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

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TABLE OF CONTENTS

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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 drop-outs; 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 list of included trials gives trial-specific details.

METHODOLOGICAL QUALITY

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 bronchitis. 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 [Olseni 1994] compared postural drainage and forced exhalation technique with positive expiratory pressure and forced exhalation. Olseni 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 Olseni'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 bronchitis, 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.

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* *Indicates the major publication for the study*

TABLES

Characteristics of included studies

Study	**Bateman 1981**
Methods	Crossover trial with random order of interventions. Allocation method unspecified.
Participants	Inclusion criteria: stable airway obstruction with regular daily expectoration. Setting unknown. N = 6; gender, male (3), female (3). Dx chronic bronchitis (3), bronchiectasis (3).
Interventions	Percussion, postural drainage, shaking, vibration, coughing vs.: 1) cough 2) no intervention
Outcomes	Sputum weight (g) Radioaerosol clearance from whole lung Radioaerosol clearance from central lung Radioaerosol clearance from peripheral lung
Notes	
Allocation concealment	B – Unclear

Study	**May 1979**
Methods	Crossover trial with random order of interventions. Allocation method unspecified.
Participants	Inclusion criteria: stable chronic bronchitis, chronic productive cough, obstructive disease. Exclusion: markedly reactive airways disease, need for supplemental oxygen therapy, fixed beliefs about chest physiotherapy. N = 35, male = 29, female = 6. Age range = 37-83, age mean 59.
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
Allocation concealment	B – Unclear

Study	**Mohsenifar 1985**
Methods	Randomized parallel group comparison- method of randomization, concealment unspecified.
Participants	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.
Interventions	Percussion and postural drainage vs. mechanical vibration
Outcomes	FEV1% early, FEV% late PEF early PEF late FVC early FVC late PaO2 early PaO2 late
Notes	
Allocation concealment	B – Unclear

Study	**Newton 1978**
Methods	Crossover trial with random order of interventions Non-investigator drew card from sealed envelope. Person making post-intervention measurements blinded to group assignment
Participants	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.
Interventions	Percussion, postural drainage, vibration, deep breathing vs. no intervention
Outcomes	FEV1 early FEV1 late FVC early FVC late
Notes	
Allocation concealment	A – Adequate

Study	**Oldenburg 1979**
Methods	Crossover trial with random order of interventions. Allocation method unspecified.
Participants	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.

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- dailly 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	
Allocation concealment	B – Unclear

Study	**Sutton 1983**
Methods	Crossover trial with random order of interventions. Allocation method unspecified.
Participants	Inclusion criteria: copious sputum production, N= 10, male = 7, female = 3; age range 19-60, age mean 41. Dx = bronchiectasis (5), cystic fibrosis (4), asthma (1).
Interventions	Postural drainage, forced exhalation technique vs.: 1) forced exhalation technique 2) cough no intervention
Outcomes	Sputum weight Radioaerosol retention in total lung
Notes	Sample contaminated with cystic fibrosis and asthma patients.
Allocation concealment	B – Unclear

Characteristics of excluded studies

Study	**Reason for exclusion**
Agoston 1968	Inappropriate intervention
Ambrosino 1981	Inappropriate intervention
Anthonisen 1964	Not an RCT
Belcastro 1984	Not an RCT, and inappropriate patient population
Boksha 1989	Inappropriate intervention
Boye 1994	Inappropriate intervention

Characteristics of excluded studies (*Continued*)

Castillo 1985	Inappropriate patient population
Cegla 1993	Inappropriate intervention
Cegla 1994	Inappropriate intervention
Christensen 1990	Inappropriate intervention
Christensen 1991	Inappropriate intervention
Clark 1986	Inappropriate intervention
Conway 1992	Inappropriate intervention
Craven 1974	Inappropriate intervention and patient population
Edenbrandt 1990	Inappropriate intervention
Feldman 1979	Not an RCT
Foglio 1992	Retrospective study
Gallon 1991	No control or mechanical arm
Hansen 1990	Not an RCT
Hasani 1991	Inappropriate intervention
Kraszko 1973	Inappropriate intervention
Lorin 1971	Inappropriate patient population
Luttman 1994	Inappropriate intervention and no randomizatoin
Marcq 1981	Inappropriate intervention
Mazzoco 1985	Not an RCT
Nichols 1970	Inappropriate patient population
Pavia 1976	Inappropriate intervention
Peterson 1967	Unspecified intervention
Pryor 1979	Inappropriate patient population
Rivington 1984	Not an RCT
Sutton 1985	No control or mechanical arm
Toevs 1984	Inappropriate intervention
Tonnesen 1982	Inappropriate intervention
Vandschans 1986	Not an RCT
Vandschans 1990	Not an RCT
Vanhengstum 1988	Inappropriate intervention
Vanhengstum 1991	Inappropriate intervention
Wollmer 1985	No control or mechanical arm

ANALYSES

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

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
01 FEV1 120 min. post-treatment	1	70	Weighted Mean Difference (Fixed) 95% CI	-0.01 [-0.02, 0.00]
02 FVC 120 min. post-treatment	1	70	Weighted Mean Difference (Fixed) 95% CI	0.07 [0.05, 0.09]
03 PEFR 120 min. post-treatment	1	70	Weighted Mean Difference (Fixed) 95% CI	0.19 [0.15, 0.23]
04 PaO2 120 min. post-treatment	1	70	Weighted Mean Difference (Fixed) 95% CI	-1.00 [-1.40, -0.60]
05 Sputum production	1	70	Weighted Mean Difference (Fixed) 95% CI	-7.80 [-8.56, -7.04]

Comparison 02. P, PD versus NI (acute COPD)

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

Comparison 03. P, PD versus NI (bronchiectasis)

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
01 Pulmonary clearance			Weighted Mean Difference (Fixed) 95% CI	Totals not selected

Comparison 04. FET, PD versus NI (bronchiectasis)

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
01 Pulmonary clearance			Weighted Mean Difference (Fixed) 95% CI	Subtotals only

Comparison 05. PD versus NI (chronic bronchitis)

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
02 Radioisotope clearance	1	16	Weighted Mean Difference (Fixed) 95% CI	8.00 [5.05, 10.95]

Comparison 06. P, PD versus MV (COPD)

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
01 FEV1/FVC% 40 min post-treatment	1	20	Weighted Mean Difference (Fixed) 95% CI	2.00 [-7.80, 11.80]
02 PEFR 40 min post-treatment	1	20	Weighted Mean Difference (Fixed) 95% CI	0.50 [-0.12, 1.12]
03 FVC %pred 40 min post-treatment	1	20	Weighted Mean Difference (Fixed) 95% CI	16.00 [-0.50, 32.50]
04 PaO2	1	20	Weighted Mean Difference (Fixed) 95% CI	0.00 [-7.89, 7.89]

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

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
01 Radioisotope clearance	1	28	Weighted Mean Difference (Fixed) 95% CI	-5.00 [-16.71, 6.71]

INDEX TERMS

Medical Subject Headings (MeSH)

Bronchiectasis [*therapy]; *Drainage, Postural; Lung Diseases, Obstructive [*therapy]; Physical Therapy Modalities [*methods]

MeSH 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
Issue protocol first published	1997/2
Review first published	1998/3
Date of most recent amendment	18 February 2005
Date of most recent SUBSTANTIVE amendment	13 July 1998
What's New	Information not supplied by author
Date new studies sought but none found	01 January 2005
Date new studies found but not yet included/excluded	Information not supplied by author
Date new studies found and included/excluded	Information not supplied by author
Date authors' conclusions section amended	Information not supplied by author
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GRAPHS AND OTHER TABLES

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

Study	P,PD N	P,PD Mean(SD)	Placebo N	Placebo Mean(SD)	Weighted Mean Difference (Fixed) 95% CI	Weight (%)	Weighted Mean Difference (Fixed) 95% CI
May 1979	35	-0.06 (0.03)	35	-0.05 (0.02)		100.0	-0.01 [-0.02, 0.00]
Total (95% CI)	35		35			100.0	-0.01 [-0.02, 0.00]
Test for heterogeneity: not applicable							
Test for overall effect z=1.64 p=0.1							

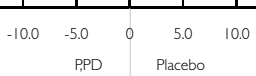
Analysis 01.02. Comparison 01 P, PD versus placebo (stable COPD), Outcome 02 FVC 120 min. post-treatment

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

Study	P,PD N	P,PD Mean(SD)	Placebo N	Placebo Mean(SD)	Weighted Mean Difference (Fixed) 95% CI	Weight (%)	Weighted Mean Difference (Fixed) 95% CI
May 1979	35	-0.09 (0.03)	35	-0.16 (0.04)		100.0	0.07 [0.05, 0.09]
Total (95% CI)	35		35			100.0	0.07 [0.05, 0.09]
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

Study	P,PD N	P,PD Mean(SD)	Placebo N	Placebo Mean(SD)	Weighted Mean Difference (Fixed) 95% CI	Weight (%)	Weighted Mean Difference (Fixed) 95% CI
May 1979	35	-0.06 (0.10)	35	-0.25 (0.07)		100.0	0.19 [0.15, 0.23]
Total (95% CI)	35		35			100.0	0.19 [0.15, 0.23]

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

Study	P,PD N	P,PD Mean(SD)	Placebo N	Placebo Mean(SD)	Weighted Mean Difference (Fixed) 95% CI	Weight (%)	Weighted Mean Difference (Fixed) 95% CI
May 1979	35	-1.30 (0.70)	35	-0.30 (1.00)		100.0	-1.00 [-1.40, -0.60]
Total (95% CI)	35		35			100.0	-1.00 [-1.40, -0.60]

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

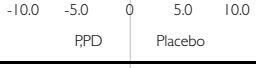
Comparison: 01 P, PD versus placebo (stable COPD)

Outcome: 05 Sputum production

Study	P,PD N	P,PD Mean(SD)	Placebo N	Placebo Mean(SD)	Weighted Mean Difference (Fixed) 95% CI	Weight (%)	Weighted Mean Difference (Fixed) 95% CI
May 1979	35	-9.00 (2.20)	35	-1.20 (0.70)		100.0	-7.80 [-8.56, -7.04]
Total (95% CI)	35		35			100.0	-7.80 [-8.56, -7.04]

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

Study	Treatment N	Mean(SD)	Control N	Mean(SD)	Weighted Mean Difference (Fixed) 95% CI	Weight (%)	Weighted Mean Difference (Fixed) 95% CI
Newton 1978	33	1.00 (0.35)	33	1.00 (0.40)		100.0	0.00 [-0.18, 0.18]
Total (95% CI)	33		33			100.0	0.00 [-0.18, 0.18]

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

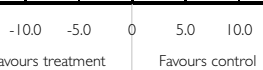
Comparison: 02 P, PD versus NI (acute COPD)

Outcome: 02 VC 40 min post-treatment

Study	Treatment N	Mean(SD)	Control N	Mean(SD)	Weighted Mean Difference (Fixed) 95% CI	Weight (%)	Weighted Mean Difference (Fixed) 95% CI
Newton 1978	33	2.30 (0.80)	33	2.30 (1.00)		100.0	0.00 [-0.44, 0.44]
Total (95% CI)	33		33			100.0	0.00 [-0.44, 0.44]

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

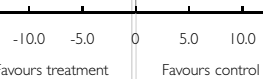
Comparison: 02 P, PD versus NI (acute COPD)

Outcome: 03 PaO2 40 min. post-treatment

Study	Treatment N	Mean(SD)	Control N	Mean(SD)	Weighted Mean Difference (Fixed) 95% CI	Weight (%)	Weighted Mean Difference (Fixed) 95% CI
Newton 1978	33	-7.80 (0.90)	33	-7.60 (1.00)		100.0	-0.20 [-0.66, 0.26]
Total (95% CI)	33		33			100.0	-0.20 [-0.66, 0.26]

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

Study	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Weighted Mean Difference (Fixed) 95% CI	Weighted Mean Difference (Fixed) 95% CI
01 Sputum production						
Bateman 1981	6	-9.00 (2.20)	6	-3.50 (4.00)		-5.50 [-9.15, -1.85]
02 Radioisotope clearance						
Bateman 1981	6	-34.00 (3.50)	6	-5.50 (4.00)		-28.50 [-32.75, -24.25]

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

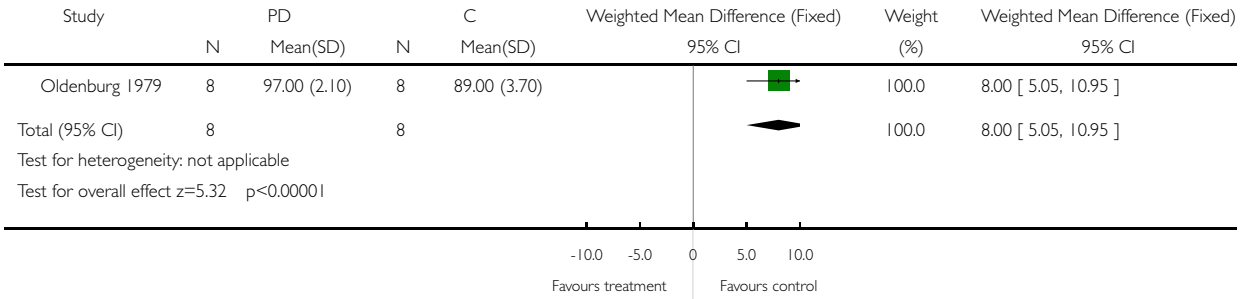
Study	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Weighted Mean Difference (Fixed) 95% CI	Weight (%)	Weighted Mean Difference (Fixed) 95% CI
01 Sputum production							
Sutton 1983	10	-23.00 (7.00)	10	-3.30 (2.00)		100.0	-19.70 [-24.21, -15.19]
Subtotal (95% CI)	10		10			100.0	-19.70 [-24.21, -15.19]
Test for heterogeneity: not applicable							
Test for overall effect z=8.56 p<0.00001							
02 Radioisotope clearance							
Sutton 1983	10	65.00 (8.00)	10	83.00 (5.00)		100.0	-18.00 [-23.85, -12.15]
Subtotal (95% CI)	10		10			100.0	-18.00 [-23.85, -12.15]
Test for heterogeneity: not applicable							
Test for overall effect z=6.03 p<0.00001							

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

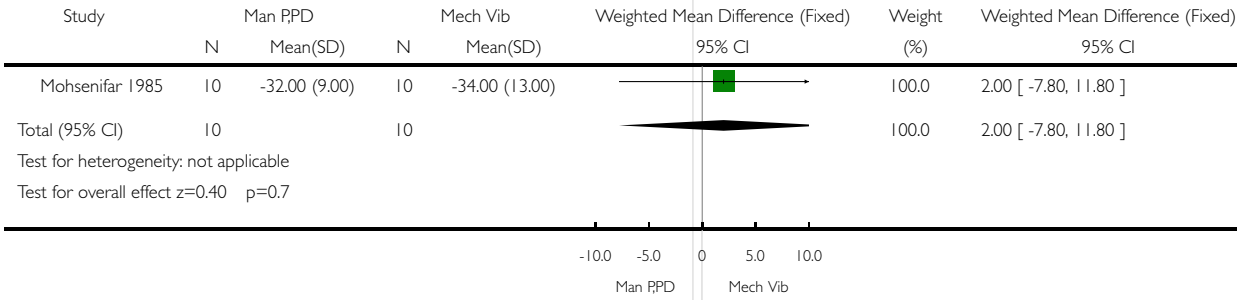


Analysis 06.01. Comparison 06 P, PD versus MV (COPD), Outcome 01 FEV1/FVC% 40 min post-treatment

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

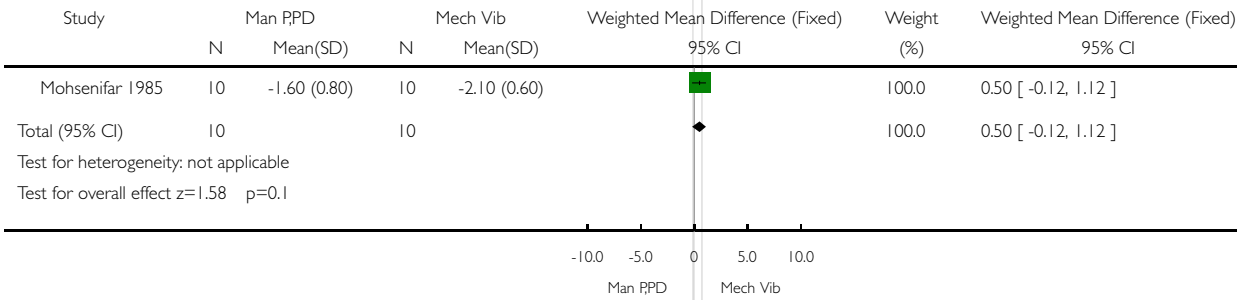


Analysis 06.02. Comparison 06 P, PD versus MV (COPD), Outcome 02 PEFR 40 min post-treatment

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

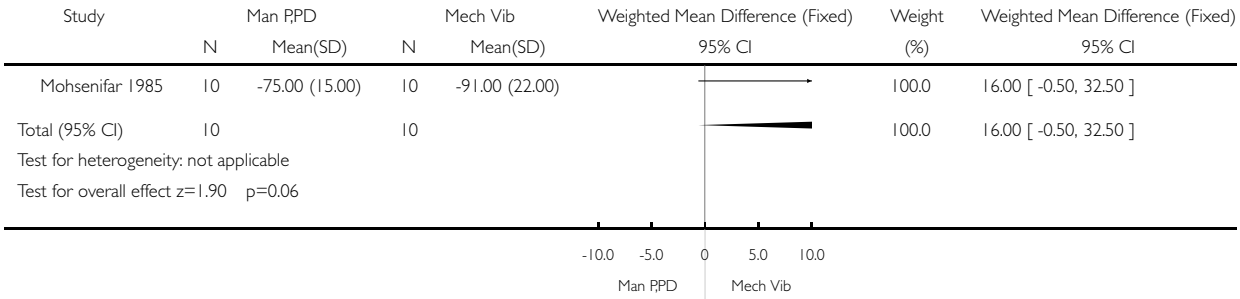


Analysis 06.03. Comparison 06 P, PD versus MV (COPD), Outcome 03 FVC %pred 40 min post-treatment

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

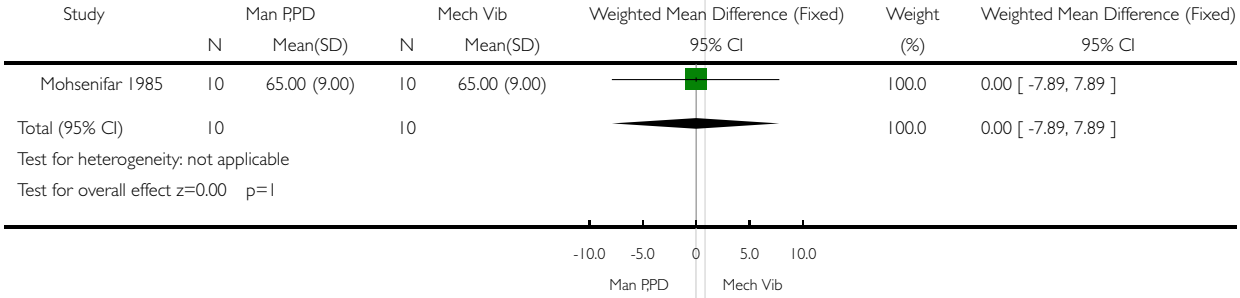


Analysis 06.04. Comparison 06 P, PD versus MV (COPD), Outcome 04 PaO2

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

Comparison: 06 P, PD versus MV (COPD)

Outcome: 04 PaO2



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