JHCH_NICU_12.03

John Hunter Children's Hospital
CHILDREN, YOUNG PEOPLE AND FAMILIES

GUIDELINE/PROCEDURE

SUBJECT: **Surfactant Administration in NICU**

DOCUMENT NUMBER: **JHCH_NICU_12.03**

DATE DEVELOPED: **September 2005**

DATES REVISED: **July 2011**

DATE APPROVED: **November 2013**

REVIEW DATE: **November 2017**

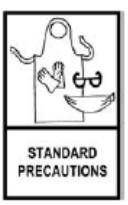
DISTRIBUTION: **Neonatal Intensive Care JHCH**

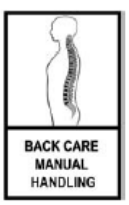
PERSON RESPONSIBLE FOR MONITORING AND REVIEW:
Jennifer Ormsby CNE (Relieving) NICU)

COMMITTEE RESPONSIBLE FOR RATIFICATION AND REVIEW:
NICU Management Committee

KEYWORDS: Curosurf, preterm, prophylaxis, rescue, respiratory distress syndrome, surfactant

S.W.P.





Background

Respiratory distress syndrome (RDS) is defined by the presence of acute respiratory distress with disturbed gas exchange in an infant with a typical clinical course or x-ray appearance (ground glass appearance, air bronchograms and reduced lung volume). The lungs of babies with RDS are immature, with poor synthesis and utilization of surfactant. Endogenously produced surfactant normally lines the alveolar surfaces in the lung, reduces surface tension and prevents atelectasis.

Is surfactant beneficial?

Several RCTs and their meta-analyses have demonstrated the effectiveness of artificial surfactant therapy in both the prevention and treatment of infants with or at risk for RDS. Surfactant administration decreases the severity of RDS and frequency of pneumothorax and air leaks, increases survival without chronic lung disease, and decreases mortality[1].

Which is better: natural or synthetic surfactant?

A wide variety of surfactant preparations have been developed and tested. These include synthetic surfactants and surfactants derived from animal sources. Comparative trials demonstrate greater and earlier improvement in the requirement for ventilator support, fewer pneumothoraces, and fewer deaths with natural surfactant treatment[2]. Thus natural surfactant extracts seem to be the more desirable choice. (New synthetic surfactants have been developed which may have enhanced efficacy and these are presently being investigated).

- *Natural surfactants should be used in preference to any of the synthetic surfactants available at the time of this review.*

Porcine (Curosurf™) or Bovine (Survanta™)?

Among the currently available natural surfactants Curosurf™ use requires a smaller volume and results in a somewhat faster onset of action when compared to Survanta™. A recent meta-analysis suggests that Curosurf use is associated with a further reduction in mortality and reduction in severe grades of IVH when compared with Survanta[3].

- *Curosurf™ should be used for exogenous surfactant therapy at a dose of 200mg/kg.*

Which is better: Prophylaxis or Rescue treatment?

Surfactant may be given as prophylaxis or as rescue treatment for RDS. Prophylactic use is based on the better distribution of surfactant when administered before the first breath and on reduced lung injury, resulting in less alveolar oedema and less inactivation. A meta-analysis of RCTs on this issue has shown improved clinical outcome with decreased risk of air leaks, mortality and a decreased risk of bronchopulmonary dysplasia or death with prophylactic treatment[4]. The meta-analysis suggests a reduction of 2 pneumothoraces and 5 deaths for every 100 newborns treated prophylactically[4]. (In most of the studies analysed, the antenatal use of steroids ranged from 14%-50%, which is considerably less than current practice).

Infants at a significant risk of RDS should receive prophylactic natural surfactant therapy immediately after intubation.

Ventilator management following surfactant therapy

Following rapid changes in lung mechanics and the ventilation/perfusion matching that occurs after rescue surfactant therapy, many infants can be very rapidly weaned and extubated to nasal CPAP soon after intubation and surfactant administration. A Cochrane review of 4 RCTs concluded that early surfactant replacement therapy with extubation to nasal CPAP compared with later, selective surfactant replacement and continued mechanical ventilation is associated with a reduced need for mechanical ventilation and increased utilization of exogenous surfactant therapy[5].

Recently published RCTs investigating the use of prophylactic surfactant (CURPAP & SUPPORT studies) have not demonstrated reduced chronic lung disease, mortality or improved long term development using an approach of early surfactant and extubation to CPAP. However, infants in these trials receiving prophylactic surfactant remained ventilated for up to 2 hours post surfactant administration and there were significant differences in management and patient population as compared with the JHCH NICU.

Spontaneously breathing infants should be extubated to nasal CPAP within 5 minutes of surfactant administration (see procedure for surfactant administration p7).

Guidelines for Curosurf™ use

- A fellow or neonatologist should be contacted for all deliveries less than 29 weeks
- 100-200mg/kg (1.25-2.5ml/kg)
- Initial dose 200mg/kg. Up to 2 follow up doses of 100mg/kg if required at 6-12 hour interval.
- The guidelines for surfactant use and administration are described below.

23-25^{+6} weeks	**26-28^{+6} weeks**	**> 29 weeks**
Surfactant for all infants (within 30 minutes of birth)	Surfactant if FiO_2 > 25% at 2 hours of age (i.e. after at least 1 hour of effective CPAP)	Surfactant if FiO_2 > 40% up to 48 hours age and X-Ray consistent with HMD
	Surfactant if FiO_2 > 30% up to 48 hours age	
	Surfactant if intubated in the first 48 hours after birth	

Any potential variations from these guidelines should be first discussed with the fellow or neonatologist.

High-risk infants

- Severe RDS (complete white out on CXR)
- Lack of antenatal steroids
- Pulmonary haemorrhage

What are the criteria, timing and role of, retreatment?

Multiple doses of surfactant have been shown to improve oxygenation, decrease the need for mechanical ventilation with a trend towards reduced mortality in a Cochrane review of the subject.

There are extremely limited data comparing the different criteria for retreatment. In the trials comparing the criteria and timing of retreatment, repeat treatment at a lower

threshold (FiO_2 greater than 0.30) and at an earlier interval provided some benefit in infants below 1000 grams and in infants with complicated RDS.

- Retreatment should be considered in infants with a persistent or recurrent oxygen requirement of 40% or more *despite optimal CPAP*, based on clinical situation and presence of complicating factors.
- Need for retreatment should always be discussed with Neonatal Fellow or Consultant.

Procedure for Surfactant Administration

Surfactant administration is a two-person procedure. Medical and Nursing staff educated in the procedure may administer surfactant. The infant must have oxygen saturation and ECG monitoring throughout the procedure.

- Artificial Surfactant (Curosurf™)
- Size FG 5/6 feeding tube
- 10 ml syringe
- Drawing up needle
- Tape measure
- Alcohol Wipe
- Sterile scissors
- Sterile gloves
- Neopuff
- Ventilator available

Key Points

- Before administration, artificial surfactant should be warmed at room temperature for 20 minutes or in the hand for 8 minutes. Do not artificially warm (i.e. **do not** place under radiant warmer on in the patient crib).
- The surfactant vial should not be shaken.
- Artificial surfactant can rapidly affect oxygenation and lung compliance; therefore medical staff/NNP must be present in the unit during its administration to an infant.
- Ensure continuous Neopuff CPAP application as the infant is being readied for surfactant administration.

Procedure

- To ensure the correct depth for administration, note the ETT length (measurement at which the ETT is cut for ventilated babies) to determine the length of the feeding tube insertion.
- Using the sterile scissors cut the feeding tube to the predetermined length.
- Draw up the prescribed volume of surfactant (200mg/kg; 2.5 mls/kg). Attach syringe to the connector of the feeding tube.
- Prime the feeding tube leaving only the required amount of surfactant in the syringe.
- Place the infant in a supine position with the head in the midline. The base of the incubator should be kept flat throughout the procedure.
- Ensure continuous application of mask Neopuff CPAP.
- Set Neopuff at PIP/PEEP: 20/6.
- Have correct size nasal prongs and CPAP circuit available for immediate application.
- Ensure that a ventilator is available at the infant's bedside.
- Intubate the infant with appropriate size endotracheal tube.
- Check ETT position during insertion by noting appropriate positioning of vocal cord guide (heavy black mark near distal end of ETT) and by appropriate colour change on the Pedi-Cap™.
- Connect Neopuff to ensure immediate Neopuff ETT CPAP (**Do not** provide positive pressure breaths unless infant is truly apnoeic).
- Ensure equal air entry on both sides of the chest.
- Insert the appropriately cut feeding tube all the way through the ETT.
- Administer surfactant in a single bolus.
- Inject at a steady pace (over 10-15 seconds) whilst observing the infant. If there is a significant desaturation or bradycardia, stop the administration temporarily. If recovery is prolonged alert medical staff/NNP.
- Withdraw the catheter from the endotracheal tube.
- Immediately reconnect the Neopuff to provide ETT CPAP until infant recovers from surfactant administration.
- The FiO_2 may be temporarily increased by 10-15% and/or PEEP may be temporarily increased up to 8cm of H_2O to assist with recovery. (**Do not** provide positive pressure breaths unless infant is truly apnoeic).

- Aim to extubate the infant within 5 minutes of surfactant administration (provided infant is breathing spontaneously ***and*** has SpO_2 in the appropriate range without significant FiO_2 requirement).
- Alert Neonatal Fellow or Consultant immediately if there appears to be a need for prolonged ventilation.
- If an infant requires prolonged ventilation aim to maintain the SPO_2 90-94 by adjusting the pressures and FiO_2.
- Commence bubble CPAP at 6 cm H_2O immediately following extubation.
- The infant should be closely observed for at least 30 minutes after administration of surfactant. In particular, monitor changes in SPO_2 and work of breathing.
- A blood gas should be taken at 30 minutes after administration of surfactant and then as directed by the medical team.
- Following administration of surfactant the infant should be preferably nursed in a prone position with appropriate positional aids to support the chest.

Documentation

1. Surfactant should be prescribed on the medication chart by the medical staff/NNP before it is administered.
2. The procedure should be documented – date, time, dosage and type of surfactant used – on the observation chart and in the progress notes.

References

1. Rodriguez RJ, Martin RJ. Exogenous surfactant therapy in newborns. Respir Care Clin N Am 1999; 5:595-616.
2. Soll RF, Blanco F. Natural surfactant extract versus synthetic surfactant for neonatal respiratory distress syndrome (Cochrane Review). In: The Cochrane Library, Issue 4, 2004. Chichester, UK: John Wiley & Sons, Ltd.
3. Halliday HL. History of surfactant from 1980. Biol Neonate. 2005; 87(4):317-22. Epub 2005 Jun 1.
4. Soll RF, Morley CJ. Prophylactic versus selective use of surfactant in preventing morbidity and mortality in preterm infants (Cochrane Review). In: The Cochrane Library, Issue 4, 2004. Chichester, UK: John Wiley & Sons, Ltd.
5. Stevens TP, Blennow M, Soll RF. Early surfactant administration with brief ventilation vs. selective surfactant and continued mechanical ventilation for

preterm infants with or at risk for respiratory distress syndrome. Cochrane Database Syst Rev. 2004 ;(3):CD003063.

6. Sandri F, Plavka R, Ancora G et al; CURPAP Study Group. Prophylactic or early selective surfactant combined with nCPAP in very preterm infants. Pediatrics. 2010 Jun; 125(6):e1402-9. Epub 2010.

Drug Guideline

NICU JHCH Drug Guideline: Curosurf (Poractant alfa) JHCH_NICU_19.024 :May 2013

DEVELOPED BY: Dr Javeed Travadi, Senior Staff Specialist (Neonatology)

REVIEWED BY:

Michelle Jenkins. Senior Pharmacist JHCH

NICU Management Executive Group

APPROVED: NICU Management Executive Committee- 2nd November 2011

Kaleidoscope CYPF Quality and Safety Committee -26th November 2013