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<b>Department:</b>	Neonatal Intensive Care Unit (NICU)		
<b>Document:</b>	Multidisciplinary Policy and Procedure		
<b>Title:</b>	Surfactant Administration to Neonates		
<b>Applies To:</b>	All NICU Staff and Respiratory Therapist		
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## 1. PURPOSE:

- 1.1 Surfactant administration in preterm infants with established respiratory distress syndrome (RDS) reduces mortality, decreases the incidence of pulmonary air leak (pneumothorax and pulmonary interstitial emphysema), and lowers the risk of chronic lung disease or death at 28 days of age.
- 1.2 Surfactant replacement increases the likelihood of surviving without broncho pulmonary dysplasia.

## 2. DEFINITIONS:

- 2.1 **Surfactant** is a complex lipoprotein rich in saturated phosphatidylcholine molecules is produced by the cytoplasmic lamellar bodies in type II pneumocytes of the distal respiratory epithelium. It binds to the internal surface of the lung and markedly lessens the forces of surface tension at the air-water interphase, thereby reducing the pressure tending to collapse the alveolus.
- 2.2 **Respiratory distress syndrome (RDS)** is the result of a primary absence or deficiency of surfactant. It presents as acute respiratory distress with disturbed gas exchange in a preterm infant with a typical clinical course or x-ray (ground glass appearance, air bronchograms and reduced lung volume).
- 2.3 **INSURE** strategy: early administration of surfactant followed by brief ventilation and extubation to CPAP
- 2.4 **MIST** method: Minimally invasive surfactant therapies have recently been investigated, aiming to administer surfactant to spontaneously breathing infants. These techniques have included administration of exogenous surfactant by brief tracheal catheterization, aerosolization, and laryngeal mask. Of these, the methods involving brief tracheal catheterization have been most extensively studied, with surfactant administered by using both a flexible feeding tube and a semi-rigid vascular catheter.

## 3. POLICY:

- 3.1 Surfactant therapy must be administered with written order of the physician.
- 3.2 The nurse/ respiratory therapist should assist the physician during administration of surfactant.
- 3.3 Infant should be closely monitored throughout the procedure
- 3.4 Strict aseptic technique should be observed during surfactant administration.
- 3.5 The nurse should be aware of the possible complications of the procedure.
- 3.6 Intubation equipment and oxygen source must be ready.
- 3.7 Working condition of suctioning equipment must be ensured.
- 3.8 If the preterm infant with RDS needs intubation as part of his/her resuscitation (e.g. apnea, gasping, heart rate < 100 bpm and not responding to proper positive pressure ventilation), stabilize him/her and then give surfactant preferably before 2 hours of age.
- 3.9 Spontaneously breathing preterm infants who do not require intubation as part of their resuscitation, but have mild to moderate respiratory distress and require FiO<sub>2</sub> less than 40% can be resuscitated with CPAP 4 - 6 cmH<sub>2</sub>O, using the T-piece resuscitator. Early initiation of CPAP with subsequent selective surfactant administration in extremely preterm infants results in lower rates of BPD/death when compared with treatment with prophylactic surfactant therapy.
- 3.10 For infants on CPAP give early rescue surfactant before 2 hours of age if required i.e. if infant exhibits clinical signs of RDS, hemodynamically stable, FiO<sub>2</sub> requirements increase or infant requires intubation

- e.g.  $\text{FiO}_2 > 40\%$  is needed to keep  $\text{PO}_2$  50 mmHg and  $\text{SpO}_2$  90-92%, or if infant needs ventilation  $\text{PCO}_2$  is  $> 60$  mmHg and pH is  $< 7.25$
- 3.11 Wean infants to CPAP as soon as tolerated. Suggested parameters for extubation include; ventilator rate 15 - 25, PIP  $< 16$  cm  $\text{H}_2\text{O}$ , PEEP  $< 5$  cm  $\text{H}_2\text{O}$ ,  $\text{FiO}_2 < 35\%$ ,
  - 3.12 Repeating dose of surfactant:
    - 3.12.1 Repeat dose of surfactant if there is a persistent or recurrent oxygen requirement of  $> 30\%$  or mean airway pressure of 7cm $\text{H}_2\text{O}$  during the first 72 hours of life.
    - 3.12.2 Repeat after 6-12 hours for not more than 3 doses. Note that given the long half-life for surfactant in preterm infants with RDS, re-dosing should not be needed more often than every 12 hours, unless surfactant is being inactivated by an infectious process, meconium, or blood. Dosing intervals shorter than 12 hours recommended by some manufacturers are not based on human pharmacokinetic data.

#### 4. PROCEDURE:

- 4.1 Observe surfactant for discoloration or sediment. If noted, do not use. Warm it by standing at room temperature for at least 20 minutes or warm it in the hand for at least 8 minutes. Do not shake it.
- 4.2 Position infant on back and suction if needed.
- 4.3 Ensure proper endotracheal tube position clinically; auscultation, chest movement and depth of ETT at the angle of the mouth (weight in kg + 6).
- 4.4 Wash hands and put on sterile gloves. It is aseptic procedure.
- 4.5 Measure and shorten 5 Fr end-hole catheters so that the tip of catheter is at the end or just protrude beyond the end of ETT, above the carina. Keep the catheter sterile all through the procedure.
- 4.6 Wash hands, draw surfactant dose into syringe.
- 4.7 Attach the measured 5 Fr catheter to syringe, fill catheter.
- 4.8 Administer surfactant as intra-tracheal bolus or into 2 aliquots over few minutes as tolerated while infant is disconnected from the mechanical ventilator, or by infusion through an adaptor port on the proximal end of the endotracheal tube (if available). Ventilate the baby as required during administration to achieve prescribed oxygen saturation.
- 4.9 Surfactant can occlude the ETT and it may be necessary to cease dosage until the tube is cleared and chest wall movement resumes.
- 4.10 There is no evidence to support the practice of placing the infant in multiple different positions during the administration of surfactant.
- 4.11 **Precautions:**
  - 4.11.1 Surfactant can result in marked improvements in lung volume, functional residual capacity, and compliance within minutes of administration. Thus, expeditious changes in mechanical ventilator settings e.g. weaning of PIP may be necessary to minimize the risks of lung injury and air leak.
  - 4.11.2 Ensure volume guarantee (properly functioning ventilator flow sensor) and continue frequent and careful clinical observation and monitoring of oxygenation for one hour to avoid hyper-oxygenation or exposure to excessive peak inspiratory pressures and possible pneumothorax.
  - 4.11.3 Check blood gases after 2 hours.
  - 4.11.4 Hyperventilation with very low  $\text{PCO}_2$  may occur.
  - 4.11.5 Be alert that the onset of clinical signs of patent ductus arteriosus may occur earlier.
  - 4.11.6 Avoid suctioning the endotracheal tube for as long as possible (at least 1hour post administration) unless clear-cut signs of airway obstruction are present.
- 4.12 **Complications of surfactant:**
  - 4.12.1 Airway obstruction during instillation, hypoxemia, bradycardia, and alterations in cerebral blood flow and brain electrical activity.
  - 4.12.2 Pneumothorax due to sudden changes in pulmonary compliance if the ventilator settings are not appropriately changed.
  - 4.12.3 Pulmonary haemorrhage; low incidence, but reported, do not decrease PEEP below 5cm $\text{H}_2\text{O}$ .
  - 4.12.4 Administration of surfactant to only one lung i.e. right main stem intubation.

#### 4.13 Surfactant Dose

- 4.13.1 Survanta minced bovine lung extract:4ml/kg/dose
- 4.13.2 Infasurf Bovine calf lung lavage; 3ml/kg/dose

#### 5. MATERIAL AND EQUIPMENT:

- 5.1 Surfactant- warmed to room temperature
- 5.2 10 cc syringe
- 5.3 20 g needle
- 5.4 Sterile feeding tube 5Fr, 6Fr, 8Fr
- 5.5 Sterile blade
- 5.6 ETT of various sizes
- 5.7 Ambu bag

#### 6. RESPONSIBILITIES:

- 6.1 Physician
- 6.2 Neonatology staff nurse
- 6.3 Respiratory therapist

#### 7. APPENDICES:

N/A

#### 8. REFERENCES:

- 8.1 American Academy of Pediatrics. Committee on fetus and newborn. POLICY Statement. Respiratory Support in Preterm Infants at Birth. Pediatrics 2014. 133:. 171-175
- 8.2 American Academy of pediatrics. Clinical Report. Surfactant Replacement therapy for Preterm and Term Neonates with Respiratory Distress. Polin RA, Carlo WA and Committee on fetus and newborn. Pediatrics 2014. | 33; | 56-1 64
- 8.3 Canadian Pediatric Society Fetus and Newborn Committee Position Statement. Recommendations for neonatal surfactant therapy- Addendum. Michael S Dunn, Ann L Jefferies. Paediatric Child Health Vol. | 7 No- 3 March 2012
- 8.4 Bahadue FL, Soll R. Early versus delayed selective surfactant treatment for neonatal respiratory distress syndrome. Cochrane Database of Systematic Reviews 2012, Issue II. Art. No.: CD001456
- 8.5 Soll R. Prophylactic versus selective use of surfactant in preventing morbidity and mortality in preterm infants. Cochrane neonatal reviews. December 2011.

9. APPROVALS:

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