ENDOTRACHEAL SURFACTANT – ADMINISTRATION

PRACTICE GUIDELINE

DOCUMENT SUMMARY/KEY POINTS

- Decision guide for surfactant administration
- Timely and safe administration of exogenous surfactant is important
- When NETS teams are present at an extreme preterm delivery, aim for surfactant administration within 15 minutes from first contact with baby.
- This guideline describes method for surfactant administration via an endotracheal tube.

CHANGE SUMMARY

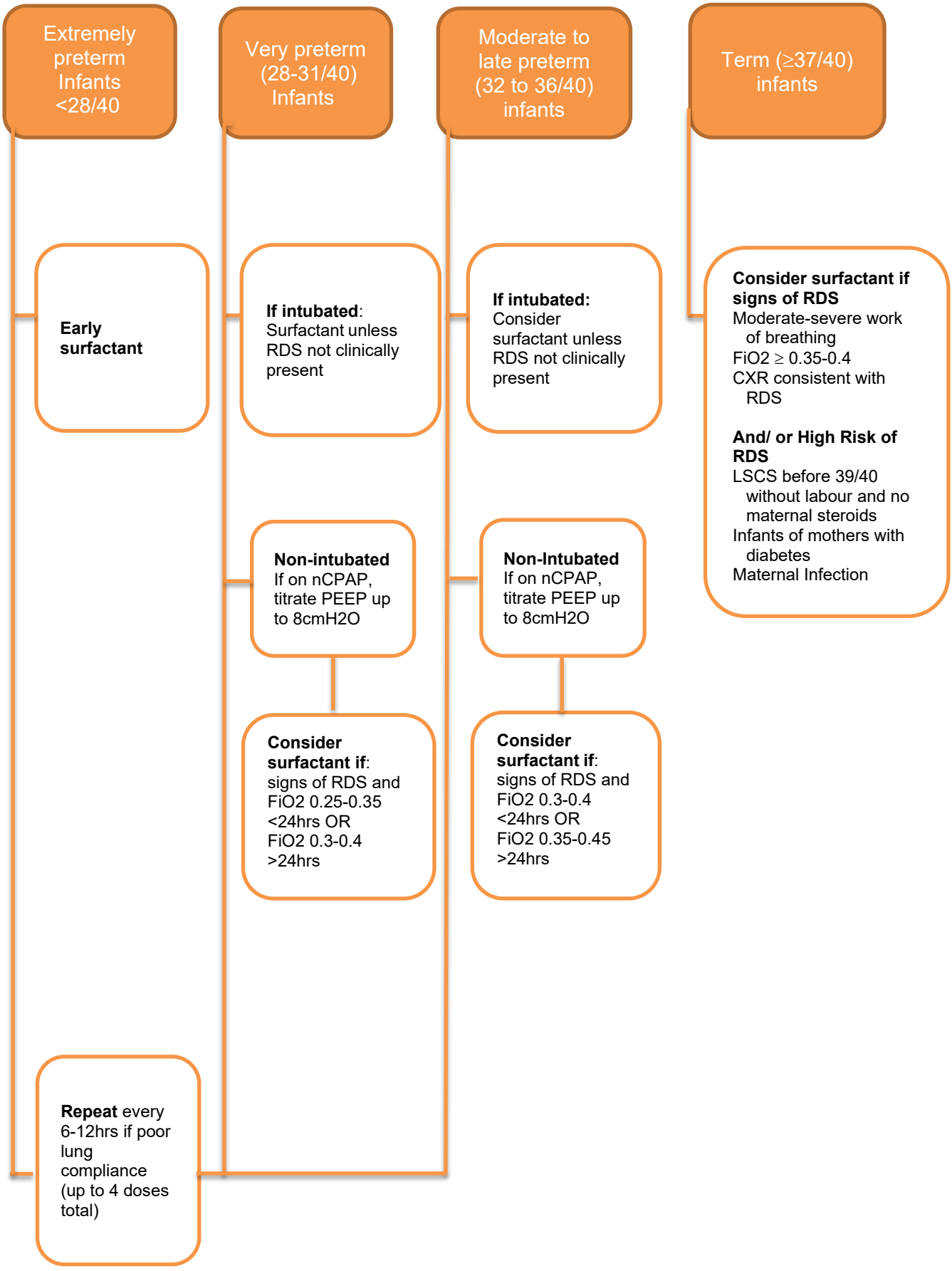
- New needle-free surfactant kit.
- Guideline specific to Poractant alfa (Curosurf®), eliminating Survanta.

READ ACKNOWLEDGEMENT

- All NETS clinical staff are to read and acknowledge they understand the contents of this guideline.

Approved by:	SCHN Policy, Procedure and Guideline Committee	
Date Effective:	1st November 2024	**Review Period:** 3 years
Team Leader:	Staff Specialist	**Area/Dept:** NETS

Summary of Surfactant Administration Decision Guide:



Background

Respiratory Distress Syndrome (RDS)

RDS (known pathologically as Hyaline Membrane Disease) is a condition of surfactant deficiency, which results in increased surface tension in the air-liquid interface of the alveoli leading to atelectasis and ventilation-perfusion mismatch.[1] The risk of RDS can be reduced by the timely administration of antenatal corticosteroids to the mother. Exogenous surfactant is a well-established therapy for RDS and has been shown to reduce the risk of death, bronchopulmonary dysplasia (BPD) and pneumothorax in mechanically ventilated preterm infants[2-5].

Risk Factors for RDS:

- The incidence and severity increase with decreasing gestational age.
- Other risk factors described for RDS include [6-8]:
  - Caesarean section (LSCS) before 39/40 without labour
  - No maternal corticosteroids (for preterm birth)
  - Maternal-foetal infection and prolonged rupture of membranes
  - Severe birth asphyxia
  - Maternal diabetes
  - Male gender
  - Growth restriction
- Inactivation of surfactant, with resultant respiratory distress, can be seen in meconium aspiration, infection, increased permeability of alveolar membranes to plasma proteins[9], amniotic fluid[10] and aspiration of maternal blood[11].

Recommended surfactant dose in RDS:

- Surfactant in use at NETS is Poractant alfa (Curosurf®).
- Dosing is in line with the Australian Neonatal Medicines Formulary recommendations (anmfonline.org)
  - First (loading) dose of Poractant alfa (Curosurf®): 200mg/kg
  - Second and subsequent doses of Poractant alfa (Curosurf®): 100mg/kg when required every 6–12 hours. Maximum of 3 doses.
- **Note:** Round up (or down) dosage to avoid discarding (and wasting) any contents of the vial. Preterm infants <600g can be given the full vial of 120mg. The online NETS Clinical Calculator (calculator.nets.org.au or search for “NETS Clinical calculator”) provides dose appropriate for weight, including minimum number of 120mg or 240mg vials required for the dose.

Timing of Surfactant Administration

- Surfactant therapy is most effective when given early. Precise guidance regarding optimal timing is not possible as the definition of early surfactant ranges from 30-180 minutes in the studies included in the largest meta-analysis published in the Cochrane Database of Systematic Reviews[5].
- The 'Supporting Transition' model of neonatal care supports that all spontaneously breathing infants with respiratory distress should be started on nasal continuous positive airway pressure (nCPAP) rather than being intubated.[12,13]
- Routine IPPV is discouraged, unless the baby is apnoeic.
- Surfactant administration is indicated for persistent severe RDS (recessions, expiratory grunting, nasal flaring, tachypnoea)
- Where surfactant is indicated, NETS practice is to aim for:
  - surfactant within 15 minutes of birth (prophylactic surfactant) for extremely preterm infants (<28/40)
  - surfactant within 30-60 minutes for 28 weeks and above.

Meconium Aspiration Syndrome (MAS)

- The Cochrane Systematic review on surfactant for MAS in term and late preterm infants[14] (four trials included) demonstrated that surfactant therapy in MAS yielded no improvement in mortality, however two trials demonstrated reduction in the need for ECMO[15, 16]. Routine administration of surfactant is currently not recommended in MAS at NETS.
- However, for severe MAS with persistent pulmonary hypertension of the newborn (PPHN), surfactant may be considered in discussion with the NETS and/or receiving consultants.

Equipment

- Vial/s of Poractant alfa (Curosurf®) at room temperature.
  - Poractant alfa (Curosurf®) 240mg/3mL Intratracheal Suspension
  - Poractant alfa (Curosurf®) 120mg/1.5mL Intratracheal Suspension
- Poractant Alfa (Curosurf®) is a white to creamy suspension. Vials are single use only.
- Needle-free surfactant kit
- Sterile gloves
- Sterile field (dressing pack or similar).
- Trolley

Handling and Storage of Poractant alfa (Curosurf®)

- Poractant alfa (Curosurf®) should be kept refrigerated between 2° and 8° Celsius and protected from light.[17]

- NETS teams carry Poractant alfa (Curosurf®) in insulated packs adjacent to Elite Packs™ (frozen packs) to maintain the cold chain.
- Poractant alfa (Curosurf®) may be returned to refrigerator after exposure to room temperature for up to 24 hours ONCE ONLY. Therefore, it is imperative to label vials that have been exposed to room temperature with date and duration of 'Warming'.[17]

Procedure for administration of surfactant via ETT

Preparation

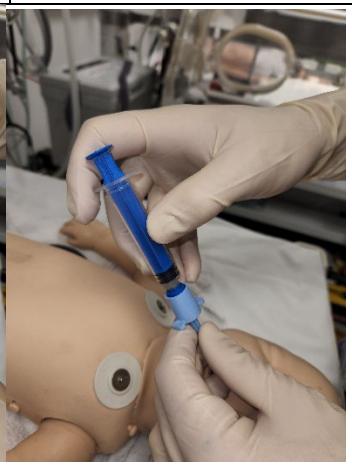
- Explain procedure to parents and answer their questions
- Allow surfactant to reach room temperature before use (expose to room temperature for 20 minutes, or warm in the hand for at least 8 minutes). Do not artificially warm
- Repeatedly invert vial to mix. **Do NOT shake**
- Check the NETS Calculator for appropriate endotracheal tube (ETT) and depth of intubation
- Attach oxygen saturation probe (and cardiorespiratory monitoring if available)
- Ensure manual ventilation device is available
- Set the ventilator to deliver positive end-expiratory pressure (PEEP) of 5-8cmH_2O to ensure adequate alveolar recruitment with peak inspiratory pressure (PIP) set at the minimum required to achieve appropriate chest movement, tidal volume of 4-6ml/kg and rate approximately 40. FiO_2 administration should be targeted to achieve oxygen saturations 90-95% in preterm babies, and >95% in term babies.

Intubation

- Intubate with an ETT to a depth (at the lips/nares) indicated by the NETS Calculator and verified by visual inspection at the vocal cord marker, PediCap (turning gold) and auscultation for equal air entry
- Secure ETT with adhesive tape (protective barrier dressing e.g. Comfeel™ protecting skin from adhesive tape).
- Establish on ventilator with desired settings or continue manual ventilation with anaesthetic bag/T-piece.
- A CXR is not required to confirm ETT position and should not delay the administration of surfactant
- ETT suction before surfactant - consider if lung infection present, or crackles on auscultation.
- Document full observations (including temperature) prior to administration.

Administration

- Two team members are required for procedure. Both the NETS retrieval medical team member or NETS retrieval nurse can administer surfactant.
- Note size of ETT (essential for determination of catheter insertion length)
- Set up a sterile field, open Needle-Free surfactant kit onto sterile field and don sterile gloves
- Draw up Poractant alfa (Curosurf®) from vial:
  - Connect syringe to the needle-free vial adaptor
  - Spike vial with needle-free vial adaptor
  - Draw up the surfactant dose, continue to draw back on syringe whilst detaching syringe from vial adaptor and attach to the administration catheter
  - Use the following guide for insertion length (based on PORTEX™ and Mallinckrodt ET tubes
    - For **2.5 ETT**: insert catheter so the **17cm** mark of the catheter aligns with the tip of the ETT adapter.
    - For **3.0 ETT**: insert catheter so the **19cm** mark of the catheter aligns with tip of ETT adapter.
    - For **3.5 ETT**: insert catheter so the edge of blue hub aligns with tip of ETT adapter (**21cm**), **see photo 1** in table below.
    - For **4.0 ETT**: insert catheter so the entire blue hub is inside the tip of ETT adapter **(23cm), see photo 2** in table below.

ETT SIZE (MM)	INSERTION LENGTH (CM)	*Photo 1	**Photo 2
2.5	**17cm**		
3.0	**19cm**		
3.5*	**21cm***		
4.0**	**23cm****		

To administer dose

- Assistant maintain baby's head in midline position, disconnect ETT from ventilator at operator's request.
- Operator insert catheter to desired depth and administer surfactant as a rapid bolus
- Administration in two aliquots may be required in larger neonates where the dose volume is greater than 5ml or in an unstable patient
- Remove catheter from ETT.
- Reflux of surfactant up the ETT can contaminate the flow sensor, rendering the sensor ineffective.
- Reflux of surfactant up the ETT may be overcome by increasing PIP briefly or by delivering manual breaths, with extreme caution not to overexpand the lungs and increase the risk of an air leak.

Post surfactant administration care

- Surfactant administration usually results in a prompt clinical improvement, enabling inspired oxygen and ventilator settings to be weaned promptly. As pulmonary compliance improves it is important to wean PIP (and PEEP) to avoid unnecessary barotrauma and to avoid air leak.

Documentation

- Record Poractant alfa (Curosurf®) dosage and time in the NETS medication chart in accordance with medication prescribing guidelines.
- Document in clinical notes any relevant information, including patient's tolerance of procedure, lung compliance and ventilator changes post procedure.

Bibliography

1. Martin R. Respiratory distress syndrome (RDS) in the newborn: Clinical features and diagnosis. UpToDate. This topic last updated: 8 August, 2024. Accessed Oct 1, 2024. https://www.uptodate.com/contents/respiratory-distress-syndrome-rds-in-preterm-neonates-management
2. Soll R, Ozek E. Prophylactic protein free synthetic surfactant for preventing morbidity and mortality in preterm infants. Cochrane database of systematic reviews (Online) 2010; (1).
3. Soll RF. Prophylactic natural surfactant extract for preventing morbidity and mortality in preterm infants. Cochrane database of systematic reviews (Online) 2000; (2).
4. Soll RF. Prophylactic synthetic surfactant for preventing morbidity and mortality in preterm infants. Cochrane database of systematic reviews (Online) 2000; (2).
5. Bahadue FL, Soll R. Early versus delayed selective surfactant treatment for neonatal respiratory distress syndrome. Cochrane Database of Systematic Reviews 2012; (11).
6. Dani C, Reali MF, Bertini G, Wiechmann L, Spagnolo, A, Tangucci, M, Rubaltelli, FF. Risk factors for the development of respiratory distress syndrome and transient tachypnoea in newborn infants. Italian Group of Neonatal Pneumology. European Respiratory Journal 1999 14: 155-159; DOI: 10.1034/j.1399-3003.1999.14a26.x
7. Liu J, Yang N, Liu Y. High-risk Factors of Respiratory Distress Syndrome in Term Neonates: A Retrospective Case-control Study. Balkan Med J 2014; 31(1): 64-8.
8. Stylianou-Riga P, Boutsikou T, Kouis P, et al. Maternal and neonatal risk factors for neonatal respiratory distress syndrome in term neonates in Cyprus: a prospective case-control study. Ital J Pediatr 2021; 47(1): 129.
9. Robertson B, Halliday HL. Principles of surfactant replacement. Biochimica et Biophysica Acta (BBA) - Molecular Basis of Disease 1998; 1408(2): 346-61.
10. Pender CB. Respiratory distress in the newborn due to aspiration of amniotic fluid and its contents. Resuscitation 1973; 2(3): 157-67.
11. Celik IH, Demirel G, Canpolat FE, Erdeve O, Dilmen U. Surfactant therapy for maternal blood aspiration: an unusual cause of neonatal respiratory distress syndrome. Indian J Pediatr 2012; 79(10): 1358-9.
12. Poets, CF & Lorenz, L. Prevention of bronchopulmonary dysplasia in extremely low gestational age neonates: current evidence. Arch Disease. Child Fetal Neonatal Ed 2018; **103:**F285-F291. *doi:10.1136/archdischild-2017-314264*
13. Sweet DG, Carnielli V, Greisen G, Hallman M, Ozek E, te Pas A, et al. European Consensus Guidelines on the management of respiratory distress Syndrome- 2019 Update. Neonatology. 2019;115:432–50.
14. El Shahed AI, Dargaville PA, Ohlsson A, Soll R. Surfactant for meconium aspiration syndrome in term and late preterm infants. Cochrane Database of Systematic Reviews 2014, Issue 12. Art. No.: CD002054. DOI: 10.1002/14651858.CD002054.pub3. Accessed 11 September 2023.
15. Findlay RD, Taeusch HW, Walther FJ. Surfactant replacement therapy for meconium aspiration syndrome. *Pediatrics* 1996;97(1):48-52.
16. Lotze A, Mitchell BR, Bulas DI, Zola EM, Shalwitz RA, Gunkel HJ, et al. Multicenter study of surfactant (beractant) use in the treatment of term infants with severe respiratory failure. *Journal of Pediatrics* 1998;132(1):40-7.
17. Chiesi F. Curosurf (Poractant alfa) Intratracheal Suspension: Consumer medicine information leaflet. Revised 24 November 2022.