557FM.1 SURFACTANT ADMINISTRATION BY LISA TECHNIQUE

Target Audience: Neonatal Unit

Introduction:

Less invasive surfactant administration (LISA) is a method using a fine catheter into the trachea as an alternative to an endotracheal tube for surfactant delivery in spontaneously breathing preterm infants with respiratory distress syndrome receiving non-invasive ventilation.

Comparing intubate, surfactant, and extubation (INSURE) technique with LISA, the infant will continue breathing and the airway is only minimally obstructed by the catheter. By not suppressing spontaneous breathing, one can continue non-invasive ventilator support during the procedure, thus reducing the need for mechanical ventilation. Therefore, the benefits seen with the LISA technique may be related to many factors:

1) Likely more homogeneous distribution of surfactant as it is diffused through spontaneous breathing, comparing to INSURE where the surfactant is pushed in with non-synchronised breaths. With LISA there is a more rapid and complete tissue incorporation of the surfactant in the neonatal lung.
2) The LISA technique allows for continuation of uninterrupted nasal continuous positive airway pressure (CPAP)/high flow support during the entire process of providing surfactant. This prevents lung injury that could result from the temporary loss of functional lung capacity and atelectasis during the process of intubation. It also reduces the risk of mechanical ventilation and duration of non-invasive respiratory support.
3) Meta-analyses have shown that LISA is superior to CPAP alone or the INSURE technique both in terms of avoidance of bronchopulmonary dysplasia and intraventricular haemorrhage.

Infants at risk:

- Preterm infants <32 week gestation
- Age <48 hours old (the earlier the surfactant is given the better)

Criteria of administration technique:

LISA (all must apply)	INSURE (all must apply)	Intubation, surfactant & ongoing ventilation (any apply)
Infants >26 weeks (Consultant discretion for infants <26weeks)	Infants <26 weeks Infants >26weeks where ongoing ventilation may be required	
Respiratory support only required at delivery	Respiratory support only required at delivery	Cardiac compressions or intravenous drugs required at resuscitation
Regular spontaneous respiration after caffeine administration	Regular spontaneous respiration after caffeine administration AND following INSURE procedure	Irregular/inadequate respiration
FiO_2>0.3 but < 0.6 at start of procedure and FiO2 ≤0.3 at end of procedure	FiO_2>0.3 but < 0.6 at start of procedure AND ≤0.3 at end of procedure	FiO_2 ≥0.6 at start of procedure and/or >0.3 at end of procedure
Inotropic support <10mcg/kg/min dopamine	Inotropic support <10mcg/kg/min dopamine	Requiring inotropic support ≥10mcg/kg/min dopamine
No other organ failure	No other organ failure	1 or more organ failure

Exclusion for LISA:

1) Significant respiratory distress or apnoea in a baby, suggestive of needing mechanical ventilation.
2) Persistent/worsening respiratory acidosis despite optimal non-invasive ventilation.

Procedure guidance:

1) Determine the indication for administering surfactant by LISA and document it
2) Ensure the baby has venous access (peripheral cannula)
3) Gather all the equipment required:
    - Laryngoscope
    - Suction
    - Sterile gloves
    - LISA catheter
    - 5 ml Luer lock syringe and blunt fill needle to draw up the surfactant

Drugs to be given intravenously:

- Fentanyl 0.67 microgram/kg IV (awake sedation)
- Atropine 20 microgram/kg IV
- NALOXONE: Prescribe naloxone, in case the effect of fentanyl needs reversal. Dose: 10 microgram/kg repeated every 2 - 3 minutes, as necessary[7].

Emergency equipment: bag/valve/mask or T-piece, oxygen and air, stethoscope, endotracheal tubes. (Prepare full endotracheal tube (ETT) intubation set in case intubation should become necessary.)

4) Draw up the poractant alfa (Curosurf®) (200 mg/kg) and attach a cannula extension (T-piece) to the end of the syringe with a Luer-lock system (this avoids putting too much pressure on the catheter and prevents it from moving) and prime the LISAcath.

    Note: Do not use the standard 'surfactant giving set' as this syringe will not connect to the LISAcath.

5) Place baby supine, minimise the heat loss (increase incubator temperature, use blankets, swaddling and transwarmer if necessary) and ensure the position of the baby is adequate.
6) The baby will remain on the non-invasive ventilation support (CPAP/nasal high-flow therapy (nHFT)) during the procedure. It is better to have an nasogastric (NG)/orogastric (OG) tube in situ as this will help identify oesophagus.
7) Pre-medicate with fentanyl (0.67 mcg/kg) and full dose of atropine (may have to wait for few minutes to take effect).
8) Insert LISAcath below the vocal cords via direct laryngoscopy:
    - 1 cm for 25 - 26 weeks gestation
    - 1.5 cm for 27 - 28 weeks gestation
    - 2 cm for 29 - 32 weeks gestation

Note catheter marking at the lips for later reference. The position should equate to ETT at lips for conventional intubation. Carefully remove laryngoscope taking care not to dislodge the catheter and recheck LISA catheter position by checking catheter markings at the lips.

Close the mouth around the LISAcath with fingers ensuring not to apply any pressure on the soft tissue. Maintain the LISAcath in the midline position to avoid traumatising the mucosal lining of the trachea. This is not an emergency procedure. Stop if having difficulty and consider alternatives.

9) Slowly (!) give poractant alfa (Curosurf®) 200 mg/kg with maintenance of nHFT/positive end-expiratory pressure (PEEP). With the infant in a supine position and head in the midline, inject the surfactant as small boluses of approximately 0.2 ml aliquots every 5 - 10 breaths (give full

dose over 2 - 3 minutes). Higher aliquots may increase likelihood of overspill into mouth and oesophagus. Reduce volume of aliquots or wait for longer periods between aliquots if overspill occurs. Usually, suction of overspill surfactant is not required – if baby remains stable, allow time to clear spontaneously. Expel all the surfactant from the catheter by injecting 0.5 ml of air following administration.

10) Remove the LISAcath once surfactant administered and ensure the baby is clinically stable with normal cardiorespiratory parameters and continue nHFT.

11) Following procedure, change infant position from supine to prone position to allow better surfactant spreading and distribution for the first 30 minutes unless urgent umbilical vein catheter (UVC)/umbilical artery catheter (UAC) required (ensure peripheral access for glucose whilst respiratory status is stabilising over first 1 - 2 hours).

12) Do not forget to document the procedure, the tolerance, and the fraction of inspire oxygen (FiO_2) after the procedure.

LISA can be repeated, and a second dose of surfactant can be given as would be done in an intubated baby. Usually, it can be given if the FiO_2 is high (>0.3) suggestive of surfactant deficiency. However, the baby should be clinically stable and not requiring mechanical ventilation, otherwise the baby should be intubated.

** NOTE: The LISA technique may be carried out without sedation, i.e. by swaddling and comforting; if the operator and the team has experience and feels comfortable to do so.

Reasons for an unsuccessful procedure

1) Unable to pass the LISAcath because of difficulty in visualising the cords: will need pre-medication and intubation by an experienced operator (senior registrar/consultant).

2) LISA failure: Increased oxygen requirement or increased work of breathing after LISA.

References:

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4) Egbert H, Christoph H, Wolfgang G. Less invasive surfactant administration (LISA): chances and limitations. Arch Dis Child Fetal Neonatal Ed Epub July 2019. doi:10.1136/ archdischild-2018-316557
5) Neonatal unit guidelines for Surfactant treatment, March 2020, Oxford University Hospital NHS Trust
6) Reynolds P et al. Implementing and Improving Less Invasive Surfactant Administration. Infant 2017 Volume 13 Issue 5
7) Southampton Oxford Neonatal Transport (SONeT) Formulary, Naloxone. Available at: https://www.sort.nhs.uk/Media/SONeT/Drug-Calculator/SONeT-formulary.pdf (last accessed 6/1/2021)

Title of Guideline	Surfactant Administration by LISA Technique
Guideline Number	557FM
Version	1
Effective Date	January 2021
Review Date	January 2024
Original Version Published	January 2021
Equality Impact Assessment	5th November 2020
Approvals:	
Paediatrics Information & Guidelines Group	5th November 2020
Paediatrics Clinical Governance	10th November 2020
Medicines Check (Pharmacy)	7th November 2020
Clinical Guidelines Group	15th December 2020
Author/s	Sonal Datir
SDU(s)/Department(s) responsible for updating the guideline	Paediatrics
Uploaded to Intranet	6th January 2021
Buckinghamshire Healthcare NHS Trust	