

**Date:** August 17, 2011

## Recruitment Maneuvers Compared to Chest Physiotherapy for the Mechanically Ventilated Patient

### Clinical Question

- P (population/problem) Among infants and children (newborn to 18 years) who are mechanically ventilated and have atelectasis
- I (intervention) does the use of recruitment maneuvers
- C (comparison) versus chest physiotherapy
- O (outcome) lead to earlier resolution of atelectasis?

### Target Population

Infants and children ages newborn to 18 years who are mechanically ventilated with documented atelectasis. Exclusion criteria includes patients with increased intracranial pressure, pneumothorax and hemodynamic instability.

### Definitions

Chest physiotherapy: a treatment modality that incorporates chest wall manipulation with chest clapping, percussion and vibration to mobilize retained secretions.

Recruitment maneuvers: an intervention to increase the number of alveoli participating in gas exchange by increasing the transpulmonary pressure via ventilator or flow inflation bag.

**Recommendation** (See Table of Recommendation Strength following references)

1. There is insufficient evidence and lack of consensus to make a recommendation for using recruitment maneuvers versus chest physiotherapy for treatment of atelectasis with the mechanically ventilated pediatric patient.

### Discussion/summary of evidence

No direct evidence was found regarding the use of recruitment maneuvers compared to chest physiotherapy to improve atelectasis in the intubated, mechanically ventilated pediatric patient. Although chest physiotherapy is often the first modality to treat acute atelectasis, there is limited evidence regarding the effectiveness of chest physiotherapy among mechanically ventilated patients, including preventing pulmonary complications, facilitating weaning and decreased length of stay in the ICU (Stiller 2000 [5a]).

Few studies have been done regarding recruitment maneuvers for the treatment of atelectasis. However, the studies completed show strong evidence of improvement or resolution of atelectasis (Papadakos 2010 [5a]) Maa, 2005 [2b] Tusman 2003 [2b] Scohy 2009[3b]). In one study, the treatment group receiving alveolar recruitment maneuvers resulted in lower frequency of atelectasis observed on MRI images (Tusman 2003 [2b]). In another study, the use of recruitment maneuvers demonstrated that ARS + PEEP of 8cm H<sub>2</sub>O significantly decreases V/Q mismatch, shunting or both and improved dynamic compliance, oxygenation and end expiratory lung volume (Scohy 2009 [3b]).

## Health Benefits, Side Effects and Risks

Risks and complications associated with chest physiotherapy are rare, but may include hypoxemia, increased intracranial pressure, hypotension, pain/discomfort to ribs, cardiac arrhythmias and hemoptysis. Risks and complications associated with recruitment maneuvers may include transient hypotension, desaturation, barotrauma and arrhythmias.

Interventions that result in a decrease in the intensive care unit length of stay and/or duration of mechanical ventilation could lead to significant reductions in total inpatient cost (Stiller 2000[5a], Maa 2005[2b]).

### References (evidence grade in [ ]; see *Table of Evidence Levels following references*)

**Note:** When using the electronic version of this document,  indicates a hyperlink to the PubMed abstract. A hyperlink following this symbol goes to the article PDF when the user is within the CCHMC network.

Maa, S. H., Hung, T. J., Hsu, K. H., Hsieh, Y. I., Wang, K. Y., Wang, C. H., et al. (2005). Manual hyperinflation improves alveolar recruitment in difficult-to-wean patients\*. *Chest*, 128(4), 2714 [2b].

Papadakos, P. J., Lachmann, B., & Rudolph Koch, R. (2010). Lung recruitment: A role in mechanical ventilation. *CJRT RCTR*, [5a].

Principi, T., Fraser, D. D., Morrison, G. C., Farsi, S. A., Carrelas, J. F., Maurice, E. A., et al. Complications of mechanical ventilation in the pediatric population. *Pediatric Pulmonology*, [5b].

Scohy, T. V., Bikker, I. D. O. G., Hofland, J., De, J., Peter, L., Bogers, A. D. J. J. C., et al. (2009). Alveolar recruitment strategy and PEEP improve oxygenation, dynamic compliance of respiratory system and end-expiratory lung volume in pediatric patients undergoing cardiac surgery for congenital heart disease. *Pediatric Anesthesia*, 19(12), 1207-1212 [3b].

Stiller, K. (2000). Physiotherapy in intensive care. *Chest*, 118(6), 1801 [5a].

Tusman, G., Böhm, S. H., Tempra, A., Melkun, F., García, E., Turchetto, E., et al. (2003). Effects of recruitment maneuver on atelectasis in anesthetized children. *Anesthesiology*, 98(1), 14 [2b].

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Note: Full tables of evidence grading system available in separate document:

- [Table of Evidence Levels of Individual Studies by Domain, Study Design, & Quality](#) (abbreviated table below)
- [Grading a Body of Evidence to Answer a Clinical Question](#)
- [Judging the Strength of a Recommendation](#) (abbreviated table below)

**Table of Evidence Levels** (see note above)

Quality level	Definition
1a† or 1b†	Systematic review, meta-analysis, or meta-synthesis of multiple studies
2a or 2b	Best study design for domain
3a or 3b	Fair study design for domain
4a or 4b	Weak study design for domain
5 or 5a or 5b	Other: General review, expert opinion, case report, consensus report, or guideline

†a = good quality study; b = lesser quality study

**Table of Recommendation Strength** (see note above)

<b>Strength</b>	<b>Definition</b>
“Strongly recommended”	There is consensus that benefits clearly outweigh risks and burdens (or visa-versa for negative recommendations).
“Recommended”	There is consensus that benefits are closely balanced with risks and burdens.
No recommendation made	There is lack of consensus to direct development of a recommendation.

**Dimensions:** In determining the strength of a recommendation, the development group makes a considered judgment in a consensus process that incorporates critically appraised evidence, clinical experience, and other dimensions as listed below.

1. Grade of the Body of Evidence (see note above)
2. Safety / Harm
3. Health benefit to patient (*direct benefit*)
4. Burden to patient of adherence to recommendation (*cost, hassle, discomfort, pain, motivation, ability to adhere, time*)
5. Cost-effectiveness to healthcare system (*balance of cost / savings of resources, staff time, and supplies based on published studies or onsite analysis*)
6. Directness (*the extent to which the body of evidence directly answers the clinical question [population/problem, intervention, comparison, outcome]*)
7. Impact on morbidity/mortality or quality of life

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## Supporting information

### Introductory/background information

Atelectasis is one of the most common complications associated with mechanical ventilation (Principi 2010 [5b]). Chest physiotherapy consists of external maneuvers, such as percussion, postural drainage and vibration to mobilize and clear airway secretions. It is indicated in patients whom cough is insufficient to clear secretions on own. Chest physiotherapy is ordered regularly in our mechanically ventilated patients. This has been the most frequently used modality in our field for many years. However, technology has evolved and more sophisticated, less expensive therapy such as recruitment maneuvers may be accessible for our patients. Chest physiotherapy generates a charge and takes 3-5 minutes per lobe( usually 15 minutes) for performing therapy, but recruitment maneuvers take approximately 30 seconds and involves simply utilizing equipment that the patient is already being charged for. Recruitment maneuvers are indicated for acute lung injury to promote alveolar recruitment and may consist of intermittent sighs, sustained inflation holds and increasing PEEP. Recruitment maneuvers can be performed by manual inflation bag or manipulation of ventilator.

### Group/team members

Group/Team Leader Rhonda Schum RRT, RT II, The Heart Institute

Other group/team members Tanya Scholl, RRT-NPS, BHS, RT III, Pediatric Intensive Care Unit; Tonie Perez, RRT-NPS, BHS, RRT III, Neonatal Intensive Care Unit

Support personnel Barbara Giambra, RN, MS, CPNP, Evidence-Based Practice Mentor, Center for Professional Excellence, Research and Evidence-Based Practice

### Search strategy

Search terms used: Chest physiotherapy, atelectasis, recruitment maneuvers, pediatrics, mechanical ventilation, percussion

Date range: 2000-2011

Data bases used: Medline/PubMed, CINAHL. Google Scholar

## **Relevant Procedures**

CCHMC Respiratory Care Procedure - Procedure Number II 207  
Therapeutics and Diagnostics Effective Date 7/2/200  
Chest Physiotherapy

## **Known conflicts of interest**

No financial conflicts of interest were found.

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## **Note**

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**Reviewed against quality criteria by 2 independent reviewers.**