# Table of Contents

- **Header** ..................................................... 1
- **Abstract** .................................................. 1
- **Plain Language Summary** ................................. 2
- **Background** ............................................... 2
- **Objectives** ................................................ 3
- **Methods** .................................................. 3
- **Results** ................................................... 4
- **Discussion** ................................................ 6
- **Authors’ Conclusions** .................................... 7
- **Acknowledgements** ....................................... 8
- **References** ............................................... 8
- **Characteristics of Studies** ............................... 9
- **Data and Analyses** ....................................... 14
- **Appendices** ............................................... 14
- **What’s New** ............................................... 14
- **History** ................................................... 14
- **Contributions of Authors** ............................... 15
- **Declarations of Interest** ................................. 15
- **Sources of Support** ...................................... 15
- **Notes** ...................................................... 15
- **Index Terms** ............................................... 15
Chest physiotherapy for acute bronchiolitis in paediatric patients between 0 and 24 months old

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ABSTRACT

Background
Acute bronchiolitis is the leading cause of medical emergencies during winter in children younger than two years of age. Chest physiotherapy is thought to assist infants in the clearance of secretions and to decrease ventilatory effort.

Objectives
To determine the efficacy and safety of chest physiotherapy in infants aged less than 24 months old with acute bronchiolitis.

Search methods
In June 2006 we updated the searches of the Cochrane Central Register of Controlled Trials (CENTRAL) (The Cochrane Library 2006, issue 2); MEDLINE (2004 to May Week 4 2006); EMBASE (July 2004 to December 2005) and CINAHL (1982 to May Week 4 2006).

Selection criteria
Randomised controlled trials (RCTs) in which chest physiotherapy was compared against no intervention or against another type of physiotherapy in paediatric patients younger than 24 months old.

Data collection and analysis
Two review authors independently extracted the data. The primary outcome was a severity clinical score. Secondary outcomes were length of hospital stay, duration of oxygen supplementation, and the use of bronchodilators and steroids.

Main results
Three clinical trials met the inclusion criteria. All evaluated vibration and percussion techniques with children in postural drainage positions compared to no intervention. The study populations were hospitalised infants with a clinical diagnosis of acute bronchiolitis, although one study included only infants who required nasogastric tube feeding or intravenous fluids. None of the other included trials observed any differences in the severity of the clinical score at day five, during each of the five days of the trial, or until discharge; length of hospital stay; or oxygen requirements between paediatric patients receiving chest physiotherapy and control.
Authors’ conclusions

Based on the results of three RCTs, chest physiotherapy using vibration and percussion techniques does not reduce length of hospital stay, oxygen requirements, or improve the severity clinical score in infants with acute bronchiolitis. These were infants who were not on mechanical ventilation and who did not have any other co-morbidity. Chest physiotherapy using forced expiratory techniques needs to be further evaluated by clinical research.

P L A I N   L A N G U A G E   S U M M A R Y

Chest physiotherapy for acute bronchiolitis in children younger than two years of age

Acute bronchiolitis is a frequent viral respiratory infection in children younger than two years old. Most children have a mild disease and do not require hospitalisation. Those who do need to be hospitalised sometimes have difficulties clearing phlegm, thick mucous respiratory secretions because of the infection. It has been proposed that chest physiotherapy may assist in the clearance of the respiratory secretions and improve breathing. This review looked at the effectiveness of chest physiotherapy in acute bronchiolitis. Chest physiotherapy does not reduce the length of hospital stay for infants with acute bronchiolitis. There is no good evidence for or against the improvement of clinical scores. Further research is needed to assess the efficacy of chest physiotherapy in this condition.

B A C K G R O U N D

Description of the condition

Acute bronchiolitis is the leading cause of medical emergencies during winter in children younger than two years of age. It results in high utilisation of healthcare resources, overcrowding of hospitals during epidemics, and significant morbidity for infants. Infant mortality rates vary depending upon the population. In the USA, between 1996 and 1998, the incidence was reported as 2 per 10,000 live births (Holman 2003). Criteria for diagnosing acute bronchiolitis vary greatly. Most doctors agree that the case definition for an episode of acute bronchiolitis should include children aged 24 months or younger who have a first episode of acute wheezing accompanied by physical findings of viral infection (for example coryza, cough, and fever) (González 2001; Videla 1998; Wainwright 2003). Some doctors add to this definition the need to rule out pneumonia or atopy as the cause of wheezing (Mc Millan 1994), while other doctors cite the first episode of acute wheezing as the diagnostic criterion for acute bronchiolitis (Roosvelt 1996). The most common virus identified with the disease is respiratory syncytial virus (RSV). Other pathogens frequently identified are parainfluenza virus, adenovirus, Mycoplasma pneumoniae (M. pneumoniae), influenza virus, and human metapneumovirus (Galiano 2004; Videla 1998). Pathological changes in acute bronchiolitis are necrosis of the respiratory epithelium with destruction of ciliated epithelial cells followed by peribronchial infiltration with lymphocytes. The consequences are bronchial wall oedema, mucous production, and impairment of the clearance of mucous leading to obstruction of small airways with dense plugs of mucous, fibrin, and alveolar debris (Welliver 2003). Most cases of acute bronchiolitis are mild and can be treated on an outpatient basis; one to three per cent (depending on the seriousness) will require hospitalisation (Mc Millan 1994). Risk factors associated with the need for hospitalisation and more severe disease are premature birth, chronic lung disease, congenital heart disease, and a deficient immune system (Wallis 1999). In developing countries the most frequent risk factors associated with hospitalisation and severe disease include living in a low income family, malnourishment, low birthweight, age of the mother, mother’s education level, being bottle-fed, and premature birth (Spencer 1996).

Description of the intervention

The standard treatment of acute bronchiolitis is to ensure adequate oxygenation, fluid intake, and feeding of the infant. Pharmacological strategies used in acute bronchiolitis are bronchodilators and steroids. However, at present the effectiveness of these interventions remains uncertain. A Cochrane review concluded that bronchodilators produce modest short-term improvement in clinical scores of mild or moderately-severe bronchiolitis (Kellner 1998). Another Cochrane review assessed the benefits of steroids in patients with acute bronchiolitis and found that most well-de-
signed studies showed no benefit with either inhaled or systemic corticosteroids (Patel 2004).

**How the intervention might work**

Chest physiotherapy in paediatric respiratory diseases has been used to assist in the clearance of tracheo-bronchial secretions. The main goal is to clear the airway obstruction, reduce airway resistance, enhance gas exchange, and reduce the work of breathing. Different techniques are used in paediatric patients: chest percussion, vibration in postural drainage positions, chest shaking, directed coughing, and slow passive forced exhalation. Its utilisation varies between countries and regions. In France, the passive forced exhalation techniques are widely used, with an 82.5% to 99% utilisation per centrage, and are recommended by a consensus panel (Beauvois 2001; Consensus 2001). In other countries the utilisation is lower and the most common techniques performed are vibration and chest percussion (Beauvois 2001).

**Why it is important to do this review**

Chest physiotherapy has been linked to adverse events and some concerns have arisen in the literature about the safety of the procedure, especially in relation to rib fractures (Beeby 1998; Chalumeau 2002). The aim of reviewing clinical research was to help clarify the evidence.

**OBJECTIVES**

The objective of this review was to determine the effectiveness and safety of chest physiotherapy in infants aged less than 24 months with acute bronchiolitis.

**METHODS**

**Criteria for considering studies for this review**

**Types of studies**

We included randomised controlled trials (RCTs) evaluating chest physiotherapy in acute bronchiolitis.

**Types of participants**

Infants younger than 24 months of age with acute bronchiolitis as defined by the studies’ authors, in all settings.

**Types of interventions**

We included trials that compared any type of chest physiotherapy (postural drainage, chest percussion, vibration, chest shaking, directed coughing, or forced exhalation technique) versus standard care (excluding chest physiotherapy) or other drainage or breathing techniques.

**Types of outcome measures**

**Primary outcomes**

1. Change in the severity status of bronchiolitis
2. Oxygen saturation levels
3. Transcutaneous PCO\textsubscript{2}

**Secondary outcomes**

1. Duration of oxygen supplementation
2. Length of hospital stay
3. Use of bronchodilators and steroids

**Adverse events**

These were defined as any injury resulting from chest physiotherapy, for example rib fractures, and long-term neurological outcomes. All the outcomes were taken into consideration. We described the method used to measure any adverse events.

**Search methods for identification of studies**

**Electronic searches**

In the first version of this review we searched the Cochrane Central Register of Controlled Trials (CENTRAL) (The Cochrane Library 2004, issue 2) which contains the Acute Respiratory Infection Group’s specialised register; MEDLINE (January 1966 to June 2004); EMBASE (1990 to June 2004); PASCAL; SCISEARCH; LILACS; and Cumulative Index to the Nursing & Allied Health Literature (CINAHL) (1982 to May 2004).

In June 2006 we updated the searches of CENTRAL (The Cochrane Library 2006, issue 2); MEDLINE (2004 to May Week 4 2006); EMBASE (July 2004 to December 2005); and CINAHL (1982 to May Week 4 2006).

The following search strategy was run over MEDLINE and CENTRAL. The highly sensitive search strategy filter (Dickersin 1994) was combined with the search strategy and run over MEDLINE. The MEDLINE search was modified slightly to search CINAHL. No language restrictions were applied.

MEDLINE (OVID)

1 exp BRONCHIOLITIS
Two review authors (CP, MR) assessed the studies. Each RCT was rated according to the following quality of allocation concealment categories.
Category A: adequate concealment.
Category B: uncertain, indication of adequate.
Category C: inadequate concealment.

Data extraction
Two review authors (CP, MR) extracted the data. A standard form was used to extract the following data:
- characteristics of the study (design, method of randomisation, withdrawals, drop outs);
- participants (age, gender, low birth weight or normal weight, ambulatory or hospital patients, disease severity, nutritional status);
- intervention (type of chest physiotherapy, administration, co-interventions) and its comparator;
- outcomes (types of outcome measures, timing of outcomes, adverse effects);
- results.

Data analysis
The extracted data were insufficient to perform a meta-analysis. We described the individual results with the effect measures described in the original trials.

RESULTS

Description of studies
See: Characteristics of included studies; Characteristics of excluded studies; Characteristics of ongoing studies.
In the first published version of this review the searches identified six studies that evaluated chest physiotherapy for acute bronchiolitis. Three studies were excluded as they were not RCTs (see ‘Characteristics of excluded studies’ table). Bernard-Narbonne (Bernard-Narbonne 2003) was a before-and-after study conducted in mechanically ventilated infants in an intensive care unit in France and the end points were short-term oxygenation parameters. Belcastro (Belcastro 1984) was an open pilot study with 12 patients and did not meet the quality criteria for inclusion. Finally, Quitell (Quitell 1988) was a before-and-after study which measured physiological parameters.
In this 2006 update we added another excluded study (Postiaux 2004). This was a prospective, longitudinal study which included 19 infants with bronchiolitis. The aim was to evaluate the efficacy and safety of the slow, prolonged expiration technique used in Belgium. The clinical severity score, pulse oximetry, and heart rate were measured before and after the physiotherapy intervention.
over the first two days of hospital admission and at discharge. An 
analysis was made to evaluate the effects after the sessions and 
during the day. The clinical severity score improved both after the 
session and during the day, while the SpO₂ (oxygen saturation) 
and heart rate improved only after the session. Even though this 
is not a clinical trial it is an important study as it shows the safety 
and possible efficacy of this technique.

The included studies were RCTs. Two studies were carried out in 
the UK (Nicholas 1999; Webb 1985) and one in Argentina (Bohe 
2004). All three evaluated the efficacy of chest physiotherapy in 
hospitalised infants with a clinical diagnosis of acute bronchiolitis. 
Nicholas (Nicholas 1999) included more seriously ill infants who 
required nasogastric feeding or intravenous fluid.

Webb (Webb 1985) recruited 90 infants with a mean age of 4.6 
months (range 0 months to 15 months). Forty-four infants were 
allocated to physiotherapy and 46 infants to the control group. The 
two groups were similar with regard to age, sex, severity score on ad-
mission, proportion who were respiratory syncytial virus positive 
(overall proportion 69%), proportion with a first-degree family 
history of atopy (overall proportion 36%), and those participants 
with smokers in their household (overall proportion 66%). The 
intervention tested consisted of "chest percussion with a cupped 
hand for three minutes in each of five postural drainage positions 
followed by assisted coughing" or "gentle oropharyngeal suction 
performed twice each day while in the hospital". Three independent 
medical doctors made clinical assessments of the severity of 
the illness at a fixed time every day: A score of zero to three was al-
located for each of 10 clinical signs: heart rate, respiratory rate, hy-
perinflation, use of accessory muscles, recession, rhinitis, wheeze, 
cough, crepitations and rhonchi to give a total severity clinical 
score of a maximum of 30 points. At hospital discharge, parents 
were asked to maintain a symptom record diary, and children were 
reviewed in outpatient clinics after two weeks. The main outcomes 
were: clinical score on admission, every day, and after five days; 
length of hospital stay; and total length of illness. Results were 
expressed as median and range. The study author was unable to 
provide the mean and standard deviation of each parameter be-
cause the raw data were no longer available.

In the other included UK trial, Nicholas (Nicholas 1999) ran-
domly allocated 50 infants to control or treatment groups; their 
mean age was 2.8 months (range 0.4 months to 7.6 months). The 
physiotherapy protocol established manual techniques of percus-
sion and vibrations performed in postural drainage positions with 
possible modifications as required in relation to infant tolerance. 
The main outcomes were clinical status and length of hospital stay.

Secondary end points were oxygen requirements and change in 
oxygen saturation levels after physiotherapy; these outcomes were 
measured only in the intervention arm. The physiotherapy pro-
tocol was described in terms of an infant’s general position and 
for postural drainage, the technique used (percussion or vibration 
according to the level of infant distress), the frequency of suction, 
and oxygen supply during treatment. Results were expressed us-
ing means but standard deviations were not reported. The study 
author could not provide clarification as she was no longer in pos-
session of the complete database.

In Bohe (Bohe 2004), 16 infants were randomly allocated to the 
physiotherapy group and 16 to the control group. Patients were 
included if they had a clinical diagnosis of acute bronchiolitis de-
efined by an acute upper respiratory infection plus fever, tachyp-
noea, or increase of respiratory effort. The intervention was per-
cussion, postural drainage, vibration, and nasopharyngeal aspira-
tion twice a day. The control group received only nasopharyn-
geal aspiration. The end points were length of hospital stay and a 
severity score constructed out of five clinical variables: respiratory 
rate, heart rate, lung auscultation, and accessory muscle use. A 
physiotherapist who was unaware of the intervention given eval-
uated each participant. The mean age of the participants was 2.8 
months, 65.5% were boys and 34.4% girls. Overall, 78.1% were 
positive with RSV.

Risk of bias in included studies

Webb (Webb 1985) performed a random allocation of the inter-
vention. The physicians that assessed clinical outcomes were in-
tended to be blinded to the treatment status. The clinical assess-
ment was made at a fixed time each day. Sample size was not de-
scribed.

Nicholas (Nicholas 1999) had also randomly allocated patients to 
the intervention. The original paper did not state if the clinical 
status was assessed in a blinded fashion, and sample size was not 
calculated.

Bohe (Bohe 2004) was similar to the other two studies. Patients 
were randomly allocated, clinical status was assessed in a blinded 
fashion, and assessment was made at a fixed time each day: at least 
one hour after the chest physiotherapy.

The overall quality in relation to randomisation, allocation con-
cealment and outcome assessment was good. The main flaws of 
the studies were inadequate reporting of results, lack of estimation 
of sample size, and the use of clinical scores that were not properly 
validated.

Effects of interventions

Primary outcomes

Respiratory parameters

Studies did not evaluate oxygen saturation levels or transcutaneous 
PCO₂ as an outcome measure comparing intervention and control 
groups.
**Change in status of severity of bronchiolitis**

Nicholas and Webb (Nicholas 1999; Webb 1985) assessed this outcome using the clinical score described above. In the Webb (Webb 1985) study the clinical score was similar in both groups at baseline and on each of the first five days of assessment at the hospital. In the control group the median score on admission was 12 (range 4 to 24) in 46 patients and in the physiotherapy group the median score was 10 (range 4 to 22) in 44 patients. On the fifth day, 18 patients who remained in hospital had a median score of five (range 1 to 11) in the control group; 11 patients in the physiotherapy group had a median score of six (The range was not included in the original article. We contacted the trial author to ask for this information but they no longer have access to the files). There were no statistically significant differences between groups in relation to the clinical score or to the proportion who remained in hospital at day five.

Nicholas (Nicholas 1999) expressed clinical scores using means but did not report standard deviations. There were no differences in the admission mean clinical scores (intervention group 9.1 versus control group 10.9) between groups. The authors reported that clinical scores did not show any statistically significant differences between groups during the five-day trial. Data were provided on a graph but could not be extracted. Authors described this data in a figure where it was not possible to extract means and standard deviation. Bohe (Bohe 2004) used a different severity clinical score to the one used in the other two trials. The score was similar at baseline between the two groups; at day five or the day of discharge the score was 3.25 (standard deviation (SD) 1.27) in the physiotherapy group and 3.12 (SD 1.15) in the control group (mean difference (MD) 0.13, 95% CI -0.71 to 0.97).

**Secondary outcomes**

**Duration of oxygen supplementation**

Nicholas (Nicholas 1999) found that the mean number of hours with supplemental oxygen in the control group was 63 (range 2.3 hours to 128 hours) compared with 86 (range 36 hours to 148 hours) in the physiotherapy group. Differences were reported as not significant using a non-parametric test.

**Length of hospital stay**

Webb (Webb 1985) showed a median length of hospital stay of four days (range 1 day to 15 days) in the control group and a median of four days (range 2 days to 11 days) in the physiotherapy group, with no statistical difference between groups. In the Nicholas (Nicholas 1999) study the mean length of hospital stay was 6.6 days (range 2.3 days to 11.5 days) in the control group and 6.7 days (range 3 days to 9.5 days) in the physiotherapy arm. Authors did not find any statistically significant difference.

In the Bohe (Bohe 2004) study the mean length of hospital stay was 4 days (SD 2) in the treatment group and 3.9 days (SD 1.3) in the control arm. There was no statistically significant differences between them (MD 0.13, 95% CI -1 to 1.26).

**Use of bronchodilators and steroids**

This outcome was not reported in the trials.

**Adverse events**

None of the trials reported adverse events. Bohe (Bohe 2004) reported that one child in the control group was withdrawn from the study because he developed a basal atelectasia.

**Subgroup analysis**

Nicholas (Nicholas 1999) performed a subgroup analysis between patients who had more than 10 points on the baseline clinical score and those with a baseline clinical score below 9.5. There were no differences between the physiotherapy and control groups in this subgroup analysis.

**DISCUSSION**

The rationale for the use of chest physiotherapy in infants with acute bronchiolitis is that it will enhance clearance of secretions and improve oxygenation parameters. Those who are against its routine use claim that it might cause distress to the infant and the benefits are not substantial. The use of chest physiotherapy in the treatment of acute bronchiolitis varies among countries and institutions. While in some countries it is standard practice and doctors feel unethical if they do not provide this practice, in other countries it is not standard practice and physiotherapists are not part of the regular staff taking care of these infants. The evidence for and against its use is weak. The three trials we analysed in this systematic review did not support the use of chest physiotherapy using percussion and vibration techniques in acute bronchiolitis. The question is whether these trials are robust enough to address this question or whether further research is needed.

Unfortunately it was not possible to pool the data from the trials since they were summarised using different measures. Pooling the data would have added sample size, diminishing the probability of a type II error. There were two main outcomes evaluated in the three trials: length of hospital stay and clinical scores. The length of hospital stay result is unlikely to be the cause of a lack of power since Nicholas (Nicholas 1999) and Webb (Webb 1985) have adequate sample sizes to find at least one day’s difference between the groups. In the case of the change of clinical score, lack of power could be a possible explanation considering that the authors did
not clearly state the magnitude of effect they looked for in this outcome. Outcome selection is a key issue when addressing the efficacy of chest physiotherapy. Length of hospital stay is unlikely to be decreased by the use of chest physiotherapy. Bronchiolitis is a self-limiting disease and usually the patient is discharged between day three and day four. It is unlikely that chest physiotherapy will change the evolution of the disease. The clinical status assessment using well-validated instruments, therefore, seems a more valid outcome.

Another methodological issue in the trials was the lack of a valid placebo. Since the trials had a non-intervention group, the researchers would have been expected to establish an outcome assessment procedure that prevented bias. The main outcomes in the three trials were clinical status, length of hospital stay and, in the case of Nicholas (Nicholas 1999), oxygen requirements. However, clinical assessment blinding was not clearly described. Although the selection of an appropriate placebo is an important point for future research it does not seem to have had a relevant impact on the results observed in the included trials. However, for future research it seems relevant to perform a blinded outcome assessment.

An important issue in any intervention assessment is safety. None of the trials included in this review reported adverse events. Bohe (Bohe 2004) reported that one patient in the control arm withdrew from the study because he developed an atelectasis. Adverse events reported in the literature are a brain lesion (encephaloclastic porencephaly (ECPE)) in extremely pre-term infants, and rib fractures. The brain lesion was suggested in a retrospective case-control study by Harding (Harding 1998) but in later larger studies (Beeby 1998; Knight 2001) it was not observed. Some observational studies in the literature suggest an association between rib fractures and chest physiotherapy (Chalumeau 2002). Until more evidence arises on the association of chest physiotherapy and rib fractures, it would be advisable that those centres that use chest physiotherapy regularly perform surveillance in vulnerable infants.

Currently, there are two different approaches to chest physiotherapy: one relies on percussion and vibration techniques; and the other acts through the passive acceleration of expiratory flux, with the goal being to trigger coughing and help to move secretions. This last technique is widely used in France. It is to be noted that all the trials included in this review applied percussion and vibration techniques and thus the conclusions derived from this review may not be applicable to gentler approaches to physiotherapy. In the first publication of this review we identified two ongoing trials assessing the efficacy of chest physiotherapy in acute bronchiolitis (Gajdos 2004; Galvany 2004). Both of these trials were evaluating the expiratory forced technique and their results could cast some light on the efficacy and safety of these techniques. In 2006 we contacted Gajdos 2004 and Galvany 2004. Both trials are still ongoing at the moment of this update.

The use of chest physiotherapy is not recommended in published clinical guidelines (González 2001; Perlstein 1999). These clinical guidelines are based on the first two trials (Nicholas 1999; Webb 1985) and expert recommendations. The University of Cincinnati developed and tested a clinical guideline for the treatment of bronchiolitis where chest physiotherapy was not recommended for acute bronchiolitis. The use of chest physiotherapy (among others therapies) was reduced after the implementation of the guideline, while outcomes (length of hospital stay, mortality, oxygen requirements, admission to intensive care units) has remained unchanged (Perlstein 1999). In France, the use of chest physiotherapy in acute bronchiolitis is recommended by expert consensus (Beauvois 2001; Consensus 2001; Delauna 1998).

In conclusion, vibration and percussion techniques have not been shown to reduce length of hospital stay in acute bronchiolitis or to improve a severity clinical score. Further research is needed to evaluate other types of physiotherapy and it is essential that authors choose their outcome measures accurately and state in advance the benefits they expect to gain with the intervention.

A U T H O R S’ C O N C L U S I O N S

Implications for practice

Based on three trials, chest physiotherapy using percussion and vibration techniques could not be recommended for hospitalised infants with acute bronchiolitis.

Implications for research

For future research, several issues need to be addressed. Firstly, which type of physiotherapy (if indeed there is one) is effective? The acceleration of expiratory flux deserves further clinical research. The use of chest physiotherapy on an outpatient basis also needs to be evaluated. Another important concern is the lack of a valid placebo for chest physiotherapy. In cases where the use of placebo is complex, outcome assessments need to be as unbiased as possible and clearly reported. The best way to do this is to use a blinded observer.

Outcome selection also deserves further thought. Length of hospital stay does not seem to be an appropriate end point. Bronchiolitis is a self-limiting disease and usually the patient is discharged between days three and four. It’s unlikely that chest physiotherapy will change the evolution of the disease. However, we would expect the infant to go through the process as undisturbed as possible. The way in which discomfort is measured is the key issue. The most useful clinical severity scores are probably those that measure respiratory effort, oxygen saturation, and oxygen requirements (Wainwright 2003); and those that have prior psychometric validation data.
Finally, adverse events such as rib fractures need to be surveyed in centres where chest physiotherapy is a common procedure.

ACKNOWLEDGEMENTS

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REFERENCES

References to studies included in this review

Bohe 2004 [published data only]

Nicholas 1999 [published data only]

Webb 1985 [published data only]
Webb MS, Martin JA, Cartlidge PH, Ng YK, Wright NA. Chest physiotherapy in acute bronchiolitis. *Archives of Disease in Childhood* 1985;60:1078–9.

References to studies excluded from this review

Belcastro 1984 [published data only]

Bernard-Narbonne 2003 [published data only]

Postiaux 2004 [unpublished data only]

Quitell 1988 [published data only]

References to ongoing studies

Gajdos 2004 [unpublished data only]
Chest physiotherapy for acute bronchiolitis. Ongoing study September 2004

Paris, France.

Galvany 2004 [unpublished data only]
Chest physiotherapy for acute bronchiolitis. Ongoing study November 2003

Pilot study enrolled 30 participants.

Additional references

Beauvois 2001

Beeby 1998

Chalumeau 2002
**Consensus 2001**


**Delauna 1998**


**Dickersin 1994**


**Galiano 2004**


**González 2001**


**Harding 1998**


**Holman 2003**


**Kellner 1998**


**Knight 2001**


**Mc Millan 1994**


**Patel 2004**


**Perlstein 1999**


**Roosvelt 1996**


**Spencer 1996**


**Videla 1998**


**Wainwright 2003**


**Wallis 1999**


**Welliver 2003**


* Indicates the major publication for the study
### Characteristics of included studies [ordered by study ID]

#### Bohe 2004

| Methods | Patients were randomly allocated to control and intervention  
<table>
<thead>
<tr>
<th></th>
<th>Children were assessed every evening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>Infants admitted to the hospital with a clinical diagnosis of acute bronchiolitis. 16 were allocated to the control group and 16 to the intervention arm</td>
</tr>
<tr>
<td>Interventions</td>
<td>Vibration and postural drainage techniques twice a day</td>
</tr>
</tbody>
</table>
| Outcomes | Length of stay (days): 4 +/- 2 (intervention) 3.87 +/- 1.3 (control)  
|          | Clinical score |
| Notes | One patient in the intervention group was withdrawn after developing atelectasia |

#### Risk of bias

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors’ judgement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>D - Not used</td>
</tr>
</tbody>
</table>

#### Nicholas 1999

<table>
<thead>
<tr>
<th>Methods</th>
<th>Participants were randomly allocated to control and treatment groups using a random sequence number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>Infants admitted to the hospital with a clinical diagnosis of acute bronchiolitis and with respiratory distress severe enough that required nasogastric tube feeding or intravenous fluids. 24 were allocated to control group and 26 to treatment. Mean age of control group: 3.2 (range 0.4 to 8.3); intervention group 2.4 (range 0.4 to 6.9). RSV positive: control 79%, intervention 85%</td>
</tr>
</tbody>
</table>
| Interventions | Vibration and postural drainage techniques twice a day  
|                | Physiotherapy arm: participant was treated on the physiotherapist’s knee, percussion and vibration lying on right side, lying on left side and sitting; suction performed after on each side, if necessary, until clear; no oxygen required during treatment  
|                | Modifications were allowed if participant did not tolerate the procedure. Oxygen was allowed depending on infant tolerability |
| Outcomes | Clinical score: data not reported  
|          | Length of stay (days): mean 6.6 in control (2.3 to 11.5) and 6.7 (3 to 9.5) in intervention groups  
|          | Nasogastric feeds: mean in control 92 hours (range 8 to 225) and in intervention group 86 (range 36 to 148) |
| Notes | The study ended at five days  
|       | Authors did not report the standard deviation |
### Webb 1985

**Methods**

Children with clinical diagnosis of acute bronchiolitis were randomly allocated to chest physiotherapy or control. During five days they were assessed using a severity clinical score. There was a follow up after two weeks at the outpatient clinic.

**Participants**

- 90 Infants admitted with clinical diagnosis of acute bronchiolitis. Mean age 46 months (range 0.5 to 15)
- 69% had respiratory syncytial virus
- 36% had a first degree family history of atopy
- 66% had smokers in the household

**Interventions**

- Chest physiotherapy comprising standard techniques applied by a trained paediatric physiotherapist
  - They performed chest percussion with a cupped hand for three minutes in each of five postural drainage positions followed by assisted coughing or gentle oropharyngeal suction twice a day

**Outcomes**

- Length of stay (days): control group 4 (range 1 to 15) and intervention 4 (range 2 to 11)
- Clinical score at day five: control group 5 (range 1 to 11) and intervention 6 (range 3 to 10)
- Clinical score at day one: control group 10 (range 2 to 27) and intervention 7 (range 2 to 24)

**Notes**

Authors did not report mean and standard deviation of the mean. Results were expressed as median values and range.

### Risk of bias

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors’ judgement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation concealment?</td>
<td>Unclear</td>
<td>B - Unclear</td>
</tr>
</tbody>
</table>

### Characteristics of excluded studies

**[ordered by study ID]**

<table>
<thead>
<tr>
<th>Study</th>
<th>Reason for exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belcastro 1984</td>
<td>Not an RCT. This was a pilot study conducted with 12 participants. Trialists intended to compare osteopathic manipulative treatment versus postural drainage but the study was not designed as a clinical trial</td>
</tr>
<tr>
<td>Bernard-Narbon 2003</td>
<td>Before-and-after study. Twenty infants less than 30 weeks. (mean 9, SD 7). Patients received mechanical ventilation. Intervention: forced expiration technique. Short-term outcomes: oxygen saturation rise from 94.5 +/- 3.8 to 97.5 +/- 10.5.</td>
</tr>
</tbody>
</table>
Inspiratory tidal volume: 55.4 +/- 16 to 63.6 +/- 20.
Expiratory tidal volume: 53.15 +/- 16 62.3 +/- 21.

Postiaux 2004
Not an RCT and the outcome assessment was not blinded.
19 infants (mean 7.75, SD 6.6 months) were evaluated before and after “Experation Lente Prolongee” and toux provoque.
The severity clinical score, O2 saturation and heart rates improved after the intervention. All of these parameter changes were statistically significant

Quitell 1988
Before-and-after study. Thirteen infants between 2 and 6 weeks of age entered in the study. Short-term outcomes

Characteristics of ongoing studies [ordered by study ID]

Gajdos 2004

<table>
<thead>
<tr>
<th>Trial name or title</th>
<th>Chest physiotherapy for acute bronchiolitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methods</td>
<td></td>
</tr>
<tr>
<td>Participants</td>
<td>Patients less than two years old</td>
</tr>
<tr>
<td>Interventions</td>
<td>Two chest physiotherapy techniques</td>
</tr>
<tr>
<td>Outcomes</td>
<td></td>
</tr>
<tr>
<td>Starting date</td>
<td>September 2004</td>
</tr>
<tr>
<td></td>
<td>Paris, France</td>
</tr>
<tr>
<td>Contact information</td>
<td><a href="mailto:vincent.gajdos@abc.ap-hop-paris.fr">vincent.gajdos@abc.ap-hop-paris.fr</a></td>
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<tr>
<td>Notes</td>
<td>information by e-mail correspondence</td>
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Galvany 2004

<table>
<thead>
<tr>
<th>Trial name or title</th>
<th>Chest physiotherapy for acute bronchiolitis</th>
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</thead>
<tbody>
<tr>
<td>Methods</td>
<td></td>
</tr>
<tr>
<td>Participants</td>
<td>Hospitalised patients. Less than two years old. Virus syncytial respiratory positive</td>
</tr>
<tr>
<td>Interventions</td>
<td>Forced expiratory technique</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Length of stay</td>
</tr>
<tr>
<td></td>
<td>Severity clinical score</td>
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</tbody>
</table>
| Starting date | November 2003  
Pilot study enrolled 30 participants |
<table>
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</thead>
<tbody>
<tr>
<td>Contact information</td>
<td><a href="mailto:nurialopez@sumi.es">nurialopez@sumi.es</a></td>
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<tr>
<td>Notes</td>
<td></td>
</tr>
</tbody>
</table>
This review has no analyses.

**APPENDICES**

**Appendix 1. EMBASE search strategy**

EMBASE (WebSpirs)

#1 explode 'bronchiolitis-' / all subheadings in DEM,DER,DRM,DRR
#2 (bronchiolitis in ti) or (bronchiolitis in ab)
#3 explode 'Respiratory-syncytial-pneumovirus' / all subheadings in DEM,DER,DRM,DRR
#4 (respiratory syncytial virus* or RSV) in ti
#5 #1 or #2 or #3 or #4
#6 explode 'physiotherapy-' / all subheadings in DEM,DER,DRM,DRR
#7 (physiotherapy in ti) or (physiotherapy in ab)
#8 explode 'postural-drainage' / all subheadings in DEM,DER,DRM,DRR
#9 (postural drainage in ti) or (postural drainage in ab)
#10 (chest percussion in ti) or (chest percussion in ab)
#11 explode 'vibration-' / all subheadings in DEM,DER,DRM,DRR
#12 (vibration in ti) or (vibration in ab)
#13 (chest shaking in ti) or (chest shaking in ab)
#14 (directed coughing in ti) or (directed coughing in ab)
#15 (forced exhalation in ti) or (forced exhalation in ab)
#16 explode 'breathing-exercise' / all subheadings in DEM,DER,DRM,DRR
#17 (breathing exercise* in ti) or (breathing exercise* in ab)
#18 #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17
#19 #5 and #18

**WHAT’S NEW**

Last assessed as up-to-date: 10 October 2006.

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Description</th>
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<tbody>
<tr>
<td>14 May 2008</td>
<td>Amended</td>
<td>Converted to new review format.</td>
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**HISTORY**

Protocol first published: Issue 3, 2004

Review first published: Issue 2, 2005

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>9 June 2004</td>
<td>New search has been performed</td>
<td>Searches conducted.</td>
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</tbody>
</table>

**CONTRIBUTIONS OF AUTHORS**

Carla Perrotta (CP) wrote the protocol.

Zulma Ortiz (ZO) and Marta Roque (MR) both commented on and corrected the protocol.

Dr Mariano Gallo contributed to the protocol development.

Marta Roque and Carla Perrotta extracted the data for the review.

Carla Perrotta updated the review.

**DECLARATIONS OF INTEREST**

None known.

**SOURCES OF SUPPORT**

**Internal sources**

- Iberoamerican Cochrane Center, Barcelona, Spain.
- UCD School of Public Health and Population Sciences, Ireland.

**External sources**

- Instituto de Salud Carlos III Subdireccion General de Investigacion Sanitaria (01/A060), Spain.

**NOTES**

In June 2006 we updated the electronic searches. We received, through personal communication, one longitudinal study with 19 patients. We have added this study as an excluded trial, given that it is not a clinical trial. However, it is an important study that shows the safety and probable efficacy of the “expiration lente prolongee technique”. As we stated in the first publication of this review, further clinical trials are needed to evaluate the efficacy of expiratory techniques through controlled clinical trials.
INDEX TERMS

Medical Subject Headings (MeSH)
Acute Disease; Bronchiolitis [*therapy]; Drainage, Postural; Infant, Newborn; Oxygen Inhalation Therapy; Percussion [*methods]; Randomized Controlled Trials as Topic; Respiratory Therapy [*methods]; Vibration [*therapeutic use]

MeSH check words
Humans; Infant