

# Local Guideline



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



Health  
Hunter New England  
Local Health District

## Surfactant Administration in NICU

<b>Sites where Local Guideline applies</b>	Neonatal Intensive Care Unit, JHCH
<b>This Local Guideline applies to:</b>	
1. Adults	No
2. Children up to 16 years	No
3. Neonates – less than 29 days	Yes
<b>Target audience</b>	Clinicians ordering, administering and assisting surfactant administration to the neonate
<b>Description</b>	Provides guidance for surfactant administration in NICU
<b>National Standard</b>	Standard 4 Medication Safety

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<b>Keywords</b>	Curosurf, preterm, prophylaxis, rescue, respiratory distress syndrome, surfactant
<b>Document registration number</b>	JHCH_NICU_12.03
<b>Replaces existing document?</b>	Yes
<b>Registration number and dates of superseded documents</b>	Surfactant Administration JHCH_NICU_12.03
<b>Related Legislation, Australian Standard, NSW Ministry of Health Policy Directive or Guideline, National Safety and Quality Health Service Standard (NSQHSS) and/or other, HNE Health Document, Professional Guideline, Code of Practice or Ethics:</b>	
<ul style="list-style-type: none"> <li>• <a href="#">HNELHD PD2013_043:PCP 31 Medication Safety in HNE Health</a></li> <li>• <a href="#">NSW Health Policy Directive PD2017_032Clinical Procedure Safety</a></li> </ul>	
<b>Prerequisites (if required)</b>	N/A
<b>Local Guideline note</b>	This document reflects what is currently regarded as safe and appropriate practice. The guideline section does not replace the need for the application of clinical judgment in respect to each individual patient but the procedure/s <b>requires mandatory compliance</b> . If staff believe that the procedure/s should not apply in a particular clinical situation they must seek advice from their unit manager/delegate and document the variance in the patients' health record.
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<b>Date authorised</b>	12 <sup>th</sup> February 2018
<b>This document contains advice on therapeutics</b>	Yes Approval gained from Local Quality Use of Medicines Committee on 8 <sup>th</sup> January 2018
<b>Issue date</b>	16 <sup>th</sup> February 2018
<b>Review date</b>	16 <sup>th</sup> February 2021

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## PURPOSE AND RISKS

*This local clinical procedure has been developed to provide instruction to the health clinician and to ensure that the risks of harm to the neonate associated with administration of surfactant are prevented, identified and managed.*

*The risks are:*

- *Respiratory compromise if not administered in timely manner*
- *Contamination*
- *Medication not stored in refrigerator <4 degrees C*

*The risks are minimised by:*

- *Clinicians having knowledge of timely administration of surfactant*
- *Clinicians seeking assistance if the therapy is outside their scope of practice*
- *Following the instructions set out in the clinical procedure*
- *Recognition of the common clinical signs of during administration*
- *Monitoring fridge temperatures by alert set up to notify Biomed if out of normal setting range and regular audit of temperatures*

**Risk Category:** *Clinical Care & Patient Safety*

## Glossary

Acronym or Term	Definition
CPAP	Continuous Positive Airway Pressure
CXR	Chest X Ray
ETT	Endo tracheal tube
FiO <sub>2</sub>	Fraction of inspired Oxygen
HMD	Hyaline Membrane Disease
PIP/PEEP	Peak Inspiratory Pressure/Positive End Expiratory Pressure
RCT	Randomised Control Trial
RDS	Respiratory Distress Syndrome
SpO <sub>2</sub>	Measurement of saturation oxygen

## Staff Preparation

It is mandatory for staff to follow relevant: “Five moments of hand hygiene”, infection control, moving safely/safe manual handling, documentation practices and to use HAIDET for patient/carer communication: **H**and hygiene **A**cknowledge, **I**ntroduce, **D**uration, **E**xplanation, **T**hank you or closing comment.

## 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). Endogenously produced surfactant normally lines the alveolar surfaces in the lung, reduces surface tension and prevents atelectasis. The lungs of babies with RDS are immature, with poor synthesis and utilization of surfactant.

## 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 incidence of pneumothorax and air leaks, increases survival without chronic lung disease, and decreases mortality<sup>1</sup>.

## 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<sup>2</sup>. 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<sup>3</sup>.

- *Curosurf™ should be used for exogenous surfactant therapy at an initial 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 (defined in most RCTs as surfactant administration within 30 minutes of birth) is based on 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<sup>4</sup>. The meta-analysis suggests a reduction of 2 pneumothoraces and 5 deaths for every 100 newborns treated with prophylactic surfactant<sup>4</sup>. (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<sup>5</sup>.

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
- 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 <sup>+0</sup> to 28 <sup>+6</sup> weeks GA	29 <sup>+0</sup> to 31 <sup>+6</sup> weeks GA	≥ 32 weeks GA
<p>Surfactant for <b>all</b> infants</p> <ul style="list-style-type: none"> <li>• Within 30 minutes of birth</li> <li>• Where appropriate, surfactant may be administered in the delivery suite/OT</li> </ul>	<p><b>Clinical RDS and O<sub>2</sub> &gt; 30%</b> up to 48 hours of age (after at least 1 hour of effective CPAP)</p> <p><b><u>OR</u></b></p> <p>RDS up to 48 hours of age with <b>any</b> O<sub>2</sub> need <b>and</b></p> <ul style="list-style-type: none"> <li>• Increased WOB <b>and</b></li> <li>• CXR consistent with RDS</li> </ul>	<p><b>Clinical RDS and O<sub>2</sub> &gt; 40%</b> up to 48 hours of age (after at least 1 hour of effective CPAP)</p> <p><b><u>AND</u></b></p> <p>CXR consistent with RDS</p>
	<p>Surfactant may also be given to infants who do not meet all of the above criteria, and have one or more of the following: (<b>Always discuss with Neonatologist/ Neonatal Fellow</b>)</p> <ul style="list-style-type: none"> <li>• Intubated in the first 48 hours of life and also have RDS (surfactant deficiency)</li> <li>• Other risk factors such as - no/incomplete antenatal steroids; poor diabetic control during pregnancy etc.</li> </ul>	
<p>Note:</p> <ol style="list-style-type: none"> <li>1. Effective CPAP may include optimising pressures up to 8cm H<sub>2</sub>O and/or increasing gas flow to achieve consistent bubbling</li> <li>2. Initial surfactant dose = 200mg/kg of Curosurf®</li> <li>3. Repeat dose to be considered from 6 to 48 hours after 1<sup>st</sup> dose if O<sub>2</sub> requirements are &gt; 21% (<i>after consultation with Neonatologist</i>)</li> <li>4. Repeat surfactant dose = 100mg/kg of Curosurf®</li> </ol>		

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

## 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 on this 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<sub>2</sub> 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

### Equipment required

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 or 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 – Curosurf™ (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<sub>2</sub> may be temporarily increased by 10-15% and/or PEEP may be temporarily increased up to 10cm of H<sub>2</sub>O 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<sub>2</sub> in the appropriate range with decreasing FiO<sub>2</sub> 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<sub>2</sub> 90-94% by adjusting the pressures and FiO<sub>2</sub>.
- Commence bubble CPAP at 6-8 cm H<sub>2</sub>O immediately following extubation.
- The infant should be closely observed for at least 30 minutes after administration of surfactant. In particular, monitor changes in SPO<sub>2</sub> 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 and checked as per unit guidelines by a second staff member 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.
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7. 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: Poractant alfa JHCH NICU 19.024: 2015](#)

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### **Implementation, monitoring compliance**

1. the document will be communicated via email and message on HUB and available for staff on the PPG
2. Update of changes will be communicated to staff via in-service and email/HUB
3. the document will be monitored for effectiveness and compliance

### **FEEDBACK**

Any feedback on this document should be sent to the Contact Officer listed on the front page.