1.0 PURPOSE AND INTENT

1.1 To provide a process for surfactant administration to neonates in neonatal areas.

1.2 Surfactant therapy in premature infants should be given as early rescue therapy and not prophylactically. Early rescue therapy is defined as administration of surfactant between 30 and 120 minutes of birth, after initial stabilization.

Note: All recommendations are approximate guidelines only and practitioners must take into account individual patient characteristics and situation. Concerns regarding appropriate treatment must be discussed with the attending neonatologist.

2.0 PRACTICE OUTCOME

2.1 To prevent development of respiratory distress syndrome and ultimately to prevent bronchopulmonary dysplasia in premature infants.

3.0 INDICATIONS

<table>
<thead>
<tr>
<th>Infant description</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Infants less than 27 weeks gestation who require intubation at birth</td>
<td>Give exogenous surfactant once stable on ventilator</td>
</tr>
<tr>
<td>3.2 Infants 27-30 weeks gestation or less than 1250 grams birth weight who require intubation at birth and who have clinical and/or radiologic evidence of respiratory distress syndrome (RDS)</td>
<td>Consider exogenous surfactant</td>
</tr>
<tr>
<td>3.3 Infants who do not require intubation but have inadequate oxygenation on nasal CPAP with radiological and/or clinical evidence of RDS (see 4.1 below)</td>
<td>Give exogenous surfactant. (May be done with transient intubation)</td>
</tr>
<tr>
<td>3.4 Infants with parenchymal lung disease and an oxygenation index &gt;15 or FiO$_2$ greater than 0.50</td>
<td>Consider exogenous surfactant. Review with attending neonatologist</td>
</tr>
<tr>
<td>3.5 Intubated infants with pulmonary hemorrhage that leads to clinical deterioration (persistent FiO$_2$ increased greater than 10% or MAP increase greater than 2 cm H$_2$O)</td>
<td>Consider exogenous surfactant. Review with attending neonatologist.</td>
</tr>
<tr>
<td>3.6 Infants with congenital diaphragmatic hernia</td>
<td>Surfactant not generally indicated. Review with attending neonatologist.</td>
</tr>
</tbody>
</table>

4.0 GUIDELINES

4.1 Assess need for surfactant administration for infants <34 weeks gestation at 30 minutes of age and as needed during the first days of life.

4.1.1 Non-intubated infants

- All spontaneously breathing infants should be treated with nCPAP prior to decision to administer surfactant.
- If at greater than 30 minutes of age the infant requires FiO$_2$ >0.30 to maintain oxygen saturation between 88-92% and has received nCPAP of at least 7 cm H$_2$O for at least 15 minutes should receive early rescue surfactant.
4.1.2 **Intubated infants**

- Gestational Age less than 27 weeks:
  - Administer surfactant within 2 hours of delivery

- Gestational age between 27 and 34 weeks:
  - If at greater 30 minutes of age the infant requires FiO$_2$ >0.30 to maintain oxygen saturation between 88-92% and has received PEEP of least 7 cm H$_2$O for at least 15 minutes should receive early rescue surfactant.

4.2 Determine need to obtain a chest x-ray prior to surfactant administration.

<table>
<thead>
<tr>
<th>Infant description</th>
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</tr>
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<tbody>
<tr>
<td>Intubated infant less than 1000 grams requiring ongoing ventilation</td>
<td>Chest x-ray required</td>
</tr>
<tr>
<td>Infant less than 1000 grams with plan to intubate solely for the surfactant then extubate</td>
<td>Chest x-ray recommended</td>
</tr>
<tr>
<td>Intubated infant greater or equal to 1000 grams requiring ongoing ventilation</td>
<td>Chest x-ray recommended prior to surfactant administration</td>
</tr>
<tr>
<td>Infant greater or equal to 1000 grams with plan to intubate solely for the surfactant then extubated</td>
<td>No chest x-ray required</td>
</tr>
<tr>
<td>Infant severely ill or unstable and requires urgent surfactant.</td>
<td>Administer surfactant before chest x-ray confirmation of endotracheal tube placement.</td>
</tr>
</tbody>
</table>

4.3 **Timing and Frequency**

4.3.1 Administer surfactant once the infant is stabilized on non-invasive or intubated ventilation. Early rescue surfactant should be given between 30 and 120 minutes of birth.

4.3.2 Consider repeated doses of surfactant in infants with respiratory distress syndrome (RDS) who have persistent or recurrent oxygen and/or ventilation requirements within the first 72 hours of life.

4.4 **Dosage**: 5 mL/kg/dose* (135mg phospholipid) divided into 2 aliquots. Give intra-tracheally using one of the methods described below. If second dose required, give it 6-12 hours after the first. 2nd and subsequent dosing of surfactant may be more likely to be associated with adverse events. Caution should be undertaken during dosing. A third dose may be administered within 72 hours of birth with the approval of the attending neonatologist.

* The dosage quoted is for BLES surfactant. If other surfactant products are used the manufacturer should be contacted for recommendations.

4.5 **Preparation**

4.5.1 Warm to room temperature prior to administration. Remove surfactant from the freezer or refrigerator and bring preparation close to room temperature (from frozen, 60 minutes; from refrigerated, 20 minutes or if warmed by holding in the hand, 5 to 10 minutes) before administering. SWIRL the vial gently, DO NOT SHAKE. An unopened vial warmed to room temperature for less than 6 hours may be returned to its previous storage condition a maximum of 2 times.

4.5.2 Withdraw the dose required into 1 or 2 syringes using a 21 or 22 gauge needle. Choose size of syringe up to a 5 mL size according to the volume of the required dose.

4.6 **Administration procedure for intubated and ventilated infants:**

4.6.1 Ideally begin when SpO$_2$ is ≥ 88%.

4.6.2 Advance the MAC catheter to the end of the endotracheal tube. Administer one half of the surfactant preparation as rapidly as tolerated (typically significantly less than 10
seconds). Withdraw the MAC catheter from the ET tube as it severely reduces (or occludes) the ET tube lumen and restricts ventilation which can lead to adverse events (desaturation, bradycardia, and chest rigidity).

4.6.3 Observe for chest movement and monitor heart rate and saturation. If there is no chest movement or there is bradycardia and/or desaturation <80% then gentle bag-tube ventilation should be performed until infant has re-stabilized.

4.6.4 Repeat the above process for the second aliquot of surfactant.

4.7 Administration procedure when planning to intubate – surfactant – extubated (InSurE method):

4.7.1 Ideally begin when SpO2 is ≥ 88%.

4.7.2 Maintain infant on nCPAP during intubation. After intubation attach double swivel elbow with 9.5mm port to endotracheal tube.

4.7.3 Advance the MAC catheter to the end of the endotracheal tube (ETT length +9 cm). Administer surfactant as described above.

4.7.4 When heart rate and oxygen saturations stabilize, re-establish nCPAP and then remove endotracheal tube.

4.8 Administration procedure for minimally invasive technique:

4.8.1 Maintain infant on nCPAP during procedure.

4.8.2 Use 16 (5 French) gauge, 133 mm length vascular catheter. Mark catheter with tape indicating the depth of insertion at the level of the lips (6 cm plus weight of the infant in kg).

4.8.3 Insert the vascular catheter through the vocal cords under direct vision using standard laryngoscopy technique.

4.8.4 After the catheter placement, remove the laryngoscope and stabilize the catheter using two fingers at the level of the upper lip.

4.8.5 Once the catheter is correctly positioned, connect the syringe with surfactant and administer a 0.25-0.5 ml bolus of surfactant.

4.8.6 Remove the syringe from the catheter and observe for surfactant moving up and down as indication of accurate intubation of the trachea.

4.8.7 Re-attach the syringe and slowly administer the desired volume of surfactant by small boluses of 0.25-0.5 ml over 20-30 seconds with each bolus about 10 seconds apart. At the end of the procedure, flush the catheter with 0.5 ml of air before removing the catheter.

4.8.8 If the infant becomes apneic, bradycardic, or develops significant desaturation during the procedure, interrupt the administration of surfactant for 20 to 30 seconds until the vital signs return to baseline. During this time ensure that the infant’s mouth is closed and check made to see that the CPAP is being maintained. If the infant could not recover after a trial of increasing the NCPAP pressure and FiO2 levels and the vital signs remain unstable or deteriorate, stop the procedure and intubate and ventilate the infant according to the neonatal resuscitation program (NRP) guidelines.
4.9 Following the procedure document in the integrated progress notes and monitor the infant for adverse effects.

4.10 If the endotracheal tube becomes obstructed take immediate action to clear the tube by giving manual breaths via the ventilator. If after 3-4 breaths the tube continues to be obstructed, ventilate using a flow-inflating bag and consider suctioning the endotracheal tube. If these do not quickly resolve the situation, remove the endotracheal tube and consider re-intubation.

5.0 REFERENCES


6.0 PRIMARY AUTHORS

6.1 Dr. Ruben Alvaro, Medical Director, NICU St. Boniface General Hospital
6.2 Dr. John Baier, Assistant Medical Director, NICU HSC
6.3 John Minski, Clinical Specialist, Respiratory Therapy