

Minimally-Invasive Surfactant Therapy (MIST)

This Local Operating Procedure 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 Operating Procedure.

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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"¹, 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

- Newborns

3. STAFF

- Medical and nursing staff

4. EQUIPMENT

- nCPAP interface
- Chin strap
- Oral sucrose
- Layngoscope handle and blade – Miller 0 or 00
- Vygon surfcath 6 Fr, 0.8 x 2 mm, 200 mm (alternative BD Angiocath 16 G, 1.7 x 133 mm)
- Surfactant
- 3ml or 5ml syringe (slip lock)
- 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. Ensure three staff members are available to assist (1 x proceduralist; 1 x airway assistant for surfactant administration; 1 x assistant for intragastric tube aspiration prior and during procedure)
4. Assemble necessary equipment to perform the procedure.
5. Ensure Neopuff circuit with appropriate sized mask is checked and functional if required.

6. Ensure intubation trolley and all necessary equipment required for invasive ventilation is readily available if required.
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

8. Continue cardiorespiratory monitoring throughout the procedure.
9. Swaddle the infant and administer oral sucrose. It is optional to also give atropine (10 microg/kg) intravenously at fellow/consultant discretion.
10. Position the infant as for a standard intubation procedure.
11. Ensure intragastric tube is secure and aspirate abdominal contents.

Proceduralist

12. Perform direct laryngoscopy using a standard laryngoscope blade. If possible, the laryngoscopy and tracheal cannulation should be performed with the nCPAP prongs remaining in situ. The NCC has a video laryngoscope that can be used to ensure correct placement of the catheter.
13. Insert the surfcath orally and pass it through the vocal cords until the black marking is below the cords (the bend in the tube should be at the level of the cords) and hold it in position at the lips.
14. Remove the laryngoscope blade.
15. Close the mouth to maintain PEEP.
16. Take note of the measurement at the lips.

Airway Assistant

17. Connect the surfactant syringe to the catheter hub and instil the surfactant in 2-4 boluses over 15-30 seconds.

Second Assistant

18. Aspirate intragastric tube intermittently during the administration of surfactant to ensure surfcath correctly positioned.

Proceduralist

19. 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 or surfactant aspirated through the intragastric tube.
20. Remove the catheter immediately after administering surfactant and continue nCPAP.
21. Apply chin strap.

Post-procedure

22. Remain with infant until heart rate, oxygen saturations and respiratory effort are close to baseline values.
23. Restore the infant to their previous position.
24. Avoid oral suctioning immediately after the procedure to avoid coughing or gagging.
25. Document the details of the procedure in the integrated clinical notes and record the procedure in the infant's observation chart.

6. DOCUMENTATION

- eMR
- Neonatal Observation Chart
- Medication Chart

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.²
- 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.²
- 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.³⁻⁵

- 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.²
- 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.²
- 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.²
- 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.²
- Infiltration is generally benign but a large volume of infiltrate can cause a compartment syndrome, compressing nerves and compromising circulation.²

8. RELATED POLICIES/PROCEDURES/CLINICAL PRACTICE LOP

- RHW NCC Medical LOP – CPAP - Continuous Positive Airway Pressure Therapy

9. RISK RATING

- Medium

10. NATIONAL STANDARD

- Standard 1 Clinical Governance
- Standard 4 Medication Safety
- Standard 5 Comprehensive Care
- Standard 8 Recognising and Responding to Acute Deterioration

11. ABBREVIATIONS AND DEFINITIONS OF TERMS

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

12. REFERENCES

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