Clinical Guideline

Surfactant Administration in Neonates

Sites where Clinical Guideline applies	All Newborn Service sites in HNELHD
This Clinical Guideline applies to:	
1. Adults	No
2. Children up to 16 years	No
3. Neonates – less than 29 days	Yes
Target audience	Clinicians in neonatal units in HNELHD
Description	Provides guidance for neonatal clinicians in reagrds to surfactant administration for respiratory management & stabilisation of infants

Hyperlink to Guideline

Keywords	Neonate, newborn, surfactant, preterm, prophylaxis, rescue, respiratory distress syndrome, RDS, NICU, SCU, respiratory, premature
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Replaces existing document?	Yes
Registration number and dates of superseded documents	Surfactant Administration in NICU JHCH_NICU_12.03

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:

- HNELHD Policy Directive PD2013_043:PCP 31 Medication Safety in HNE Health
- NSW Health Policy Directive PD2017_032 Clinical Procedure Safety

Position responsible for Clinical Guideline Governance and authorised by	Dr Paul Craven, Executive Director, Children, Young People and Families Services
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PURPOSE AND RISKS

This 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 with appropriate temperature range*

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 respiratory compromise during administration*
- *Monitoring fridge temperatures by alert set up to notify Biomedical Services if out of normal setting range and regular audit of temperatures*

Any unplanned event resulting in, or with the potential for injury, damage or other loss to infants/staff/family as a result of this procedure must be reported through the Incident Management System and managed in accordance with the NSW Health Policy Directive PD2020_020: Incident Management Policy. This would include unintended injury that results in disability, death or prolonged hospital stay.

*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.*

Risk Category: *Clinical Care & Patient Safety*

CLINICAL PROCEDURE SAFETY LEVEL

Every clinician involved in the procedure is responsible for ensuring the processes for clinical procedure safety are followed. The following level applies to this procedure (click on the link for more information):

Level 1 procedure

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SURFACTANT SUMMARY

- Earlier studies suggested that prophylactic surfactant was optimal to reduce morbidity in very preterm infants
- Recent large trials that reflect current practice (increased use of maternal steroids and routine stabilisation on CPAP) demonstrated that prophylactic use of surfactant may result in an increased risk of bronchopulmonary dysplasia, and that a selective approach has more benefits
- There is no evidence that repeat dose surfactant is effective in reducing morbidity or mortality if given at a low threshold
- Exclude other reasons for hypoxia when considering a second dose of surfactant
- Repeat dose surfactant is associated with significant physiological changes

GUIDELINE

While not requiring mandatory compliance, staff must have sound reasons for not implementing standards or practices set out within guidelines issued by HNE Health, or for measuring consistent variance in practice.

Introduction

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 utilisation of surfactant.

Surfactant administration decreases the severity of RDS and incidence of pneumothorax and air leaks, increases survival without chronic lung disease and decreases mortality. Clinical management focus is on early rescue administration over prophylaxis.

Clinical Indications

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23^{+0} weeks to 25^{+6} weeks GA
SURFACTANT FOR ALL INFANTS Ideally within 15 minutes of birth *Where appropriate*; *surfactant may be administered in the birthing environment*

26^{+0} weeks to 31^{+6} weeks GA
CLINICAL RDS AND FiO_2 ≥30% Within 2 hours of age OR RDS up to 48 hours of age with: Increased work of breathing and CXR consistent with RDS and any FiO_2 need

≥32^{+0} weeks GA
CLINICAL RDS AND FiO_2 ≥40% Up to 48 hours of age AND CXR consistent with RDS

Surfactant may also be given to infants who do not meet all of the above criteria, but have one or more of the following;

- Intubated in the first 48 hours of life and also have RDS (surfactant deficiency)
- Other risk factors such as; incomplete or no antenatal steroids; poor diabetic control during pregnancy, CDH, MAS etc.

This decision must always be discussed with a Neonatologist/Neonatal Fellow across all Neonatal Units.

If an infant is being stabilised in a regional neonatal unit, surfactant administration and post-procedure management must be discussed with NETS and a Neonatologist/or Neonatal Fellow at a tertiary centre.
Any infant who receives surfactant administration in a SCU setting must be transferred to a tertiary centre via NETS after any administration of surfactant.

Dosage

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HNELHD use poractant alpha (Curosurf™) which is a natural porcine surfactant.

First dose

- **Initial surfactant dose = 200 mg/kg**

Repeat dose

Repeated surfactant doses may be given if RDS and high oxygen need (≥40%) persists following the initial dose. If possible, treat other underlying causes of hypoxia (PPHN, acidosis) before considering a second dose of surfactant.

- **Repeat surfactant dose = 100 mg/kg**
- Up to 3 follow up doses of 100 mg/kg can be given if required at 6–12 hour intervals
- Consultation with a Neonatologist and/or a Neonatal Fellow must occur prior to administration

Surfactant Administration Requirements

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Requirements

- Surfactant administration, at a minimum, is a two-person procedure
- Medical and nursing staff educated in the procedure may administer surfactant
- The infant must have:
  - Continuous oxygen saturation and ECG monitoring
  - Resuscitation equipment, including T-piece with appropriate settings, and blended gases and suction available throughout the procedure

Key Points

- Before administration, artificial surfactant should be warmed via either:
  - Sitting at room temperature for 20 minutes or
  - By being held in hand for 8 minutes
- Never artificially warm (i.e. do not place under radiant warmer or in crib)
- The surfactant vial should never be shaken
- Artificial surfactant can rapidly affect oxygenation and lung compliance; therefore Senior Medical staff must be present during its administration to an infant. This includes:
  - Staff Specialist (Neonatologist/Paediatrician)
  - Fellow (Neonatal/Paediatric)
  - Neonatal Nurse Practitioner (NICU only)
- Any indication of a pneumothorax should be ruled out by CXR prior to surfactant administration

Equipment

- Surfactant/poractant alpha (Curosurf)
- Sterile drape
- Sterile scissors
- Sterile gloves
- Needleless surfactant administration kit (containing size 4 intra-tracheal catheter, 5 mL syringe, vial bung adaptor, see Figure 1)
- Intubation procedure equipment (including appropriate size ETT)
- Ventilator/CPAP circuit

Figure 1: *Needleless Surfactant Kit* (*Image from Google images*)

Procedure

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- Ensure continuous application of respiratory support while preparing for procedure
- Set up required equipment on sterile drape on clean trolley
- Complete hand wash and put on sterile gloves in manner to maintain sterility
- To ensure the correct depth for administration follow as below; always premeasure the intra-tracheal catheter by inserting into a sterile ETT and cut the intra-tracheal catheter 1 cm shorter than measurement at the tip of the ETT
- Using the sterile scissors cut the intra-tracheal catheter to the pre-determined length
- Connect syringe with vial adaptor bung and access surfactant vial
- Draw up the entire volume of surfactant from the appropriately selected vial
- Attach syringe to the connector of the intra-tracheal catheter
- Prime the intra-tracheal catheter, leaving the required volume for the surfactant dose in the syringe
- Place the infant in a supine position with the head in the midline, with the base of the bed kept flat throughout the procedure
- Ensure continuous application of mask CPAP
- Intubate the infant with appropriate size endotracheal tube (*where applicable*)
- Check ETT position during insertion by noting:
  - Appropriate positioning of vocal cord guide (heavy black mark near distal end of ETT) and
  - Appropriate colour change via the CO_2 detector and
  - Noting equal air entry into the lungs
- Provide ETT CPAP at this point, do not provide positive pressure breaths unless infant is apnoeic
- Insert the entire length of the premeasured intra-tracheal catheter into the ETT
- Administer surfactant in 1 to 2 aliquots. Inject at a steady pace (over 20–30 seconds) whilst observing the infant
- Withdraw the intra-tracheal catheter from the ETT
- Immediately reconnect the T-piece to provide ETT CPAP until infant recovers from surfactant administration. Do not provide positive pressure breaths unless infant is apnoeic
- Aim to extubate the infant to CPAP within 5 minutes of surfactant administration, provided infant is breathing spontaneously and has SpO_2 in the target range with decreasing FiO_2 requirement. (Note: If the infant is being stabilised in a regional centre an extubation plan should be discussed with the tertiary centre prior to extubation)
- Infants who remain ventilated after surfactant administration should not have ETT suctioning for 1 hour post-procedure. Ventilator settings may need to be adjusted post-surfactant to accommodate increased lung compliance
- The infant should be closely observed for at least 30 minutes after administration of surfactant. In particular, monitor changes in FiO_2, SpO_2 and work of breathing
- A blood gas should be considered at 30 minutes after administration of surfactant
- Following administration of surfactant the infant should, preferably, be nursed in a prone position with appropriate positional aids to support the chest
- Continue to monitor the infant closely

Documentation

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- Surfactant must be prescribed on the stat medication chart/or on MedChart by the medical staff/NNP, in line with medication administration policy

- Surfactant must have an independent double check by a second clinician before administration
- Administration must be signed on the medication chart/or on MedChart by both checking and administering clinicians
- The surfactant dose should also be recorded in the NICUS database

Storage

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- Surfactant is stored in a refrigerator at +2℃ to +6℃
- Use the appropriate sized vial for the prescribed volume and discard unused portion immediately after use
- Unopened, unused vials of surfactant suspension that have warmed to room temperature can be returned to refrigerated storage within 24 hours for future use (these vials should be flagged or labelled in order to identify that they have had a temperature excursion)
- Do not warm to room temperature and return to refrigerated storage more than once
- Protect from light

IMPLEMENTATION PLAN

The clinical guideline will be:

- Circulated to General Managers and Cluster Managers
- Circulated to the clinicians via the Children Young People and Families Network and the Women's Health and Maternity Network
- Made available on the intranet (PPG) and HNEKids website
- Presented at facility/unit meetings and tabled for staff to action

MONITORING AND AUDITING PLAN

- The person or leadership team approving the clinical guideline is responsible for ensuring timely and effective review of the guideline
- Evaluation will require a review of the most current evidence as well as consideration of the experience of HNELHD staff in the implementation of the clinical guideline
- Data derived from monitoring and evaluation should inform the review of the clinical guideline either as required or scheduled
- Implementation, education support and monitoring compliance be completed by local clinical educators and managers
- Amendments to the guideline will be ratified by the Clinical Director of the Newborn & WHaM Networks prior to final sign off by the Children Young People and Families Network

CONSULTATION WITH KEY STAKEHOLDERS

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APPENDICES

1. Glossary & Abbreviations

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FEEDBACK

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

APPENDIX 1

GLOSSARY & ABBREVIATIONS

Acronym or Term	Definition
ARRH	Armidale Rural Referral Hospital
CO_2	Carbon Dioxide
CDH	Congenital Diaphragmatic Hernia
CPAP	Continuous Positive Airway Pressure
CXR	Chest X-Ray
ECG	Electrocardiogram
ETT	Endo-Tracheal Tube
FiO_2	Fraction of inspired Oxygen
GA	Gestational age
HNELHD	Hunter New England Local Health District
JHCH	John Hunter Children's Hospital
MAS	Meconium Aspiration Syndrome
MBH	Manning Base Hospital
MedChart	Electronic medication prescription program
NETS	Newborn and Paediatric Emergency Transport Service
NICU	Neonatal Intensive Care Unit
NICUS (database)	Neonatal Intensive Care Units Data Collection
NNP	Neonatal Nurse Practitioner
PPHN	Persistent Pulmonary Hypertension of the Newborn
RDS	Respiratory Distress Syndrome, defined by surfactant deficiency
SCU	Special Care Unit
SpO_2	Peripheral capillary oxygen saturation, a measurement of the percentage of oxygenated haemoglobin.
TMH	The Maitland Hospital
T-piece resuscitator	Flow-driven resuscitation device (Neopuff™)
TRRH	Tamworth Rural Referral Hospital