Chest Physiotherapy

Introduction

The aim of chest physiotherapy in the newborn infant is to increase the clearance of lung secretions and maintain lung expansion with the potential benefit of

1. reducing need for ventilatory support,
2. Improving oxygenation,
3. prevention of endotracheal tube obstruction, need for endotracheal tube changes and resultant hypoxia, and
4. prevention of extubation failure.

Evidence from properly designed clinical trials is incomplete. This guideline reviews the available evidence and documents our current practices.

The benefits of active chest physiotherapy

1. Chest physiotherapy treatment of ventilated infants and periextubation chest physiotherapy

Observational studies in ventilated preterm neonates have documented improvement in oxygenation\(^1\),\(^2\), improvement in airway resistance\(^3\), and fewer hypoxemic episodes\(^2\) in neonates post active chest physiotherapy treatment. Studies comparing active physiotherapy to suction and postural drainage without physiotherapy documented increased weight of secretion removal\(^4\), improvement in oxygenation\(^5\),\(^6\) in the active treated infants. Systematic review of randomised trials has documented a reduction in extubation failure (reintubation) in preterm infants receiving periextubation physiotherapy\(^7\) although no difference was seen in the incidence of chest x-ray diagnosed atelectasis. Extubation failure would seem to be a more important patient related benefit of chest physiotherapy. No evidence is available regarding the use of active chest physiotherapy to prevent endotracheal tube obstruction or need for replacement, or to improve respiratory function and reduce the infant’s need for ventilatory support.

2. Saline instillation into the endotracheal tube

A RCT documented benefit from saline instillation for secretion removal to maintain endotracheal tube patency\(^8\). Studies have reported no deleterious effect on lung mechanics\(^9\) or cardiovascular parameters\(^10\) with randomly assigned treatment groups.
Potential harms of chest physiotherapy

A cohort study\textsuperscript{11} of preterm infants at RPA Hospital found no association between active chest physiotherapy (as performed in our nursery) and cerebral ischaemic lesions (intraventricular haemorrhage or periventricular leucomalacia) or subsequent cerebral palsy on follow up. However, concerns have been raised regarding active chest physiotherapy and cerebral injury. It may be that the problem is over vigorous physiotherapy or physiotherapy given to vulnerable infants. Physiotherapy, if essential, should be very gentle and when the infant is stable for those infants born < 30 weeks’ gestation in the first week of life who are at risk of intraventricular haemorrhage. The following concerns have been documented in the literature:

Intraventricular haemorrhage:

A single randomised trial found an increased incidence of severe intraventricular haemorrhage in preterm infants with respiratory distress syndrome receiving active chest physiotherapy (postural drainage, percussion, and vibration) in the first day of life\textsuperscript{12}. Postural drainage with head up and then down, on day one would not be given in our unit.

Encephaloclastic porencephaly:

A lesion first described in 1992\textsuperscript{13} has recently been linked to chest physiotherapy\textsuperscript{14}. This lesion has not been seen in our unit in either the treated or non-treatment infants.

In which infants should chest physiotherapy be considered?

In principle, chest physiotherapy should be limited to those infants considered most likely to benefit - with significant respiratory distress and thick, tenacious secretions. Concerns regarding cerebral injury in extremely preterm infants suggests that infants at risk of intraventricular haemorrhage should only receive chest physiotherapy if the benefit is considered to outweigh any potential harm.

In preterm infants:

Chest physiotherapy should be considered in the following situations:

1. To facilitated the removal of excessive or tenacious secretions in ventilated infants so as to:

   - Prevent endotracheal tube obstruction
   - Reduce excessive ventilatory requirements
   - To reinflate collapsed or atelectatic lung

Excessive or tenacious secretions may be suspected if:

   - Tenacious secretions with "plugs" are suctioned from endotracheal tube,
   - Airway obstruction indicated by increasing ventilatory / oxygen requirements and/or and obstructive pattern on the flow-time loop (increased expiratory time) on respiratory mechanic monitoring (Draeger Evita screen, see Figure 1)
• On high frequency ventilation: decreased tidal volume
• Presence of lung infections and congenital pneumonia with associated lung collapse

![Flowy Time Graph](image1)
![Pressure Time Graph](image2)
![Volume Time Graph](image3)

Figure 1. Pattern of severe obstruction

2. To prevent extubation failure: premature infants with excessive or tenacious secretions and increasing respiratory distress, oxygen requirements or hypercarbia may benefit from periextubation physiotherapy.

**In term infants:**

Ventilated term infants with excessive or tenacious secretions including:

- Infants who require muscle relaxation and ventilatory support. As muscle relaxation wears off and ventilatory requirements reduce, copious sticky secretions and sputum plugs commonly become evident.
- Infants with meconium aspiration syndrome or congenital pneumonia
- Infants with airway obstruction secondary to secretions
- Infants with collapsed/consolidated lung or lobe

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**How to give chest physiotherapy**
Chest physiotherapy should be ordered by the attending neonatologist in consultation with the unit physiotherapist and nurse. Usual active physiotherapy includes gentle active vibrations and suctioning.

- **Frequency of treatment:**

  Treatments are given according to individual need and assessment. Usually 4th to 6th hourly treatments are adequate.

- **Assess infant:**

  Auscultate and palpate baby’s chest for location of coarse crepitations.

- **Monitoring:**

  The principal of chest physiotherapy is to not adversely impact on the cardiorespiratory status. Oxygen desaturations can be compensated for by a small increase in inspired oxygen supply or inspiratory pressure. Prior to commencing active chest physiotherapy treatment the physiotherapist must note baseline heart rate, mean blood pressure, oxygen saturation, as well as the ventilator mode, rate and pressures. The baby’s flow chart should be noted for any fluctuations in the previous few hours and the correlation of the blood gas with the monitor readings. The flow loops on the respiratory mechanic monitor (Evita screen) should be monitored during treatment.

- **Drainage positions:**

  These are not usually required in the newborn infant. The side lying position is indicated when coarse crepitations are greatest on one side, or unilateral disease is indicated on CXR. Only perform side lying if the infant can tolerate it and avoid excessive neck flexion / extension. Contralateral head support should be used. For upper lobe collapse/consolidation, the crib may be tilted to 15-25 degrees head elevation. With severe unilateral lung disease such as pulmonary interstitial emphysema, the neonate should lie on the affected side as this may hasten the disappearance of interstitial gas when tolerated.

- **Active gentle vibrations:**

  These are given by the fingers of one hand moulded to the shape of the baby’s chest wall, with contra-lateral thumb support. Vibrations are at a rapid rate (approximately 120 / minute, with minimal compression pressure), and within the baby’s tolerance. The physiotherapist’s other hand is cupped and supports the baby’s head for the duration of treatment. During unilateral vibrations the head should be supported in the physiotherapist palm. Drain only one area per treatment.
• **Suctioning:**

This is performed after the use of active gentle vibrations. The endotracheal tube may be suctioned using a 5 to 8 Fg Y-suction catheter with up to 120 mmHg low flow suction. Repeat suction as tolerated by infant until clear return.

If secretions are excessively tenacious, consider saline instillation. The physiotherapist instils up to 0.25 mls NaCl and stabilises the endotracheal tube. The nurse performs the endotracheal suction. Any "wet" suction is concluded by a final dry suction. Repeat suction as tolerated by the infant until clear return.

• **Reduction or cessation of physiotherapy:**

Cessation of physiotherapy should be considered when there is evidence of re-expansion of collapsed / consolidated lung plus there is a significant reduction in the production of excessive or tenacious secretions. There should be consultation with the attending physiotherapist, prior to cessation.

• **Documentation:**

All details of treatment will be documented on the purple physiotherapy chart taped to the ventilator or shelf. The planned time of the next physiotherapy treatment should also be listed.

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**Key Points**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Evidence Level</th>
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<tbody>
<tr>
<td>Active chest physiotherapy increases the clearance of lung secretions</td>
<td>★★★★ 4</td>
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<tr>
<td>Active chest physiotherapy prevents extubation failure</td>
<td>★★★★★ 7</td>
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<tr>
<td>Active chest physiotherapy as performed at RPA Hospital is not associated with adverse outcomes</td>
<td>★★★★ 11</td>
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<tr>
<td>Use of saline instillation prevents endotracheal</td>
<td>★★★★ 8</td>
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<tr>
<td>Active chest physiotherapy leads to improvement in airways resistance</td>
<td>3</td>
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<tr>
<td>Active chest physiotherapy leads to improvement in oxygenation</td>
<td>1, 2, 5, 6</td>
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**References**


Last Updated: March, 2000