Bronchopulmonary hygiene physical therapy for chronic obstructive pulmonary disease and bronchiectasis (Review)

Jones AP, Rowe BH

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ABSTRACT

Background
Bronchopulmonary hygiene physical therapy is a form of chest physical therapy including chest percussion and postural drainage to remove lung secretions. These are applied commonly to patients with both acute and chronic airway diseases. Despite controversies in the literature regarding its efficacy, it remains in use in a variety of clinical settings. The various forms of this therapy are labour intensive and need to be evaluated.

Objectives
The objective of this review was to assess the effects of bronchial hygiene physical therapy in people with chronic obstructive pulmonary disease and bronchiectasis.

Search strategy
We searched the Cochrane Airways Group trials register and reference lists of articles up to January 2005. We also wrote to study authors.

Selection criteria
Randomised trials in which postural drainage, chest percussion, vibration, chest shaking, directed coughing or forced exhalation technique was compared to other drainage or breathing techniques, placebo or no treatment.

Data collection and analysis
Two reviewers applied the inclusion and exclusion criteria on masked publications independently. They assessed the trial quality independently. Only data from the first arm of crossover trials were included.

Main results
The seven included trials involved six comparisons and a total of 126 people. The trials were small and not generally of high quality. The results could not be combined as trials addressed different patient groups and outcomes. In most comparisons, bronchial hygiene physical therapy produced no significant effects on pulmonary function, apart from clearing sputum in chronic obstructive pulmonary disease and in bronchiectasis.

An update search carried out in January 2005 did not identify any new studies for inclusion.

Authors’ conclusions
There is not enough evidence to support or refute the use of bronchial hygiene physical therapy in people with chronic obstructive pulmonary disease and bronchiectasis.

PLAIN LANGUAGE SUMMARY

Not enough evidence to show whether there are benefits from chest physiotherapy to remove secretions from the lungs of people with COPD or bronchiectasis.
People with acute and chronic airway diseases often have secretions building up in their lungs. Bronchopulmonary hygiene physical therapy (BHPT) is a form of chest physical therapy that uses physical forces such as gravity and chest tapping to remove secretions from the lungs. The therapy is labour intensive. This review of trials found there was not enough evidence to show the benefit of BHPT for people with airway diseases such as chronic bronchitis or bronchiectasis. More research is needed.

**BACKGROUND**

Bronchopulmonary hygiene physical therapy (BHPT), a form of chest physical therapy, uses physical forces, such as gravity and chest percussion to remove lung secretions from patients with various conditions. Whilst there is a variety of manual techniques under this umbrella term, they are commonly applied to patients with both acute and chronic airway diseases. Despite controversies in the literature regarding the efficacy of BHPT, it continues to be used in a variety of clinical settings. A 1994 Delphi study (Cullen 1994) concluded that clarifying the effect of BHPT should be a research priority.

There are a number of reasons why the various BHPT regimens should be subjected to rigorous review. First, BHPT is labor intensive and, therefore, expensive. Second, it poses some potential risks to patients. For example, its use may result in decreased arterial oxygen tension (Connors 1980) and pulmonary functions (Campbell 1975) in some patients. Finally, certain techniques may be more effective than others, and this needs investigation.

To date, only one systematic review on BHPT has been conducted. (Thomas 1995). This review was limited to patients with cystic fibrosis. A systematic review of the literature may clarify the effects of this therapy for patients with COPD and bronchiectasis.

**OBJECTIVES**

The aim of this review was to estimate the effects of BHPT, as applied to patients with COPD (e.g., chronic bronchitis and emphysema - acute and chronic) and bronchiectasis.

Specifically, we sought to assess the effects of BHPT on these patient groups using the following outcomes: Pulmonary function variables; such as vital capacity, timed forced vital capacity (FEV1, FEV1/FVC), blood gases, sputum production, morbidity and mortality. Also, we sought to determine effects of BHPT on adverse outcomes, such as arterial desaturation, arrhythmias, and respiratory distress. Finally, we sought to identify any differences between manual and mechanical methods for administering BHPT.

**CRITERIA FOR CONSIDERING STUDIES FOR THIS REVIEW**

**Types of studies**

To be eligible, studies had to be randomized, controlled trials (RCTs), with or without blinding.

**Types of participants**

Patients with chronic obstructive pulmonary diseases (COPD, emphysema, chronic bronchitis) or bronchiectasis.

**Types of intervention**

INTERVENTIONS: Any of the following interventions or combinations thereof: manual interventions, such as postural drainage, chest percussion, vibration, chest shaking, directed coughing, or forced exhalation technique. CONTROLS: No intervention, placebo, coughing; mechanical interventions, such as positive-expiratory pressure and mechanical vibration.

**Types of outcome measures**

Studies reporting any of the following short or long-term outcomes were eligible:

1) Pulmonary functions: Absolute or percent predicted forced vital capacity (FVC), forced expiratory volume in one second (FEV1) peak expiratory flow rate (PEFR).
2) Oxygenation: Arterial oxygen tension or saturation;
3) Pulmonary clearance: Sputum production, radio aerosol clearance
4) Adverse reactions: such as arrhythmia, tachypnoea
4) Symptoms: such as dyspnea
5) General outcomes: Resolution of chest radiograph, mortality, length of hospital stay.

**SEARCH METHODS FOR IDENTIFICATION OF STUDIES**

See: methods used in reviews.

Randomized controlled trials were identified from the Cochrane Airways Review Group Register (asthma, wheezing, bronchiectasis, and COPD).

Search of this register was completed using the following terms:

a) Postural drainage OR
b) Physical therapy OR
c) Percussion OR
d) Physiotherapy

Randomised controlled trials were identified in the register using the following search strategy: (placebo* OR trial* OR random* OR double-blind OR double blind OR single-blind OR single blind OR controlled study OR comparative study).

Reference lists of all available primary studies and review articles were reviewed to identify potentially relevant citations. Finally, the first author of each study was contacted to verify data, and queried on the existence of unpublished trials.

METHODS OF THE REVIEW

One reviewer screened the original collection of abstracts and the reference lists of trials and previous reviews to identify potentially relevant trials for this review. These trials were retrieved, and two reviewers independently applied the inclusion/exclusion criteria to those trials. Publications were masked as to source and authorship.

Two reviewers assessed the methodological quality of the RCTs using a modified version of the 5 point scoring instrument proposed by Jadad (Jadad 1996). One point is allocated for randomisation, blinding and description of withdrawals and dropouts; an extra point can be added for methods of randomisation and blinding that are well described and adequate. Studies which use a clearly inadequate method of randomisation or blinding (such as alternating patients) lose the point allocated. The maximum score is five points and studies scoring below three points are usually regarded as being of low methodological quality. The methodological quality of the included trials was also assessed with particular emphasis on the allocation concealment, which was ranked using the Cochrane approach: Grade A: Adequate concealment
Grade B: Uncertain
Grade C: Clearly inadequate concealment

Simple agreement and weighted kappa statistics were used to measure agreement between evaluators using both assessment methods. We established consensus on quality score by discussion. No trial was excluded on the basis of quality score.

Data were extracted by one reviewer, then verified by the other. Cochrane Review Manager, Windows (Version 3.0) and Lotus® 1-2- 3 (Release 4) were used to compile and analyze the data. Where trials examined both early and late pulmonary function variables, those measured later were used for this review because we considered the late effects more clinically relevant. All of the dependent variables were continuous, so we used weighted mean differences (WMD) with 95% confidence intervals for effects of individual studies. Lung function data, PO2 and sputum clearance were entered as negative values to conform to the Cochrane convention whereby effects that favour the treatment under review move to the left.

There were two specific designs in this review: Parallel group and crossover. There is no agreement on the approach to the meta-analysis of crossover trials, so we elected to use only the first arm of the data in our analysis. The signs of effects are reported to reflect whether they represent clinical improvement or deterioration on the graphs.

The dependent variables from the trials were categorized into three specific groups for our analysis. These were:

- Pulmonary function FEV1/FVC, PEFR, FVC
- Oxygenation PaO2
- Pulmonary clearance sputum production, radio aerosol clearance

Three of the trials examined radio aerosol clearance from different portions of the lung. We used only clearance from the total lung as our indicator of radio aerosol clearance as the clinically relevant measure.

DESCRIPTION OF STUDIES

Designs
All of the trials used a crossover design with the exception of one trial that compared separate groups [Mohsenifar 1985].

Population
The included trials were conducted in Canada, the UK, the USA and Sweden, respectively. The largest trial studied 35 patients, the smallest studied 6. The diagnostic groups included stable and acute chronic bronchitis, COPD, bronchiectasis. One of the trials [Sutton 1983] included several patients with cystic fibrosis. Subjects for two of the trials were hospital inpatients, while the remaining trials reported studying outpatients or were unclear as to the setting.

Interventions
The trials tested the effects of manual and mechanical bronchopulmonary hygiene, including postural drainage, percussion, vibration and positive expiratory pressure. Generally, the trials tested the effects of single therapeutic sessions, rather than over a therapeutic regimen.

The interventions listed in the analyses are identified as follows:

- FET Forced exhalation
- MV Mechanical vibration
- P Percussion
- PD Postural drainage
- PEP Positive end expiratory pressure
- NI No intervention

Outcomes
Dependent variables included physiologic measures, such as FEV1, FVC and PaO2. Pulmonary clearance was measured by sputum production and radio aerosol clearance. None of the trials examined variables related to morbidity, such as hospital length of stay, fever, chest radiography.
The overall quality of the studies was poor. Using the Cochrane system for categorizing trials with regard to allocation concealment, the simple agreement and weighted Kappa were both 1.0. Only one trial provided evidence of allocation concealment [Newton 1978]; all others were designated as ‘unclear’.

Using Jadad’s system for trial quality, simple agreement and weighted Kappa were 0.31 and 0.26, respectively. Disagreements were resolved by consensus. The overall quality of the trials was poor, the mean Jadad score of the trials was 1.4. The majority of the trials did not describe their methods of randomization and did not address any form of blinding.

RESULTS

The search of the Cochrane Airways Group database identified 95 potential trials and reviews. We located 4 additional potential trials on reference lists of retrieved articles. Based on the abstracts, forty-seven trials were retrieved and evaluated for inclusion. Forty of these did not meet the inclusion criteria (please see list of excluded studies). This review is based on a total of seven RCTs. An update search conducted in January 2005 did not identify any new studies for inclusion in the review.

Three of the seven authors of included trials responded to written requests for information. The low response rate was not surprising; the oldest included trial was published in 1978, and the oldest trial considered for inclusion was published in 1964. The queries resulted in no additional potentially relevant trials.

Within the seven included trials, there were six separate comparisons of interest, which addressed different dependent variables. In general, trials could not be combined statistically, because those that addressed similar interventions used disparate patient groups or dependent variables. For example, there were four trials where treatment compared BHPT to no intervention. Two of these reported pulmonary function outcomes, but one examined patients with stable COPD, the other patients with acute exacerbations of COPD. Two other trials compared BHPT with no intervention used patients with bronchiectasis. These studies also measured pulmonary clearance variables including sputum production and radioisotope clearance. The results are discussed in terms of the population addressed in each trial.

ACUTE EXACERBATIONS OF COPD:

One study examined the effects of BHPT on acute exacerbations of COPD [Newton 1978]. This study found no significant effects for BHPT on pulmonary function variables or oxygenation.

CHRONIC COPD:

May [1979] used a heat lamp as a placebo to test the effects for BHPT on the pulmonary function of patients with stable COPD. This trial found no significant effects on pulmonary function or PaO2; but found favourable effects on sputum production for BHPT. Interestingly, the subjects in this trial reported greater subjective improvement for the heat lamp placebo.

Another trial [Oldenburg 1979] examined the effects of postural drainage, exercise and cough on pulmonary clearance, as measured by radioisotope clearance in patients with chronic bronchiectasis. This trial found that postural drainage alone did not improve pulmonary clearance, as compared to no intervention.

BRONCHIECTASIS:

Two trials [Bateman 1981; Sutton 1983] tested the effects of postural drainage and percussion and postural drainage and forced expiration technique, respectively, on patients with bronchiectasis. Sutton’s sample was contaminated with one asthmatic and four patients with cystic fibrosis. Both of these trials found that BHPT improved pulmonary clearance, as measured by sputum production and radioisotope clearance. Sutton reported, in the text of the paper, that there were no significant changes in PEFR following treatments, but provided no quantitative results.

MECHANICAL VS MANUAL TECHNIQUES

Two trials addressed the issue of mechanical, versus manual techniques. The first [Mohsenifar 1985], compared manual percussion and postural drainage with mechanical vibration, finding no significant differences between these techniques with respect to their effects on pulmonary function variables or PaO2. The second [Olsen 1994] compared postural drainage and forced exhalation technique with positive expiratory pressure and forced exhalation. Olsen concluded that postural drainage combined with forced exhalation technique increased radio-aerosol clearance more than positive expiratory pressure combined with forced exhalation. However, analysis of Olsen’s data found that the confidence intervals of those effects include the zero value.

No trials compared mechanical percussion with manual percussion. None of the trials reported clinical outcomes related to mortality or morbidity. One trial [Mohsenifar 1985] reported on incidence of nausea and vomiting associated with BHPT. This was the only report of an adverse event.

DISCUSSION

This systematic review examined the use of BHPT in the management of acute and chronic bronchiectasis, COPD and bronchiectasis. Despite an exhaustive search of available literature sources, only a small number of trials were identified. In addition, the quality of studies was poor. Finally, pooling of results was generally not possible due to differences in the types of populations, interventions and outcome measures in the included trials.
Whilst some research evidence does support increased sputum production and isotope clearance from the lung using BHPT, clinical benefits have not been clearly identified. In contrast to other reviews, we were unable to identify important clinical benefits from BHPT. From this review, there is insufficient data to support or refute the use of BHPT in these airway disorders.

METHODOLOGICAL LIMITATIONS:
1. The results of this review are based upon a total of only 126 patients (sample size ranges: 6-35). Trials identifying significant effects favouring BHPT compared to no intervention involved a total of 16 patients.
2. The quality of the included trials was poor. Thus, the quality of the overall recommendations must be considered in this context.
3. An important limitation in most of the studies was the selection criteria of the sample populations. In several instances, contamination occurred by mixing diagnostic groups.
4. Most BHPT regimens are applied over the course of a therapeutic period. However, many of the studies reported on outcomes following single BHPT treatments only. This limits the generalisability of these findings.
5. Outcome measures varied widely. There little investigation into the effects of BHPT on clinically important outcomes such as: pulmonary functions, symptoms, length of hospitalisation.
6. Most of the studies examined the effect of the BHPT in outpatient settings.
7. There is very limited information concerning benefit in subgroups defined in terms of severity.

AUTHORS' CONCLUSIONS

Implications for practice

1) Demonstrable beneficial effects of BHPT have been confined to sputum production and radio-aerosol clearance only.
2) The impact of BHPT on lung function is not clearly established from studies included in this review. No study found a significant beneficial effect on pulmonary function or PaO2.
3) It is not possible from the trials reviewed to identify specific patient subgroups that might benefit from BHPT.
4) Insufficient reporting in publications precludes any comments on the adverse effects or harm associated with BHPT.
5) In view of the lack of functional improvement and sample sizes of the trials, the research on BHPT is inconclusive. There is insufficient evidence to support or refute administration of BHPT to patients with acute and stable COPD, chronic bronchitis or bronchiectasis.

Implications for research

The findings of this systematic review leave many unanswered questions.
1) There is a need to conduct RCTs of sufficient power that examine the effects of the various forms of BHPT, both manual and mechanical.
2) These trials should be conducted in clearly defined patient groups, with adequate controls, randomization and blinding. In addition, such studies need to measure not only primary efficacy measures such as sputum production, radio-aerosol clearance and pulmonary function. They also should measure symptoms, exercise performance, health status (quality of life), recovery time and relapse rate.
3) There also is a need to examine various BHPT regimens, rather than a single treatment.

POTENTIAL CONFLICT OF INTEREST

None. The authors of this systematic review were not involved in the any of the primary research reported in this systematic review.

ACKNOWLEDGEMENTS

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External sources of support

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Internal sources of support

- University of Texas Health Science Center at San Antonio USA
- NHS Research and Development UK
REFERENCES

References to studies included in this review

Bateman 1981 [published data only]

May 1979 [published data only]

Mohsenifar 1985 [published data only]

Newton 1978 [published data only]

Oldenburg 1979 [published data only]

Olseni 1994 [published data only]

Sutton 1983 [published data only]

References to studies excluded from this review

Agoston 1968

Ambrosino 1981

Anthonisen 1964

Belcastro 1984

Boksha 1989

Boyce 1994

Castillo 1985

Cegla 1993

Cegla 1994

Christensen 1990

Christensen 1991

Clark 1986

Conway 1992

Craven 1974

Edenbrandt 1990

Feldman 1979

Foglio 1992
Gallon 1991

Hansen 1990
Hansen L, Warwick W. High-frequency chest compression system to aid in clearance of mucus from the lung. *Biomedical Instrumentation & Technology* 1990;24:289–94.

Hasani 1991

Kraszko 1973

Lorin 1971

Luttmann 1994

Marcq 1981

Mazzoco 1985

Nichols 1970

Pavia 1976

Peterson 1967

Pryor 1979

Rivington 1984

Sutton 1985

Toews 1984

Tonnesen 1982
Tonnesen P, Kelstrup M. Self-administered positive end expiratory pressure (PEEP) using a face mask as an alternative to conventional lung therapy. *Ugeskrift for Laeger* 1982;144:1532–6.

Vandchos 1986

Vandchos 1990

Vanhengstum 1988

Vanhengstum 1991

Wollmer 1985

Additional references
Campbell 1975

Connors 1980

Cullen 1994
### Jadad 1996


### Thomas 1995


*Indicates the major publication for the study

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#### TABLES

<table>
<thead>
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<th>Characteristics of included studies</th>
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<tr>
<td><strong>Study</strong></td>
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<td>Methods</td>
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<td>Participants</td>
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<tr>
<td>Notes</td>
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<tr>
<td>Allocation concealment</td>
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</table>

| **Study** | **May 1979** |
| Methods | Crossover trial with random order of interventions. |
| | Allocation method unspecified. |
| Interventions | Percussion, postural drainage, vibration, cough, vs.: |
| | 1) placebo (heat lamp) |
| | 2) cough |
| Outcomes | Sputum volume |
| | FEV1 (early) |
| | FEV1 (late) |
| | PEF early, |
| | PEF (late), |
| | FVC (early) |
| | FVC (late) |
Characteristics of included studies *(Continued)*

- FEF50 (early)
- FEF50 (late)
- PaO2 (early)
- PaO2 (late).

Notes: The data on sputum production were not usable, because published data in the abstract, table of results and text disagreed.

Adverse events = nausea, vomiting, headache

<table>
<thead>
<tr>
<th>Study</th>
<th>Methods</th>
<th>Participants</th>
<th>Interventions</th>
<th>Outcomes</th>
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<tbody>
<tr>
<td>Mohsenifar 1985</td>
<td>Randomized parallel group comparison- method of randomization, concealment unspecified.</td>
<td>Inclusion criteria: moderate sputum production, COPD, as determined by obstruction on pulmonary function testing. Exclusion criteria: coexistent medical problems; e.g., angina, neurologic deficits, orthopedic limitations. N = 20, male = 8, female = 12, age range 47-83, age mean = 68.7.</td>
<td>Percussion and postural drainage vs. mechanical vibration</td>
<td>FEV1% early, FEV% late, PEF early, PEF late, FVC early, FVC late, PaO2 early, PaO2 late</td>
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</table>

Notes: Allocation concealment B – Unclear

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<th>Study</th>
<th>Methods</th>
<th>Participants</th>
<th>Interventions</th>
<th>Outcomes</th>
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<tbody>
<tr>
<td>Newton 1978</td>
<td>Crossover trial with random order of interventions</td>
<td>Inclusion criteria: acute exacerbation of chronic bronchitis- increase in cough, breathlessness or sputum volume for more than 24 hours. Patients were non-responders to inhaled albuterol. N=33, gender and age unspecified.</td>
<td>Percussion, postural drainage, vibration, deep breathing vs. no intervention</td>
<td>FEV1 early, FEV1 late, FVC early, FVC late</td>
</tr>
</tbody>
</table>

Notes: Allocation concealment A – Adequate

<table>
<thead>
<tr>
<th>Study</th>
<th>Methods</th>
<th>Participants</th>
<th>Interventions</th>
<th>Outcomes</th>
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<tbody>
<tr>
<td>Oldenburg 1979</td>
<td>Crossover trial with random order of interventions. Allocation method unspecified.</td>
<td>Inclusion criteria: chronic bronchitis- cough and sputum production for 3 months over 3 years; could exercise at 70-75% maximal heart rate; refrained from cough during study period, unless instructed. N=8, male = 7, female = 1; age range 55-70, age mean 62.</td>
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Notes: Allocation concealment B – Unclear
| Interventions                          | Postural drainage, cough vs.: |
|                                     | 1) cough                      |
|                                     | 2) no intervention            |
| Outcomes                            | Radioaerosol retention in total lung |
|                                     | Radioaerosol retention in peripheral lung |
| Notes                               | Allocation concealment B – Unclear |

**Study**  
Olseni 1994

**Methods**  
Crossover trial with random order of interventions.  
Allocation method unspecified.

**Participants**  
Inclusion criteria: outpatients with chronic bronchitis- daily productive cough for 3 months of 2 years.  
N = 14, male = 8, female = 6; age mean = 57 (12)

**Interventions**  
Postural drainage, forced exhalation technique vs.  
positive expiratory pressure, forced exhalation technique

**Outcomes**  
Radioaerosol clearance from total lung  
Radioaerosol clearance from central lung  
Radioaerosol clearance from peripheral lung

**Notes**  
Sample contaminated with cystic fibrosis and asthma patients.  
Allocation concealment B – Unclear

**Characteristics of excluded studies**

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<tr>
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<th>Reason for exclusion</th>
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<tr>
<td>Ambrosino 1981</td>
<td>Inappropriate intervention</td>
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<tr>
<td>Anthonisen 1964</td>
<td>Not an RCT</td>
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<td>Belcastro 1984</td>
<td>Not an RCT; and inappropriate patient population</td>
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<td>Boksha 1989</td>
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<td>Boye 1994</td>
<td>Inappropriate intervention</td>
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<td>Conway 1992</td>
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<td>Craven 1974</td>
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<td>Edenbrandt 1990</td>
<td>Inappropriate intervention</td>
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<td>Feldman 1979</td>
<td>Not an RCT</td>
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<td>Foglio 1992</td>
<td>Retrospective study</td>
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<td>Gallon 1991</td>
<td>No control or mechanical arm</td>
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<td>Not an RCT</td>
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<td>Marcq 1981</td>
<td>Inappropriate intervention</td>
</tr>
<tr>
<td>Mazzoco 1985</td>
<td>Not an RCT</td>
</tr>
<tr>
<td>Nichols 1970</td>
<td>Inappropriate patient population</td>
</tr>
<tr>
<td>Pavia 1976</td>
<td>Inappropriate intervention</td>
</tr>
<tr>
<td>Peterson 1967</td>
<td>Unspecified intervention</td>
</tr>
<tr>
<td>Pryor 1979</td>
<td>Inappropriate patient population</td>
</tr>
<tr>
<td>Rivington 1984</td>
<td>Not an RCT</td>
</tr>
<tr>
<td>Sutton 1985</td>
<td>No control or mechanical arm</td>
</tr>
<tr>
<td>Toevs 1984</td>
<td>Inappropriate intervention</td>
</tr>
<tr>
<td>Tønnesen 1982</td>
<td>Inappropriate intervention</td>
</tr>
<tr>
<td>Vandschans 1986</td>
<td>Not an RCT</td>
</tr>
<tr>
<td>Vandschans 1990</td>
<td>Not an RCT</td>
</tr>
<tr>
<td>Vanhengstum 1988</td>
<td>Inappropriate intervention</td>
</tr>
<tr>
<td>Vanhengstum 1991</td>
<td>Inappropriate intervention</td>
</tr>
<tr>
<td>Wollmer 1985</td>
<td>No control or mechanical arm</td>
</tr>
</tbody>
</table>
## ANALYSES

### Comparison 01. P, PD versus placebo (stable COPD)

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 FEV1 120 min. post-treatment</td>
<td>1</td>
<td>70</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>-0.01 [-0.02, 0.00]</td>
</tr>
<tr>
<td>02 FVC 120 min. post-treatment</td>
<td>1</td>
<td>70</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>0.07 [0.05, 0.09]</td>
</tr>
<tr>
<td>03 PEFR 120 min. post-treatment</td>
<td>1</td>
<td>70</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>0.19 [0.15, 0.23]</td>
</tr>
<tr>
<td>04 PaO2 120 min. post-treatment</td>
<td>1</td>
<td>70</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>-1.00 [-1.40, -0.60]</td>
</tr>
<tr>
<td>05 Sputum production</td>
<td>1</td>
<td>70</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>-7.80 [-8.56, -7.04]</td>
</tr>
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### Comparison 02. P, PD versus NI (acute COPD)

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 FEV1 40 min post-treatment</td>
<td>1</td>
<td>66</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>0.00 [-0.18, 0.18]</td>
</tr>
<tr>
<td>02 VC 40 min post-treatment</td>
<td>1</td>
<td>66</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>0.00 [-0.44, 0.44]</td>
</tr>
<tr>
<td>03 PaO2 40 min. post-treatment</td>
<td>1</td>
<td>66</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>-0.20 [-0.66, 0.26]</td>
</tr>
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</table>

### Comparison 03. P, PD versus NI (bronchiectasis)

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Pulmonary clearance</td>
<td></td>
<td></td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>Totals not selected</td>
</tr>
</tbody>
</table>

### Comparison 04. FET, PD versus NI (bronchiectasis)

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Pulmonary clearance</td>
<td></td>
<td></td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>Subtotals only</td>
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</table>

### Comparison 05. PD versus NI (chronic bronchitis)

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>02 Radioisotope clearance</td>
<td>1</td>
<td>16</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>8.00 [5.05, 10.95]</td>
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</tbody>
</table>

### Comparison 06. P, PD versus MV (COPD)

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 FEV1/FVC% 40 min post-</td>
<td>1</td>
<td>20</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>2.00 [-7.80, 11.80]</td>
</tr>
<tr>
<td>treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02 PEFR 40 min post-treatment</td>
<td>1</td>
<td>20</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>0.50 [-0.12, 1.12]</td>
</tr>
<tr>
<td>03 FVC %pred 40 min post-</td>
<td>1</td>
<td>20</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>16.00 [-0.50, 32.50]</td>
</tr>
<tr>
<td>treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04 PaO2</td>
<td>1</td>
<td>20</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>0.00 [-7.89, 7.89]</td>
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</table>
Comparison 07. PD, FET versus PEP, FET (stable chronic bronchitis)

<table>
<thead>
<tr>
<th>Outcome title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radioisotope clearance</td>
<td>1</td>
<td>28</td>
<td>Weighted Mean Difference (Fixed) 95% CI</td>
<td>-5.00 [-16.71, 6.71]</td>
</tr>
</tbody>
</table>

**INDEX TERMS**

Medical Subject Headings (MeSH)
- Bronchiectasis [*therapy]; *Drainage, Postural; Lung Diseases, Obstructive [*therapy]; Physical Therapy Modalities [*methods]

McSH check words
- Humans

**COVER SHEET**

**Title**
Bronchopulmonary hygiene physical therapy for chronic obstructive pulmonary disease and bronchiectasis

**Authors**
Jones AP, Rowe BH

**Contribution of author(s)**
AJ: Protocol initiation and development, assessed search results, data extraction, entry and analysis, interpretation and write-up
BH: Protocol initiation and development, assessed search results, data extraction, entry and analysis, interpretation and write-up, editorial support throughout

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**Date new studies found but not yet included/excluded**
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Information not supplied by author

**Date authors’ conclusions section amended**
Information not supplied by author

**Contact address**
Dr Arthur Jones
3224 Sarmiento Drive
Bensalem
PA
19020
USA
E-mail: jonesapjr@comcast.net; jonesapjr@yahoo.com
Tel: + 1 215 752 3165
Fax: + 1 215 752 1081
### Analysis 01.01. Comparison 01 P, PD versus placebo (stable COPD), Outcome 01 FEV1 120 min. post-treatment

**Review:** Bronchopulmonary hygiene physical therapy for chronic obstructive pulmonary disease and bronchiectasis  
**Comparison:** 01 P, PD versus placebo (stable COPD)  
**Outcome:** 01 FEV1 120 min. post-treatment

<table>
<thead>
<tr>
<th>Study</th>
<th>PPD</th>
<th>Placebo</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
<td>95% CI (%)</td>
<td>95% CI (%)</td>
</tr>
<tr>
<td>May 1979</td>
<td>35  -0.06 (0.03)</td>
<td>35  -0.05 (0.02)</td>
<td>-0.01</td>
<td>[-0.02, 0.00]</td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>35</td>
<td>35</td>
<td>100.0</td>
<td>0.07</td>
<td>[0.05, 0.09]</td>
</tr>
</tbody>
</table>

Test for heterogeneity: not applicable  
Test for overall effect $z=1.64$ $p=0.1$

### Analysis 01.02. Comparison 01 P, PD versus placebo (stable COPD), Outcome 02 FVC 120 min. post-treatment

**Review:** Bronchopulmonary hygiene physical therapy for chronic obstructive pulmonary disease and bronchiectasis  
**Comparison:** 01 P, PD versus placebo (stable COPD)  
**Outcome:** 02 FVC 120 min. post-treatment

<table>
<thead>
<tr>
<th>Study</th>
<th>PPD</th>
<th>Placebo</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
<td>95% CI (%)</td>
<td>95% CI (%)</td>
</tr>
<tr>
<td>May 1979</td>
<td>35  -0.09 (0.03)</td>
<td>35  -0.16 (0.04)</td>
<td>0.07</td>
<td>[0.05, 0.09]</td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>35</td>
<td>35</td>
<td>100.0</td>
<td>0.07</td>
<td>[0.05, 0.09]</td>
</tr>
</tbody>
</table>

Test for heterogeneity: not applicable  
Test for overall effect $z=8.28$ $p<0.00001$
### Analysis 01.03. Comparison 01 P, PD versus placebo (stable COPD), Outcome 03 PEFR 120 min. post-treatment

**Review:** Bronchopulmonary hygiene physical therapy for chronic obstructive pulmonary disease and bronchiectasis

**Comparison:** 01 P, PD versus placebo (stable COPD)

**Outcome:** 03 PEFR 120 min. post-treatment

<table>
<thead>
<tr>
<th>Study</th>
<th>P ,PD Placebo</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
<td>95% CI</td>
</tr>
<tr>
<td>May 1979</td>
<td>35</td>
<td>-0.06 (0.10)</td>
<td>35</td>
<td>-0.25 (0.07)</td>
</tr>
<tr>
<td>Total (95% CI)</td>
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<td>35</td>
<td></td>
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</tbody>
</table>

Test for heterogeneity: not applicable

Test for overall effect z=9.21 p<0.00001

### Analysis 01.04. Comparison 01 P, PD versus placebo (stable COPD), Outcome 04 PaO2 120 min. post-treatment

**Review:** Bronchopulmonary hygiene physical therapy for chronic obstructive pulmonary disease and bronchiectasis

**Comparison:** 01 P, PD versus placebo (stable COPD)

**Outcome:** 04 PaO2 120 min. post-treatment

<table>
<thead>
<tr>
<th>Study</th>
<th>P ,PD Placebo</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
<td>95% CI</td>
</tr>
<tr>
<td>May 1979</td>
<td>35</td>
<td>-1.30 (0.70)</td>
<td>35</td>
<td>-0.30 (1.00)</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>35</td>
<td>35</td>
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</table>

Test for heterogeneity: not applicable

Test for overall effect z=4.85 p<0.00001

### Analysis 01.05. Comparison 01 P, PD versus placebo (stable COPD), Outcome 05 Sputum production

**Review:** Bronchopulmonary hygiene physical therapy for chronic obstructive pulmonary disease and bronchiectasis

**Comparison:** 01 P, PD versus placebo (stable COPD)

**Outcome:** 05 Sputum production

<table>
<thead>
<tr>
<th>Study</th>
<th>P ,PD Placebo</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight</th>
<th>Weighted Mean Difference (Fixed)</th>
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<tbody>
<tr>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
<td>95% CI</td>
</tr>
<tr>
<td>May 1979</td>
<td>35</td>
<td>-9.00 (2.20)</td>
<td>35</td>
<td>-1.20 (0.70)</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>35</td>
<td>35</td>
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<td></td>
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</table>

Test for heterogeneity: not applicable

Test for overall effect z=19.99 p<0.00001
### Analysis 02.01. Comparison 02 P, PD versus NI (acute COPD), Outcome 01 FEV1 40 min post-treatment

**Review:** Bronchopulmonary hygiene physical therapy for chronic obstructive pulmonary disease and bronchiectasis

**Comparison:** 02 P, PD versus NI (acute COPD)

**Outcome:** 01 FEV1 40 min post-treatment

<table>
<thead>
<tr>
<th>Study</th>
<th>Treatment</th>
<th>N</th>
<th>Mean(SD)</th>
<th>Control</th>
<th>N</th>
<th>Mean(SD)</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight (%)</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newton 1978</td>
<td>33</td>
<td>1.00 (0.35)</td>
<td>33</td>
<td>1.00 (0.40)</td>
<td>100.0</td>
<td>0.00 [ -0.18, 0.18 ]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>33</td>
<td>33</td>
<td>100.0</td>
<td>0.00 [ -0.18, 0.18 ]</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Test for heterogeneity: not applicable

Test for overall effect z=0.00  p=1

### Analysis 02.02. Comparison 02 P, PD versus NI (acute COPD), Outcome 02 VC 40 min post-treatment

**Review:** Bronchopulmonary hygiene physical therapy for chronic obstructive pulmonary disease and bronchiectasis

**Comparison:** 02 P, PD versus NI (acute COPD)

**Outcome:** 02 VC 40 min post-treatment

<table>
<thead>
<tr>
<th>Study</th>
<th>Treatment</th>
<th>N</th>
<th>Mean(SD)</th>
<th>Control</th>
<th>N</th>
<th>Mean(SD)</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight (%)</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>95% CI</th>
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</thead>
<tbody>
<tr>
<td>Newton 1978</td>
<td>33</td>
<td>2.30 (0.80)</td>
<td>33</td>
<td>2.30 (1.00)</td>
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<tr>
<td>Total (95% CI)</td>
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<td>33</td>
<td>100.0</td>
<td>0.00 [ -0.44, 0.44 ]</td>
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</tbody>
</table>

Test for heterogeneity: not applicable

Test for overall effect z=0.00  p=1

### Analysis 02.03. Comparison 02 P, PD versus NI (acute COPD), Outcome 03 PaO2 40 min. post-treatment

**Review:** Bronchopulmonary hygiene physical therapy for chronic obstructive pulmonary disease and bronchiectasis

**Comparison:** 02 P, PD versus NI (acute COPD)

**Outcome:** 03 PaO2 40 min. post-treatment

<table>
<thead>
<tr>
<th>Study</th>
<th>Treatment</th>
<th>N</th>
<th>Mean(SD)</th>
<th>Control</th>
<th>N</th>
<th>Mean(SD)</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight (%)</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newton 1978</td>
<td>33</td>
<td>-7.80 (0.90)</td>
<td>33</td>
<td>-7.60 (1.00)</td>
<td>100.0</td>
<td>-0.20 [ -0.66, 0.26 ]</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>33</td>
<td>33</td>
<td>100.0</td>
<td>-0.20 [ -0.66, 0.26 ]</td>
<td></td>
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</tbody>
</table>

Test for heterogeneity: not applicable

Test for overall effect z=0.85  p=0.4
### Analysis 03.01. Comparison 03 P, PD versus NI (bronchiectasis), Outcome 01 Pulmonary clearance

**Review:** Bronchopulmonary hygiene physical therapy for chronic obstructive pulmonary disease and bronchiectasis

**Comparison:** 03 P, PD versus NI (bronchiectasis)

**Outcome:** 01 Pulmonary clearance

<table>
<thead>
<tr>
<th>Study</th>
<th>Treatment</th>
<th>Control</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (Mean(SD))</td>
<td>N (Mean(SD))</td>
<td>95% CI</td>
<td>95% CI</td>
</tr>
<tr>
<td><strong>01 Sputum production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bateman 1981</td>
<td>6 (-9.00 (2.20))</td>
<td>6 (-3.50 (4.00))</td>
<td>-5.50 [ -9.15, -1.85 ]</td>
<td></td>
</tr>
<tr>
<td><strong>02 Radioisotope clearance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bateman 1981</td>
<td>6 (-34.00 (3.50))</td>
<td>6 (-5.50 (4.00))</td>
<td>-28.50 [ -32.75, -24.25 ]</td>
<td></td>
</tr>
</tbody>
</table>

### Analysis 04.01. Comparison 04 FET, PD versus NI (bronchiectasis), Outcome 01 Pulmonary clearance

**Review:** Bronchopulmonary hygiene physical therapy for chronic obstructive pulmonary disease and bronchiectasis

**Comparison:** 04 FET, PD versus NI (bronchiectasis)

**Outcome:** 01 Pulmonary clearance

<table>
<thead>
<tr>
<th>Study</th>
<th>Treatment</th>
<th>Control</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (Mean(SD))</td>
<td>N (Mean(SD))</td>
<td>95% CI</td>
<td>95% CI</td>
</tr>
<tr>
<td><strong>01 Sputum production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sutton 1983</td>
<td>10 (-23.00 (7.00))</td>
<td>10 (-3.30 (2.00))</td>
<td>-19.70 [ -24.21, -15.19 ]</td>
<td></td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>10</td>
<td>10</td>
<td>100.0</td>
<td>-19.70 [ -24.21, -15.19 ]</td>
</tr>
<tr>
<td>Test for heterogeneity: not applicable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect z=8.56 p&lt;0.00001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>02 Radioisotope clearance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sutton 1983</td>
<td>10 (65.00 (8.00))</td>
<td>10 (83.00 (5.00))</td>
<td>-18.00 [ -23.85, -12.15 ]</td>
<td></td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>10</td>
<td>10</td>
<td>100.0</td>
<td>-18.00 [ -23.85, -12.15 ]</td>
</tr>
<tr>
<td>Test for heterogeneity: not applicable</td>
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<td></td>
</tr>
<tr>
<td>Test for overall effect z=6.03 p&lt;0.00001</td>
<td></td>
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</tbody>
</table>
Analysis 05.02. Comparison 05 PD versus NI (chronic bronchitis), Outcome 02 Radioisotope clearance

Review: Bronchopulmonary hygiene physical therapy for chronic obstructive pulmonary disease and bronchiectasis

Comparison: 05 PD versus NI (chronic bronchitis)

Outcome: 02 Radioisotope clearance

<table>
<thead>
<tr>
<th>Study</th>
<th>PD</th>
<th>C</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oldenburg 1979</td>
<td>8</td>
<td>97.00 (2.10)</td>
<td>8 89.00 (3.70)</td>
<td>100.0</td>
<td>8.00 [ 5.05, 10.95 ]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>8</td>
<td>8</td>
<td>100.0</td>
<td>8.00 [ 5.05, 10.95 ]</td>
<td></td>
</tr>
</tbody>
</table>

Test for heterogeneity: not applicable

Test for overall effect z=5.32 p<0.00001

Analysis 06.01. Comparison 06 P, PD versus MV (COPD), Outcome 01 FEV1/FVC% 40 min post-treatment

Review: Bronchopulmonary hygiene physical therapy for chronic obstructive pulmonary disease and bronchiectasis

Comparison: 06 P, PD versus MV (COPD)

Outcome: 01 FEV1/FVC% 40 min post-treatment

<table>
<thead>
<tr>
<th>Study</th>
<th>Man P,PD</th>
<th>Mech Vib</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mohsenifar 1985</td>
<td>10 -32.00 (9.00)</td>
<td>10 -34.00 (13.00)</td>
<td>100.0</td>
<td>2.00 [-7.80, 11.80]</td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>10</td>
<td>10</td>
<td>100.0</td>
<td>2.00 [-7.80, 11.80]</td>
<td></td>
</tr>
</tbody>
</table>

Test for heterogeneity: not applicable

Test for overall effect z=0.40 p=0.7

Analysis 06.02. Comparison 06 P, PD versus MV (COPD), Outcome 02 PEFR 40 min post-treatment

Review: Bronchopulmonary hygiene physical therapy for chronic obstructive pulmonary disease and bronchiectasis

Comparison: 06 P, PD versus MV (COPD)

Outcome: 02 PEFR 40 min post-treatment

<table>
<thead>
<tr>
<th>Study</th>
<th>Man P,PD</th>
<th>Mech Vib</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mohsenifar 1985</td>
<td>10 -1.60 (0.80)</td>
<td>10 -2.10 (0.60)</td>
<td>100.0</td>
<td>0.50 [-0.12, 1.12]</td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>10</td>
<td>10</td>
<td>100.0</td>
<td>0.50 [-0.12, 1.12]</td>
<td></td>
</tr>
</tbody>
</table>

Test for heterogeneity: not applicable

Test for overall effect z=1.58 p=0.1

Bronchopulmonary hygiene physical therapy for chronic obstructive pulmonary disease and bronchiectasis (Review)
### Analysis 06.03. Comparison 06 P, PD versus MV (COPD), Outcome 03 FVC %pred 40 min post-treatment

**Review:** Bronchopulmonary hygiene physical therapy for chronic obstructive pulmonary disease and bronchiectasis

**Comparison:** 06 P, PD versus MV (COPD)

**Outcome:** 03 FVC %pred 40 min post-treatment

<table>
<thead>
<tr>
<th>Study</th>
<th>Man PPD</th>
<th>Mech Vib</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight (%)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mohsenifar 1985</td>
<td>10</td>
<td>10</td>
<td>-75.00 (15.00)</td>
<td>100.0</td>
<td>16.00 [-0.50, 32.50]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>10</td>
<td>10</td>
<td>-91.00 (22.00)</td>
<td>100.0</td>
<td>16.00 [-0.50, 32.50]</td>
</tr>
</tbody>
</table>

Test for heterogeneity: not applicable
Test for overall effect: $z=1.90$, $p=0.06$

### Analysis 06.04. Comparison 06 P, PD versus MV (COPD), Outcome 04 PaO2

**Review:** Bronchopulmonary hygiene physical therapy for chronic obstructive pulmonary disease and bronchiectasis

**Comparison:** 06 P, PD versus MV (COPD)

**Outcome:** 04 PaO2

<table>
<thead>
<tr>
<th>Study</th>
<th>Man PPD</th>
<th>Mech Vib</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight (%)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mohsenifar 1985</td>
<td>10</td>
<td>10</td>
<td>65.00 (9.00)</td>
<td>100.0</td>
<td>0.00 [-7.89, 7.89]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>10</td>
<td>10</td>
<td>65.00 (9.00)</td>
<td>100.0</td>
<td>0.00 [-7.89, 7.89]</td>
</tr>
</tbody>
</table>

Test for heterogeneity: not applicable
Test for overall effect: $z=0.00$, $p=1$

### Analysis 07.01. Comparison 07 PD, FET versus PEP, FET (stable chronic bronchitis), Outcome 01 Radioisotope clearance

**Review:** Bronchopulmonary hygiene physical therapy for chronic obstructive pulmonary disease and bronchiectasis

**Comparison:** 07 PD, FET versus PEP, FET (stable chronic bronchitis)

**Outcome:** 01 Radioisotope clearance

<table>
<thead>
<tr>
<th>Study</th>
<th>PD, FET</th>
<th>PEP, FET</th>
<th>Weighted Mean Difference (Fixed)</th>
<th>Weight (%)</th>
<th>Weighted Mean Difference (Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olseni 1994</td>
<td>14</td>
<td>14</td>
<td>-30.00 (20.00)</td>
<td>100.0</td>
<td>-5.00 [-16.71, 6.71]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>14</td>
<td>14</td>
<td>-25.00 (10.00)</td>
<td>100.0</td>
<td>-5.00 [-16.71, 6.71]</td>
</tr>
</tbody>
</table>

Test for heterogeneity: not applicable
Test for overall effect: $z=0.84$, $p=0.4$

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Bronchopulmonary hygiene physical therapy for chronic obstructive pulmonary disease and bronchiectasis (Review)

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