ORIGINAL RESEARCH PAPER

Paediatric Medicine

A COMPARATIVE STUDY ON THE EFFICACY OF LESS INVASIVE SURFACTANT ADMINISTRATION (LISA) AND INTUBATION-SURFACTANT-EXTUBATION (InSurE) TECHNIQUE OF SURFACTANT ADMINISTRATION IN PRETERM INFANTS WITH RESPIRATORY DISTRESS SYNDROME

KEY WORDS:

Dr Riya Mittal Paediatric resident Sawai Man Singh Medical College, Jaipur, Rajasthan

Dr M.L. Gupta* Sr. Professor, Paediatric Dept, Sawai Man Singh Medical College, Jaipur, Rajasthan*Corresponding Author

Dr Mudita Paediatric resident Sawai Man Singh Medical College, Jaipur, Rajasthan

ABSTRACT

Respiratory distress syndrome (RDS) previously known as Hyaline membrane disease. Is a disease of preterm infants that is caused by insufficient pulmonary surfactant in Alveoli. RDS is responsible in significant mortality and morbidity in preterm neonates. Respiratory distress syndrome is manifested by tachypnoea, expiratory grunting, chest retractions, nasal flaring and cyanosis. Mode of surfactant administration evolved over time. Previously surfactant bolus was administered via endotracheal intubation during mechanical ventilation. Subsequently, INSURE technique was introduced in which intubation, surfactant administration and extubation is followed by continuous positive airway pressure (CPAP). Lately, less invasive techniques (LISA) have been developed in which surfactant administration is done effectively while the infant is breathing spontaneously. In LISA thin, soft catheters like gastric tubes, suction cathetersetc have been used. In INSURE technique there is complete obstruction of larynx while in LISA There is partial obstruction. LISA technique allows the surfactant to spread up quickly without the need for positive pressure ventilation. LISA is a part of noninvasive approach. Antenatal steroids, right timing to deliver a baby in good condition enabling spontaneous respiration and efficient CPAP are crucial for success of LISA.

INTRODUCTION

Respiratory problem is one of the commonest consequences of preterm birth manifesting early as respiratory distress syndrome (RDS), a product of structurally immature lungs and pulmonary surfactant deficiency[1].These preterm infants often require invasive and non-invasive respiratory support, supplementary oxygen and surfactant replacement therapy. A proportion of these infants will go on to develop chronic lung disease of prematurity2, with abnormal respiratory function and increased respiratory morbidity persisting through childhood and into adult life. Approximately 11% of all infants are born preterm, this figure is rising in many countries[3].

The optimal management of neonatal respiratory distress syndrome include decreasing incidence and severity using antenatal corticosteroids, followed by optimal management using respiratory support, surfactant therapy, and overall care of the premature infant[4].

Surfactant therapy has become the standard of care in preterm infants with respiratory distress syndrome (RDS), and is used increasingly in near-term and term newborns with acute respiratory distress syndrome (ARDS). Surfactant therapy has been shown to reduce the combined outcomes of death and bronchopulmonary dysplasia (BPD) in preterm infants with RDS[5].

In an effort to minimize mechanical lung damage, alternative approaches to surfactant therapy have been developed utilizing noninvasive ventilatory techniques, such as early nasal continuous positive airway pressure (CPAP)6-8. The Continuous Positive Airway Pressure or Intubation at Birth (COIN) trial and Surfactant Positive Pressure and Oximetry Randomized Trial (SUPPORT) demonstrated that early nasal CPAP (nCPAP) is a safe and efficacious alternative to intubation and prophylactic surfactant administration. In an effort to exploit the benefits of early surfactant administration while minimizing mechanical ventilation complications, Victorin et al8 introduced an approach involving intubation, surfactant administration during brief mechanical ventilation, and extubation, known as the InSurE technique9. In INtubation, SURfactant administration, and Extubation (InSurE), which is the most common method, the baby is first intubated and then extubated after surfactant administration10. However, sometimes tracheal intubation fails and causes hypoxia, bradycardia, increased intracranial pressure, and respiratory system injury[11]. Moreover, mechanical ventilation can cause barotrauma and lung injuries making the infant susceptible to chronic lung disease[12].

Attempts to achieve surfactant delivery while avoiding the need for intubation for even a brief period of time have been further studied using less invasive surfactant administration (LISA), also known as minimally invasive surfactant therapy (MIST)13. In LISA, thin soft catheters like gastric tubes, suction catheters etc. have been used. In InSurE technique there is complete obstruction of larynx while in LISA, there is partial obstruction. LISA technique allows the surfactant to spread up quickly without the need for positive pressure ventilation. LISA is a part of noninvasive approach. Antenatal steroids, right timing to deliver a baby in good condition enabling spontaneous respiration and efficient CPAP are crucial for success of LISA[14].

It is shown that LISA could result in higher recovery rate without bronchopulmonary dysplasia (BPD) and reduce other complications associated with premature birth such as severe intraventricular hemorrhage (IVH)[15].

In addition, Bugter et al. found that patients who had received LISA were exposed to fewer interventions, such as radiographs and blood gas analyses16. LISA might even reduce the total number of preterm infants needing any mechanical ventilation during hospitalization[17].

There are limited studies on this subject, hence this study was undertaken to evaluate the effectiveness and short-term outcomes of LISA and compare them with the InSurE technique in the treatment of RDS in preterm infants.

AIM AND OBJECTIVES

AIM:

To compare the safety and effectiveness between Less Invasive Surfactant Administration (LISA) and Intubation-Surfactant-Extubation (InSurE) technique of surfactant administration in preterm infants with respiratory distress syndrome.

OBJECTIVES:

1.PRIMARY OBJECTIVES - To assess:

The Safety of LISA and InSurE groups in terms of apnea, trauma and desaturation.

- Need for mechanical ventilation in first 72 hours.
- The duration of invasive ventilation.
- The duration of CPAP.
- The duration of oxygen therapy.

2. SECONDARY OBJECTIVES - To evaluate:

- The need of repeat dose of surfactant and ventilation
- The mortality during NICU stay.
- Risk of pneumothorax, IVH, NEC, ROP and PDA
- Volume of enteral feeds on day 7
- Length of hospitalization

RESULTS

Table 1: Comparison of safety profile among study groups

	LISA Group Number (%)	InSurE Group Number (%)	p-value
Apnea	26 (47.3%)	33 (60)	0.251
Desaturation	28 (50.9)	30 (54.5)	0.849
Trauma	24 (43.6)	30 (54.5)	0.340

Table 2: Comparison of Need for respiratory support among study groups

	LISA Group	InSurE Group	p-value
Need for invasive ventilation within 72 hours (N)	13/55 (23.6%)	24/55 (43.63%)	0.02 (S)
Duration of invasive ventilation (days)	1.51 ± 2.61	2.92 ± 3.46	0.018 (S)
Duration of CPAP(days)	1.87 ± 2.94	3.67 ± 3.1	0.002 (S)
Duration of oxygen requirement (days)	3.28 ± 2.81	6.57 ± 3.31	<0.001 (S)

Table 3: Overall outcome among study groups

Birth weight	LISA Group (N=55) Number (%)	InSurE Group (N=55) Number (%)	p-value
Need for repeat dose of surfactant	20 (36.4%)	33 (60%)	0.022 (S)
Need For reintubation & ventilation	13 (23.6%)	33 (60%)	<0.001 (S)
Mortality	15 (27.3%)	28 (50.9%)	0.019 (S)

Table 4: Comparison of complications among study groups

Complications	LISA Group Number (%)	InSurE Group Number (%)	p-value
ICH	17 (30.9%)	38 (69.1%)	<0.001 (S)
ROP	22 (40%)	34 (61.8%)	0.036 (S)
PDA	27 (49.1%)	28 (50.9%)	0.849
NEC	20 (36.4%)	32 (58.2%)	0.033 (S)

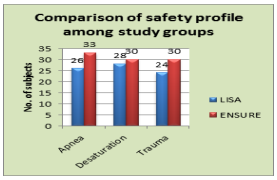

Fig.1: Comparison of safety profile among study groups

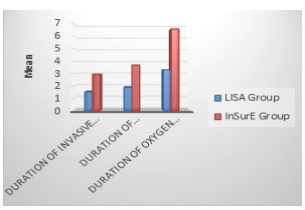

Fig.2: Comparison of Need for respiratory support among study groups

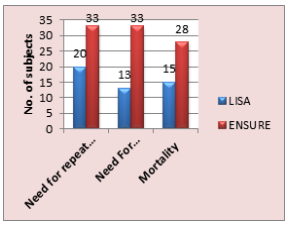

Fig.3: Overall outcome among study groups

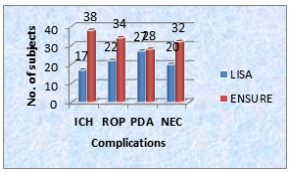

Fig.4: Incidence of complications among study groups

CONCLUSIONS

Our study found LISA to be safer and more effective compared to InSurE, as a method for surfactant administration in preterm neonates. Our study has also shown that LISA reduces the need for invasive mechanical ventilation, reduces the time for mechanical ventilation, and reduces the need for oxygen and the length of hospital stay, this in turn may help in reducing the cost of treatment, overload for the neonatal department in hospitals, and contribute in improving the mortality and morbidity of preterm infants. However, further prospective, large-scale, and multicenter trials are required to show that LISA is better and more effective than InSurE.

SUMMARY:

The study entitled "To Study Efficacy of Less Invasive Surfactant Administration (LISA) And Intubation-Surfactant-Extubation (Insure) Technique Of Surfactant Administration In Preterm Infants With Respiratory Distress Syndrome" conducted in the neonatal units of SPMCHI, Zanana, Mahila chikitsalaya of SMS Medical College, Jaipur. Following results are obtained:

- Male neonates in LISA & InSurE group were 31 (56.36%) & 23 (41.82%) while rest were female neonates. This gender difference was not found to be statistically significant.

- Number of neonates in the group LISA and InSurE in the age group of 28-30 weeks gestational age were 24 (43.6%) & 20 (36.4%) respectively in the age of 30-32 weeks gestational age were 18 (29.1%) & 27 (32.7%) respectively and in the age 32-34 weeks were 13 (23.6%) & 9 (16.4%) respectively. Maximum neonates in group LISA and group InSurE were of gestational age 28-30 weeks. Gestational age difference was not found to be statistically significant in both groups.

- Mean infant weight of study neonates group LISA & InSurE was 1411.2 ± 420.9 & 1358.3 ± 352.0 respectively. This weight differences were not found to be statistically significant in maximum numbers of newborn which were of very low birth rate ≤1500->1000 weights in both groups.

- <25 years mother in group LISA and group InSurE where 34 (61.81%) & 32 (58.2%) respectively while rest were >25 years of age. LSCS in group LISA and group InSurE was 24 (43.6%) & 23 (41.82%) respectively while rest were delivered by normal vaginal delivery. Multigravida in LISA and InSurE was 37 (67.27%) and 34 (61.8%) respectively, while rest were primigravida. There were no significant differences in maternal characteristics in both the groups.

In LISA group the respiratory support in the form of need for invasive ventilation within 72 hrs was 23.6% as compared to InSurE group which was 43.63%, duration of invasive ventilation (days) in LISA was 1.51 ± 2.61 as compared InSurE group which was 2.92 ± 3.46, duration of CPAP in LISA group was 1.87 ± 2.94 as compared to InSurE group which was 3.67 ± 3.1 & oxygen requirement in days in LISA group was 3.28 ± 2.81 as compared to InSurE group which was 6.57 ± 3.31, which was less as compared to InSurE group and was found to be statistically significant.

- Need for repeat dose of surfactant, mortality & need for reintubation & ventilation was less in LISA group compared to InSurE group which was statistically significant & needed less duration of invasive ventilation.

- Safety profile in terms of apnea, desaturation & trauma among both the groups were not found to be statistically significant.

- Risk of ICH, ROP & NEC were found statistically significant in LISA compare to InSurE group.

- Volume of enteral feed on day 7 among study groups is not found to be statistically significant.

- In LISA group maximum number of neonates 33 (60%) stayed for <7 days. Whereas in InSurE group maximum number of neonates 30 (54.5%) stayed for 7-14 days and the difference was statistically significant.

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