

## **MINIMALLY-INVASIVE SURFACTANT THERAPY (MIST)**

*This LOP is developed to guide safe clinical practice in Newborn Care Centre (NCC) at The Royal Hospital for Women. Individual patient circumstances may mean that practice diverges from this Local Operations Procedure (LOP).*

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### **INTRODUCTION**

Preterm infants are increasingly being supported with nasal continuous positive airway pressure (nCPAP) at birth and are not routinely intubated, however, many of these infants have significant surfactant deficiency. New techniques of minimally-invasive surfactant therapy (MIST) have been developed, whereby exogenous surfactant can be administered to spontaneously breathing infants on non-invasive respiratory support without the need for intubation. Our LOP at the Royal Hospital for Women is based on the "Hobart method"<sup>1</sup>, which involves the administration of surfactant via a semi-rigid catheter briefly passed into the trachea.

#### **1. AIM**

- To safely administer surfactant to spontaneously breathing infants on non-invasive respiratory support

#### **2. PATIENT**

- Neonates

#### **3. STAFF**

- Medical and nursing staff

#### **4. EQUIPMENT**

- Hudson CPAP prongs [Sizes 1 (10fr) – 4 (16fr)]
  - 700-1250 grams 1 (10fr)
  - 1250-2000 grams 2 (12.5fr)
  - 2000-3000 grams 3 (15fr)
  - >3000 grams 4 (16fr)
- Oral sucrose
- Atropine 600 mcg/ml
- Laryngoscope handle and blade – Miller 0 or 00
- BD Angiocath 16G, 1.7 x 133 mm
- Surfactant
- 3ml or 5ml syringe
- Vial access cannula

#### **5. CLINICAL PRACTICE**

##### Preparation

1. Ensure that the infant is suitable for administration of surfactant via MIST. This should always be at the discretion of the neonatologist. In general, MIST should be used in infants that are clinically stable on nCPAP where it is felt that the infant does not require invasive respiratory support but would benefit from surfactant administration.
2. Do not use this technique in an infant that is rapidly deteriorating, haemodynamically unstable or in situations where escalation to invasive ventilation is imminent or likely. MIST should be used with caution in infants who have congenital airway anomalies or other respiratory conditions (eg. pulmonary hypoplasia) contributing to their respiratory status.
3. Assemble necessary equipment to perform the procedure. Importantly, the Hudson CPAP prongs and catheters used for this procedure are not routinely ordered NCC stock and should be located prior to considering giving surfactant via MIST.

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4. Ensure intubation trolley and all necessary equipment required for invasive ventilation is readily available if required.
5. Change the infant's CPAP midline nasal tubing with prongs or mask to Hudson CPAP prongs using the existing CPAP circuit. It is very difficult to manipulate the laryngoscope blade and position the catheter with the CPAP nasal tubing in a midline position. If Hudson CPAP prongs are not available, it is an option to set up a high flow circuit and place the infant on high flow (8L/min) for the procedure.
6. Prepare the 16G Angiocath by making a slight anterior curve in the catheter so that the distance from the bend to the tip of the catheter matches the desired insertion distance below the vocal cords. This helps with positioning the catheter in the trachea and positioning the tip appropriately to ensure even distribution of surfactant to both lungs.
  - The required depth should be based on the infant's size:
    - <1000 grams – 1.5 cm
    - 1000-2000 grams – 2.0 cm
    - 2000-3000 grams – 2.5 cm
    - >3000 grams – 3 cm
7. Draw up surfactant (Curosurf™, Chiesi Farmaceutici, Parma, Italy) in a 3 or 5 mL syringe. The surfactant dose is 200 mg/kg (2.5 mL/kg). Draw up an additional 0.5 mL of air into the syringe, which allows for the dead space in the instillation catheter (~0.3 mL).

### Procedure

1. Continue cardiorespiratory monitoring throughout the procedure.
2. Swaddle the infant and administer oral sucrose. It is optional to also give atropine (10 microg/kg) intravenously at fellow/consultant discretion.
3. Position the infant as for a standard intubation procedure.
4. Perform direct laryngoscopy using a standard laryngoscope blade. If possible, the laryngoscopy and tracheal cannulation should be performed with the CPAP prongs remaining in situ. The NCC has a video laryngoscope that can be used to ensure correct placement of the catheter.
5. Insert the Angiocath orally and pass it through the vocal cords to the desired depth, and hold it in position at the lips. The laryngoscope blade should then be removed.  
 NB. If an Angiocath is not available, it is possible to insert an "old" intragastric tube (CH 05) nasally and use Magill's forceps to guide the tube into position.
6. Connect the surfactant syringe to the catheter hub and instil the surfactant in 2-4 boluses over 15-30 seconds. If catheterisation of the trachea is not possible within 20–30 seconds, remove the laryngoscope and allow recovery on nCPAP before attempting tracheal catheterisation again. Consider abandoning the procedure after three unsuccessful attempts.
7. Remove the catheter immediately after administering surfactant and continue nCPAP.

### Post-procedure

1. Remain with infant until heart rate, oxygen saturations and respiratory effort are close to baseline values.
2. Restore the infant to their previous position and change the infant's Hudson CPAP prongs back to the midline nasal tubing with prongs or mask on the same settings as prior to the procedure.
3. Document the details of the procedure in the integrated clinical notes and record the procedure in the infant's observation chart.

## 6. DOCUMENTATION

- Integrated Clinical Notes
- Observation Chart

**MINIMALLY-INVASIVE SURFACTANT THERAPY (MIST) cont'd****7. EDUCATIONAL NOTES**

- Preterm infants who have respiratory distress syndrome have for many years been managed with a combination of early intubation and exogenous surfactant therapy. With the increasing use of nCPAP as primary therapy for preterm infants, many of whom have significant surfactant deficiency, there is growing interest in developing new techniques to administer surfactant without the need for intubation.<sup>2</sup>
- From a number of potential techniques, methods involving brief tracheal catheterization have been most extensively studied. These generally involve surfactant administration using either a flexible feeding tube or a semi-rigid vascular catheter. There are a considerable number of different techniques described under the banner of MIST, none of which have been directly compared. It is likely that there is little difference between them in the ultimate effect of the instilled surfactant.<sup>2</sup>
- In clinical trials surfactant delivery via a feeding tube was found to reduce the need for subsequent intubation and ventilation and to improve short-term respiratory outcomes. Further randomized controlled trials of surfactant administration via tracheal catheterization are underway or planned, and they will help clarify the place of this therapeutic approach.<sup>3-5</sup>
- Not all preterm infants managed on nCPAP stand to benefit from MIST. Many infants will be well supported by CPAP alone and, conversely, many infants with severe surfactant deficiency will require invasive respiratory support.<sup>2</sup>
- Infants who develop severe respiratory distress syndrome (RDS) should ideally receive surfactant early to gain the most advantage, however, in practice it can be very difficult to predict which infants will require surfactant. Currently, it is felt that consideration of MIST should be coupled with early selection of infants who have significant RDS.<sup>2</sup>
- Published studies of MIST with the use of direct laryngoscopy and tracheal catheterization have used different approaches to premedication but all avoid narcotic medications. The avoidance of narcotic medications does not seem to have been associated with any major deleterious effects in the short term. There is also a theoretical benefit of more effective distribution of surfactant with spontaneous breathing during the MIST procedure, which may be ameliorated by the use of narcotic medications.<sup>2</sup>
- Surfactant dosage in published studies has been either 100 or 200 mg/kg. We have chosen the higher dose of 200 mg/kg as reflux of surfactant into the pharynx around the thin catheter is common. It is also reported that 200 mg/kg is associated with a more prolonged effect.<sup>2</sup>
- Infiltration is generally benign but a large volume of infiltrate can cause a compartment syndrome, compressing nerves and compromising circulation.<sup>2</sup>

**8. RELATED POLICIES/PROCEDURES/CLINICAL PRACTICE LOP**

- Continuous Positive Airway Pressure Therapy Devices

**9. RISK RATING**

- Medium

**10. NATIONAL STANDARD**

- Standard 12: Provision of care

## MINIMALLY-INVASIVE SURFACTANT THERAPY (MIST) cont'd

### 11. REFERENCES

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### 12. ABBREVIATIONS AND DEFINITIONS OF TERMS

NCC	Newborn Care Centre	MIST	Minimally-Invasive Surfactant Therapy
nCPAP	Nasal Continuous Positive Airway Pressure	RDS	Respiratory Distress Syndrome

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