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# A Clinical Study of Use of Surfactant in SNCU, Brims, Bidar

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**ABSTRACT**
Use of surfactant have markedly improved the survival of preterm, LBW, and VLBW infants and have resulted in reduced neonatal and infant mortality. With adequate antenatal steroids, early CPAP and early surfactant therapy improves survival outcome. Present study was aimed to study use of surfactant in SNCU of a tertiary hospital. Present study was single-center, prospective, observational study, conducted in newborns between 24-37 weeks (GA) admitted in SNCU of our tertiary hospital, Neonates meeting inclusion criteria received bolus doses of natural (bovine or porcine) surfactant at a dose of 100 mg $kg^{-1}$ of phospholipids. In present study, total neonates, in whom surfactant administered during July 2022 to July 2023) were 46. Majority of them had birth weight 1501-2500 grams (43.48 %), followed by 1001-1500 grams (39.13 %) and less than 1000 grams (17.39 %). Majority of neonates had gestational age 35-37 weeks (53.17 %) as compared to gestational age 28-34 weeks (47.83 %). Majority neonates received surfactant beyond 6 hrs (82.61 %) as compared to those received surfactant after 6 hrs (17.39 %). Mortality was noted in 12 neonates (26.09 %). Among 46 neonates who received surfactant, 18 neonates received CPAP, out of those 14 neonates (30.43 %) shown improvement with CPAP only. While 28 neonates required ventilatory support, 20 neonates (43.48 %) shown improvement and 8 (17.39 %) died. Surfactant administration have markedly improved the survival of preterm neonates and have resulted in reduced neonatal and infant mortality. Selective or rescue use of surfactant refers to a strategy of providing exogenous surfactant to neonates with established RD.

## INTRODUCTION

Respiratory distress syndrome (RDS) is the leading cause of neonatal respiratory distress in our country and is the commonest disorder requiring assisted ventilation all over the world The management is based on earlier and timely administration of surfactant along with continuous positive airway pressure (CPAP) support, thereby, avoiding mechanical ventilation[1,2]. Surfactant decreases surface tension at the gas-liquid interface of alveoli and also maintains the stability of the alveolar lattice apart from also preventing transudation of interstitial fluid into the alveoli[3].

Use of surfactant have markedly improved the survival of preterm, LBW and VLBW infants and have resulted in reduced neonatal and infant mortality. The timing of surfactant administration is also crucial as evidences support better outcomes with early administration, in addition to CPAP and preferable noninvasive or lung protective ventilation strategies[4,5]. Surfactant is administered intratracheally as either a bolus dose or in dilute form to lavage the lungs in neonates with MAS. Although bolus administration is thought to replenish the endogenous surfactant inactivated by fatty acids present in the meconium, lung lavage with surfactant is believed to wash the residual meconium from the airways[6]. Prematurity and RDS largely contribute to early neonatal morbidity and mortality. With adequate antenatal steroids, early CPAP and early surfactant therapy improves survival outcome. If given early, surfactant can improve survival of preterm babies to greater extent. Present study was aimed to study use of surfactant in SNCU of a tertiary hospital.

## MATERIAL AND METHODS

Present study was single-center, prospective, observational study, conducted in department of paediatrics, at Bidar Institute of Medical Science, Bidar, Karnataka, India. Study duration was of 1 year (July 2022 to July 2023). Study approval was obtained from institutional ethical committee.

**Inclusion criteria:**

- All newborns between 24-37 weeks (GA) admitted in SNCU of our tertiary hospital, parents willing to participate in present study

**Exclusion criteria:**

- Newborns below 24 weeks (GA) and above 36 weeks
- Newborns below 750 gm of birth weight
- Parents not willing to enrol for study

Study was explained to parents in local language and written consent was taken for participation and study. A detailed history was recorded including the gender, gestational age, birth weight, postnatal date, duration of stay in the hospital, oxygen therapy, any H/O sepsis, I.V. antibiotics, blood transfusion, etc.

Preterm newborns admitted to SNCU are administered with surfactant and overall outcome was assessed and analysed following standard treatment protocol and monitoring system. Routine standard investigations are done such as chest X-ray, ABG, depending on case requirement. Neonates meeting inclusion criteria received bolus doses of natural (bovine or porcine) surfactant at a dose of 100 mg $kg^{-1}$ of phospholipids. Repeat doses were given if indicated after 6-12 hrs. Surfactant was instilled into the trachea via an endotracheal tube using a feeding tube.

Supportive management and antibiotics were given as per unit policy. Data regarding clinical outcomes such as duration of ventilation, oxygen therapy, survival rate, duration of hospital stay and complications were collected and analysed. Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Statistical analysis was done using descriptive statistics.

## RESULTS

In present study, total neonates, in whom surfactant administered during July 2022 to July 2023) were 46. Majority of them had birth weight 1501-2500 grams (43.48 %), followed by 1001-1500 grams (39.13 %) and less than 1000 grams (17.39 %).

Majority of neonates had gestational age 35-37 weeks (53.17 %) as compared to gestational age 28-34 weeks (47.83 %).

In present study, majority neonates received surfactant beyond 6 hrs (82.61 %) as compared to those received surfactant after 6 hrs (17.39 %).

Mortality was noted in 12 neonates (26.09 %). In this study, there was no significant incidence of complications during surfactant administration and the consequences of treatment.

Among 46 neonates who received surfactant, 18 neonates received CPAP, out of those 14 neonates (30.43 %) shown improvement with CPAP only. While 28 neonates required ventilatory support, 20 neonates (43.48 %) shown improvement and 8 (17.39 %) died.

Table 1: Birth weight

| Birth weight (grams) | No. of patients | Percentage |
|---|---|---|
| >1000 | 8 | 17.39 |
| 1001-1500 | 18 | 39.13 |
| 1501-2500 | 20 | 43.48 |

Table 2: Gestational age

| Gestational age (in weeks) | No. of patients | Percentage |
|---|---|---|
| 28-34 | 22 | 47.83 |
| 35-37 | 24 | 53.17 |

Table 3: Timing of administration of surfactant

| Timing of administration | No. of patients | Percentage |
|---|---|---|
| Within 6 hrs | 8 | 17.39 |
| Beyond 6 hrs | 38 | 82.61 |

Table 4: Outcome

| Outcome | No. of patients | Percentage |
|---|---|---|
| Improved | 34 | 73.91 |
| Died | 12 | 26.09 |

Table 5: Other characteristics

| | No. of patients (n = 46) | Percentage |
|---|---|---|
| With CPAP | 18 | 39.13 |
| Survived | 14 | 30.43 |
| Died | 4 | 8.7 |
| Ventilator required | 28 | 60.87 |
| Survived | 20 | 43.48 |
| Died | 8 | 17.39 |

## DISCUSSIONS

Surfactant administration is carried out in 2 methods. In INtubation, SURfactant administration, and Extubation (INSURE), which is the most common method the baby is first intubated and then extubated after surfactant administration[7]. In minimally invasive surfactant therapy (MIST), surfactant is injected into trachea using a thin catheter with using forceps in direct laryngoscopy[8,9]. Although exogenous surfactant administration has its own known complications like hypotension or worsening shock, apnea, bradycardia, pneumothorax, PIE (pulmonary interstitial emphysema) and pulmonary hemorrhage, surfactant therapy has been the standard of care in preterm infants with RDS and is associated with a decrease in neonatal mortality, pneumothorax and increased survival without bronchopulmonary dysplasia (BPD)[10,11].

In study by Phuljhele *et al.*[12] among 100 neonates (49 male, 51 female), 46 received early surfactant therapy and 54 obtained it late; significantly more indoor patients could be treated early (p<0.0001). Although high mortality was observed with both early (65.2%) and late therapy (85.2%), there was significantly higher survival with early therapy (p = 0.018). Though no statistical differences of outcome were observed with different GA and BW in study groups, irrespective of timing of therapy, higher mortality occurred in lower BW/GA subgroups with least survival among extremely preterm <27 weeks. (p = 0.000057) and ELBW <1000 gm (p = 0.013). No difference was seen for need of reintubation/ventilation but duration of ventilation was more on late group (p = 0.043). Culture positive sepsis was found in 68% with higher association with late therapy (p = 0.033).

In study by Sunil *et al.*[13] they studied 30 cases (18 male and 12 female), 19 babies were term while 11 babies were pre-term. twenty one babies were Appropriate for Gestational Age and 9 babies were small for Gestational Age. Mean gestational age was 37.2±1.6 weeks. Mean birthweight was 2190±280 grams. Twenty two babies were vaginally delivered, 8 delivered by LSCS. Intrapartum 17 babies had fetal heart rate abnormalities. Four babies needed Chest compressions, 2 needed epinephrine during resuscitation. Two babies received intubated and on PP in NICU and 3 babies needed positive pressure ventilation (PPV) at birth. APGAR scores at 1 min, 5 min and 10 minutes are noted. Average maximum respiratory distress score was 6 ±1.6. 21 babies needed mechanical ventilation. Average duration of mechanical ventilation was 18.5 ± 43.8 hours while average duration of CPAP was 26.4 ± 19.3 hours. 11 ± 8.5 days was average duration of hospital stay. Mortality was noted in 8 cases.

Rapaka *et al.*[14] studied 100 neonates, most of the neonates 34 (66.6 %) in the surfactant group and 37 (75.0 %) neonates in the control group were between 30 weeks to 32 weeks of GA respectively. Twelve (25.0 %) in the surfactant group and 10 (19.4 %) in the control group were between 27 weeks. To 29 weeks. of GA respectively. Very less 4 (11.76 %) in the surfactant group and 3 (8.10 %) in the control group were between 32 weeks. Of GA to 35 weeks respectively.

Choupan *et al.*[15] compared efficacy of surfactant administration through a thin intratracheal catheter and its administration via an endotracheal tube. They noted that number of attempts to successfully enter the tracheal tube or catheter into the trachea the frequency of surfactant administration, and incidence of tachycardia, bradycardia or cough during surfactant administration the need for mechanical ventilation in the first 72 hrs of life the incidence of bronchopulmonary dysplasia, intraventricular hemorrhage, pulmonary hemorrhage and death were not significantly different within the two groups.

Systematic reviews indicate that early surfactant administration and the use of lesser invasive modalities such as less invasive surfactant administration (LISA) reduce mortality and the risk of bronchopulmonary dysplasia (BPD). However, there is a paucity of evidence to define the optimal thresholds at which exogenous surfactant therapy would be most effective[16,17]. The World Health Organization (WHO) recommends the use of animal-derived or protein-containing synthetic surfactant for preterm neonates with respiratory distress syndrome who are intubated and undergoing mechanical ventilation[18,19].

The cost of current formulations remains high and poses a significant barrier to access. As a result, surfactant use in low and middle-income countries is challenging. There is a need for a low-cost surfactant that can be administered without intubation and mechanical ventilation and is as efficacious and safe as standard surfactant. Many different surfactants and administration methods have been trialed, including less-invasive surfactant administration, which involves administering surfactant using a small catheter[20,21]. Surfactant delivery via laryngeal mask airway or pharyngeal instillation are other commonly used methods but they also involve passing tubes into the oro-or naso-pharynx[22].

## CONCLUSION

Surfactant administration have markedly improved the survival of preterm neonates and have resulted in reduced neonatal and infant mortality. Selective or rescue use of surfactant refers to a strategy of providing exogenous surfactant to neonates with established RDS.

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