Physical therapy

Active cycle of breathing technique in cystic fibrosis

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Background

Several techniques for airway clearance are an important component of treatment in CF.

Chest physiotherapy is beneficial for mucus transport in people with CF. However, there is no agreement upon a definitive method of treatment, thus both conventional and alternative treatments are widely used. Generally the choice of therapy is based on most familiarity to some methods, neglecting others. Either one or several airway clearance regimens are quite different in each country: conventional chest physiotherapy is more promoted in the USA, while ACBT is the most commonly used in the United Kingdom; positive expiratory pressure (PEP), flutter and AD are mainly used in the rest of Europe, and exercise is the favorite treatment in the Scandinavian countries.

People with CF and caregivers encounter every day mainly on the question of which technique is as efficacious as the other, what time length it requires, whether it can be performed independently.

Airway clearance therapies in people with CF aim to improve mucus clearance, to increase sputum production, and ultimately to improve airway function. The active cycle of breathing technique (ACBT) is a safe administered method for airway clearance that uses a cycle of techniques to loosen airway secretions including breathing control, thoracic expansion exercises, and forced expiration technique (FET).

In particular:

- in breathing control, the individual performs tidal breathing (gentle relaxed breathing) using the lower chest, related to rate and depth of the individuals that are encouraged to relax their shoulders and upper chest. Breathing control is the resting period between the active parts of ACBT;
- FET consists of deep breathing with inspiration and passive relaxed expiration. The FET combines huffing and breathing control, where one or two forced expirations (huffs) are interspersed with periods of breathing control. Huffing is a type of cough which includes inhaling and active exhaling. Huffing helps to mobilize and clear peripherally situated secretions.

Issues

To compare the clinical effectiveness of ACBT with other airway clearance therapies in people with CF.

What is known

A CDSR (Wilson LM, 2023) included 22 studies: 8 RCT and 14 quasi-randomised controlled clinical studies and crossover studies (559 participants) in which ACBT was compared with autogenic drainage, airway oscillating devices (AOD), high?frequency chest compression devices, conventional chest physiotherapy (CCPT), positive expiratory pressure (PEP), and exercise. The study size ranged from seven to 65 participants. The age of the participants ranged from six to 63 years (mean age 18.7 years). In 13 studies follow up lasted a single day. However, there were two long?term randomised controlled studies with follow up of one to three years. Most of the studies did not report on key quality items, and therefore have an unclear risk of bias in terms of random sequence generation, allocation concealment, and outcome assessor blinding. Due to the nature of the intervention, none of the studies blinded participants or the personnel applying the interventions. However, most of the studies reported on all planned outcomes, had adequate follow up, assessed compliance, and used an intention?to?treat analysis. As no difference was found between ACBT and any other airway clearance tecnique for all the outcome measures this systematic review concluded that there is little evidence to support or reject the use of the ACBT over any other airway clearance therapy and ACBT is comparable with other therapies in outcomes such as participant preference, quality of life, exercise tolerance, lung function, sputum weight, oxygen saturation, and number of pulmonary exacerbations. Longer?term studies are needed to more adequately assess the effects of ACBT on outcomes important for pwCF such as quality of life and preference.

1 CDSR (Mckoy Naomi A, 2016) on active cycle of breathing technique (ACBT), identified sixty-two studies, of which 19 (440 participants) met the inclusion criteria. Five were randomised controlled studies including 192 participants (two with a follow-up of one to three years), while three were completed cross-over studies. The study size ranged from seven to 65 participants. The age of the participants ranged from six to 63 years (mean age 22.33 years). Studies compared ACBT to autogenic drainage, airway oscillating devices, high frequency chest compression devices, conventional chest physiotherapy and physical exercise. Patient preference, lung function, sputum weight, oxygen saturation, and number of pulmonary exacerbations were evaluated as primary and secondary outcomes during the studies. Patient preference varied as more patients preferred autogenic drainage (AD) over ACBT, more preferred ACBT over airway oscillating devices, and more were comfortable with ACBT versus high frequency chest compression. No significant difference was seen in sputum weight between ACBT and autogenic drainage or between ACBT and airway oscillating devices. Again

no significant difference in lung function and number of pulmonary exacerbations was seen between ACBT and ACBT plus conventional chest physiotherapy. All other outcomes were either not measured or had insufficient data for analysis, as quality of life and mortality rate. Five studies, including 106 participants, compared ACBT to other therapies as non-invasive ventilation (NIV), pressure support ventilation (PSV), test of incremental respiratory endurance (TIRE), coughing, resistive inspiratory maneuvers (RIM), with no conclusive data.

A randomized, single-center, open-label, cross-over trial (Sands D, 2023) investigated the efficacy of the Simeox(®) Airway Clearance Technology in the homecare treatment of 40 children (8-17 years) with clinically stable CF. Patients were randomized 1:1 into two groups with or without Simeox(®). A significant decrease in proximal airway obstruction (as supported by improvement in airway resistance at 20 Hz (R20Hz) and maximum expiratory flow at 75% of FVC (MEF75)) compared to the control group was observed after 1 month of therapy with the device. Lung-clearance index was stable in the study group, while it worsened in the control group. In addition, the device group demonstrated a significant increase in the Cystic Fibrosis Questionnaire-Revised (CFQ-R) physical score. No side effects were identified during the study. Authors concluded that this device could be an option in chronic treatment of the disease.

Unresolved questions

There is insufficient evidence to support or reject the use of ACBT over any other airway clearance therapy. In order to suit the needs of patients, families and caregivers, ACTs need to be individually and continuously adapted.

Clinical results through 6 months of a prospective observational study confirm benefits of ETI in a real-world practice that are similar to those found in controlled clinical trials. It is debating whether all other chronic treatments including inhaled medications and chest physiotherapy will be discoureged in the future (Nichols DP et al, 2022) in patients treated with modulators.

Keywords

Airway clearance technique; Chest physiotherapy - Devices; Drainage;