** Findings of the present study suggest that administration of surfactant was related with reduced ventilatory necessities, enhanced respiratory status and early extubation. The most extreme effect on survival was seen in preterm babies (28-33weeks) and low birth weight (<1500gm). Sepsis is an essential confusion and its essence; alongside a high respiratory distress syndrome score at intubation are critical indicators of mortality.

Keywords: Respiratory distress syndrome, neonates, mortality, surfactant therapy.

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Introduction

Deficiency of pulmonary surfactant is the primary cause of neonatal respiratory distress syndrome which leads to progressive respiratory failure.^[1] A qualitative and quantitative surfactant deficiency at birth predominantly leads to respiratory distress syndrome in neonates. Beneficial effects of surfactant replacement were first time successfully introduced in early 1970. After that various studies had been conducted to observe the effects of surfactant on the mortality and morbidity of neonates.^[2-7] Typically, respiratory distress syndrome affects preterm infants below 35 weeks of gestational age; however, older infants with delayed lung maturation of different etiologies can also be afflicted. Common risk factors associated with respiratory distress syndrome include low gestational age, perinatal asphyxia, and maternal diabetes.^[7] Surfactant therapy is not availed by a larger number of population though it is included in the WHO essential drug list.^[9] Two fundamental hindrances to ideal utilize were non affordability by the patient and non-accessibility during

crisis hours. Distinctive procedures of surfactant instillation incorporate prophylactic methodology and early rescue approach. Prophylactic methodology has the benefit of conveying surfactant to alveoli before mechanical ventilation began and better circulation while procedure of fluid assimilation in lung is as yet happening.^[10]

Early diagnosis as well as treatment of respiratory distress syndrome has favourable position of instillation of surfactant in balanced out baby and position of endotracheal tube has been verified.^[10] The present study was designed to survey and offer our experience of early rescue surfactant use in babies with respiratory distress syndrome.

Subjects and Methods

This was a prospective cross sectional study conducted at F. H Medical College and Hospital from September 2017 - February 2018. For those neonates who were diagnosed with respiratory distress syndrome by Chest X ray and who satisfy one of the following

- a) Fail to maintain SpO₂ above 87%; or Pao₂ <50 mm Hg with rising FiO₂ requirements on bubble CPAP of 7 cm H₂O
- b) Recurrent apnea warranting intubation
- c) PaCO₂>65 mm Hg
- d) Radiological evidence of Grades III-IV RDS.

We practiced early rescue surfactant therapy (within 2 hours of life)

Exclusion criteria

Infants with structural cyanotic congenital heart disease
 severe congenital malformations
 pulmonary hypoplasia
 pneumothorax
 Apgar scores less than three at 5 min.

Exosurf was administered over a period of five to ten minutes through a side port adapter. FiO₂ and ventilator settings were immediately adjusted to maintain adequate blood gases (PaO₂ 50-70 mm Hg, PaCO₂ 40-50 mm Hg and pH>7.25) with the lowest possible peak inspiratory pressures and FiO₂. After surfactant administration for the first six hours, routine endotracheal tube suctioning was avoided. Blood gases are done thirty minutes post surfactant and thereafter for change in ventilator parameters or as per clinical requirement.

Statistical Analysis

All maternal, perinatal and neonatal data were collected and analyzed using SPSS statistical software. Continuous variables were analyzed using the Student's t or Mann-Whitney test, as appropriate, at p<0.05 the significance level was set.

Results

Table 1: Characteristics of respiratory distress syndrome neonates.

Characteristics	Numbers (Percentage)
Total admission in NICU	655
Total admission in NICU	132 (20.15%)
Surfactant recipient	42 (31.8%)
Sex	
Male	30
Female	12
Mean age of administration of surfactant (hours)	1.4±0.7
Antenatal corticosteroid	8 (19.04%)
1' Apgar	4.7±2.8
5' Apgar	7.1±1.9
Mean gestational age (wks)	
≤32weeks	30
≥32weeks	35.2
Mean birth weight(gms)	
≤32weeks	1286
≥32weeks	2012

Results of the present study showed that total 665 subjects were admitted in NICU during study period. Among them 132 (%) cases developed respiratory distress syndrome. Out of 132 patients surfactant therapy was given to 42

(31.8%) cases. There was predominance of male with a ratio of 2.5:1.

Mean age of administration of surfactant was 1.4±0.7 hr. Whereas, mean Apgar score at 1 and 5 min was 4.7±2.8 and 7.1±1.9 correspondingly. 19.04% of mothers received antenatal steroid. Mean gestational age (weeks) and birth weight (gms) in ≤32wks cases was 30wk and 1286 gm while in ≥32wks was 35.2 weeks and 2012gm [Table 1]. Surfactant was given as single dose rescue therapy in all 42 cases.

There was a statistically significant difference in ventilator rate (breaths/min) before (31.17±10.8) and at 24 hr after surfactant therapy (25.5±6.1, p value<0.05). Fraction of inspired oxygen concentration (Fio₂) requirement also significantly decreases before and after therapy (p value<0.0001) at 6, 12, and 24 hours PEEP also shows decreasing trend at 24 hours (p value <0.05) but not statistically significant at 6 and 12 hours [Table 2]

Table 2: Ventilatory parameters before and after surfactant therapy.

Parameters	Before surfactant	After surfactant			p value
		6 hr	12 hr	24 hr	
Ventilator rate (breaths/min)	31.17±10.8	31.07 ±9.9	30.1 ±9.6	25.5 ±6.1	<0.05
PIP (Cm of H ₂ O)	21.2±2.4	22.1 ±2.1	22.9 ±2.7	21.8 ±1.9	>0.05
PEEP(Cm of H ₂ O)	5.6±0.4	5.2 ±0.3	5.8 ±0.5	5.1 ±0.34	<0.05
Fio ₂	0.91±0.18	0.77 ±0.17	0.58 ±0.21	0.49 ±0.14	<0.01

ABG parameters although showed an improved trend before and after surfactant therapy but was not statistically significant [Table 3].

Table 3: ABG parameters before and after surfactant therapy.

Variants	Before surfactant	After surfactant	p value
PH	7.22±0.42	7.34±0.46	>0.05
Pao ₂	76.6±28.2	98.9±56.8	>0.05
Paco ₂	48.12±18.7	50.6±22	>0.05
Hco ₃	8.3±12	14.2±7.7	>0.05

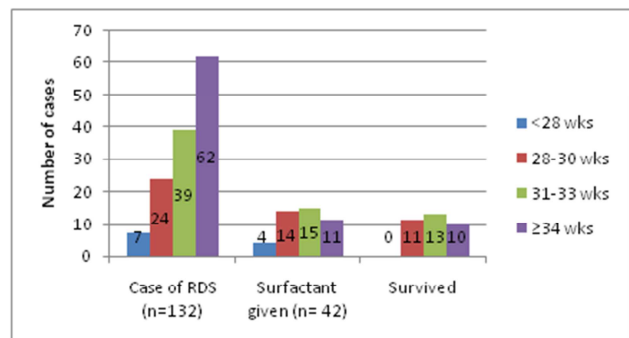


Figure 1: Outcome of surfactant therapy.

It is evident from [Figure 1] that among 42 neonates on

surfactant therapy 8 neonates could not survived. Mortality was 100% for the neonate less than 28 wks. However, overall mortality was 19.04% and was inversely related to gestational age.

Fio2 requirement at 24 hr was significantly lower in survivor group. Mean duration of ventilation was 104.9±21.8 and 24% of mother received antenatal steroid in survivor group. Sepsis was the major complication leading to mortality. [Table 4]

Table 4: characteristics of survivor and non-survivor infants following surfactant therapy.

Characteristics	Survivor	Non-survivors
Mean birth weight	1130.8±242.2	1280.9±236.4
Mean gestational age	29.6±1.8	30.8±4.2
Mean duration of ventilation (hour)	104.9±21.8	144.5±34.6
Fio2 at		
0 hr	0.9±0.16	0.89±0.15
24 hr	0.49±0.13	0.88±0.12
Antenatal steroid	08	02
Sepsis	04	07

Discussion

Respiratory distress syndrome is frequently reported up to 14% in neonates especially preterm birth.^[8,11] Moreover, studies reported incidence of respiratory distress syndrome as high as up to 30% at gestational ages of 29-30 weeks.^[10,11] Ventilation is commonly implicated in neonates suffering with respiratory distress syndrome.^[12] Present study recorded high rate of 20.15% incidence of respiratory distress syndrome in neonates. These findings are consistent with the findings of previous studies of Kumar P et al and Bhakoo O.^[11,12] This high rate of respiratory distress syndrome of neonates in the present study might be due low coverage of antenatal steroids.^[13] Moreover, studies have reported that incorporations of steroids with surfactant may results in decrease of incidence and severity of respiratory distress syndrome along with decrease of mortality due to respiratory distress syndrome.^[12,13]

The current study recorded coverage of antenatal steroid in 19.4% patients as all neonates could not be introduced SRT due to various causes like unaffordability and non-availability of back up ventilator.

Studies have shown that surfactant is quite effective in reducing the severity respiratory distress syndrome as well mortality and morbidity due respiratory distress syndrome in developed countries. However, it is too expensive for the developing countries like India.^[12-14]

Various studies reported a significant decrease of 40% in mortality and up to 50% decrease in air leak in neonates with surfactant therapy.^[15-17] In the present study a significant decrease in ventilator rate and Fio2 in neonates with surfactant therapy. These findings are in agreement with the earlier studies of Kumar P et al and Sol R et al.^[11,17] This decrease of mortality in the current study seems to be due to surfactant enhances oxygenation by expanding lung volume in under circulated air through locales and by other mechanism.^[18-20] Decreased pulmonary

perfusions is one of the important causes for high alveolar ventilation-perfusion proportions (VA/Q) districts. In this way increase oxygen availability may decrease the high VA/Q regions via countering vasoconstriction or by permitting mean arterial blood pressure to be decreased as a high mean arterial blood pressure would tend to collapse pulmonary vessels. Then again, surfactant may standardize high VA/Q areas by decreasing regions of the lung which are over ventilated. Protect surfactant treatment incorporated within two hours of life leads to decrease in neonatal mortality as well as bronchopulmonary dysplasia.^[21]

Further, sepsis has been considered as the commonest complication in ventilated babies; moreover, incidence of sepsis has been recorded as high as up to 67%. 12 In addition studies showed that septicaemia was the major cause of mortality for neonates suffering with respiratory distress syndrome.^[12,22]

Incidence of infections is directly proportional to the duration of ventilation and duration of hospital stay. Present study has recorded significantly high rate of mortality of neonates. Which may be due to low socioeconomic status of parents and they received poor antenatal care. Though, mortality rate of neonates on surfactant therapy according to gestational was similar to the previous study of India.^[22] However, mortality rate was still higher in comparison of western studies.^[23] The maximum impact on survival was seen in preterm babies(28-33weeks) and very low.

The effective administration of respiratory distress syndrome relies upon early conclusion and commencement of treatment. Administration of respiratory distress syndrome incorporates intrusive and non-obtrusive mechanical ventilation, for example, nCPAP. Surfactant utilize assumes the accessibility of prepared work force to oversee neonatal ventilation and offices to give add up to intensive care. Despite the fact that, surfactant treatment seems extremely costly at first, its effect on decreasing the span of ventilation, NICU stay and different morbidities really diminishes the aggregate cost of care.^[26,27]

Conclusion

Findings of the present study suggest that administration of surfactant was related with reduced ventilatory necessities, enhanced respiratory status and early extubation. The most extreme effect on survival was seen in preterm babies (28-33weeks) and low birth weight (<1500gm). Sepsis is an essential confusion and its essence; alongside a high respiratory distress syndrome score at intubation are critical indicators of mortality.

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