Chest physical therapy management of patients with cystic fibrosis: a meta-analysis

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Authors' objectives
To quantitatively assess the effectiveness of chest physical therapy (CPT) in the treatment of patients with cystic fibrosis (CF).

Searching
MEDLINE was searched from 1966 to 1993 using (explode) 'rehabilitation', (explode) 'cystic fibrosis' and the MeSH 'exercise' and cystic fibrosis'; CINAHL was searched from 1983 to the present day using the terms 'physical therapy', 'cystic fibrosis', 'exercise' and 'rehabilitation'. Reference lists of retrieved articles were handsearched, and authors of primary studies were contacted for further published and unpublished trials.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) were included.

Specific interventions included in the review
Positive expiratory pressure (PEP) mask, forced expiratory technique (FET), standard physical therapy (STD; i.e. postural drainage, percussion and vibration), autogenic drainage (AD) or exercise (EX).

Participants included in the review
Patients with a definite clinical diagnosis of CF (verified by a sweat chloride test) and who were at least 5 years old, were included.

Outcomes assessed in the review
Sputum weight and pulmonary function (measured by forced expiratory volume, FEV, or the percentage predicted FEV in one second, FEV1) were the primary outcomes, but radioaerosol clearance of mucus was also considered.

How were decisions on the relevance of primary studies made?
The relevancy of each article was assessed independently by two of the authors using the full manuscript of the primary studies. Good inter-observer agreement was obtained (weighted (κ) 0.9), and any disagreements were resolved by consensus.

Assessment of study quality
The validity of all selected primary articles was assessed using a methodological quality assessment form. A total methodological quality score for each article was calculated. Two reviewers independently assessed study quality, and any disagreements were resolved by consensus.

Data extraction
The authors do not state how the data were extracted for the review, or how many of the authors performed the data extraction. The effect sizes were converted to natural units (e.g. grams of sputum expectorated).

Methods of synthesis
How were the studies combined?
The independent techniques were compared by 7 separate meta-analyses using the pooled effect size technique. Effect size and 95% confidence interval (CI) for each study were calculated by dividing the mean difference in outcome between the 2 groups by the pooled standard deviation (SD; weighted on sample size).
How were differences between studies investigated?
Homogeneity was tested using the methods described by Hedges and Olkin (see Other Publications of Related Interest).

Results of the review
Twenty-two studies with 542 patients were included.

There was no significant heterogeneity of the trial results for comparison of different CPT modalities (p>0.05).

Standard therapy versus no therapy (3 studies involving 66 patients). The overall effect size (ES) was 0.61 SD units (p<0.0001), indicating a significant benefit of standard CPT over no therapy for patients with CF; this corresponds to 7.5 g expectorated sputum per day.

PEP versus STD (8 studies). Six studies involving 146 patients evaluated FEV1. The pooled ES was 0.02 (95% CI: -0.32, 0.43, p=0.27), demonstrating equivalency of STD and the PEP mask. This equivalency was also shown in 6 studies with 100 patients: the pooled ES for sputum weight was 0.08 (95% CI: -0.39, 0.23, p=0.31).

EX and STD versus STD (53 patients). Three studies reported a pooled ES of 0.48 (95% CI: 0.07, 1.02, p=0.04), indicating a clinically-important and statistically-significant benefit of STD combined with EX to STD alone, which corresponds to a 6.4% predicted FEV1.

FET versus STD (5 studies involving 186 patients). The pooled ES was 0.13 demonstrating no difference between the 2 treatments (95% CI: -0.17, 0.43, p=0.19) on FEV1. For studies which evaluated sputum weight (involving 123 patients) the ES was 0.27 (95% CI: -0.65, 0.10, p=0.08), indicating a small but not statistically-significant trend favouring FET over STD alone in sputum expectoration.

Cough versus STD (2 studies involving 30 patients). Both trials showed a benefit of STD over cough alone. The pooled ES was 0.23 in favour of STD (95% CI: -0.49, 0.95, p=0.27). There appears to be a small but non significant trend favouring STD over cough alone with respect to sputum production.

AD versus STD (1 study involving 28 patients). AD demonstrated equivalence to STD and PEP mask in the outcome of FEV1, but was superior to others in the amount of sputum expectorated.

Mechanical versus manual percussion/vibration (4 studies involving 68 patients). FEV1 demonstrated equivalency of manual and mechanical percussion/vibration with an ES of 0.04 SD units (95% CI: -0.54, 0.47, p=0.48). The pooled ES for the outcome of sputum weight of 0.12 (95% CI: -0.35, 0.58, p=0.31) also demonstrated equivalency of the two methods.

Authors' conclusions
STD results in a significantly greater sputum expectoration than no treatment. The combination of STD with EX is associated with a moderate statistically-significant increase in FEV1 over STD alone. No other differences between CPT modalities were found.

CRD commentary
A methodologically rigorous and well-presented systematic review. Although a comprehensive search of the literature was conducted, it is unclear whether the search strategy was limited to articles published in English.

Bibliographic details

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Other publications of related interest

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Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.