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Improvement in health status following bronchopulmonary hygiene physical therapy in patients with bronchiectasis

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Summary
Chronic productive cough is a common symptom in patients with bronchiectasis that is associated with a reduction in health-related quality of life (QOL). Bronchopulmonary hygiene physical therapy (BHPT) is widely prescribed for patients with bronchiectasis, although the evidence for its efficacy is limited. We set out to prospectively evaluate the impact of BHPT on health-related QOL in patients with non-cystic fibrosis bronchiectasis.

We assessed cough symptoms (0–100 mm visual analogue scale; VAS) and cough-related QOL in 53 patients with stable non-cystic fibrosis bronchiectasis at baseline and >4 weeks after outpatient-based BHPT. Cough specific health status was assessed with the Leicester Cough Questionnaire (LCQ; total score range 3–21, higher scores representing better QOL).

All patients with bronchiectasis complained of cough as the major symptom and had mean (SEM) FEV_1 of 2.1 (0.1) L. Cough-related health status was reduced at baseline; mean (SEM) LCQ score 14.3 (0.6). There were significant improvements in cough symptoms (mean cough VAS before 43.3 (3.6) vs after 27.5 (3.1); mean difference 15.8; 95% CI of difference 9.6–22; $p < 0.0001$) and cough-related health status after BHPT (mean LCQ total score before 14.2 vs after 17.3; mean difference 3.1; 95% confidence interval of difference 2.4–3.9; $p < 0.001$). A significant improvement was seen in all LCQ health-related domains (physical, psychological and social; all $p < 0.001$).

Our findings suggest that bronchopulmonary hygiene physical therapy can lead to a significant improvement in cough-related quality of life.

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Introduction

Bronchiectasis is characterised by permanent dilatation of the bronchi and impaired clearance of airway secretions. A wide range of immunological, infective and genetic conditions can lead to the development of bronchiectasis but a substantial proportion of cases is unexplained. Patients with bronchiectasis commonly present with a chronic productive cough and recurrent chest infections.[1,2] Progressive decline in lung function and deteriorating functional capacity is frequently seen and patients can suffer significant physical and psychological morbidity that leads to impaired health-related QOL.[3,4]

There is a paucity of effective therapeutic agents for patients with bronchiectasis. Bronchopulmonary hygiene physical therapy (BHPT) is the mainstay therapy for most patients and is widely prescribed as a prophylactic and therapeutic intervention. BHPT comprises patient education and a range of physical techniques that aid clearance of airway secretions.[5] Despite its routine use in both acute exacerbations and chronic non-cystic fibrosis (CF) bronchiectasis, the evidence for its efficacy is limited. BHPT may reduce sputum volume and increase clearance but there are no studies investigating the impact of BHPT on health-related QOL.[6–8] A recent Cochrane database systematic review identified few clinical trials investigating BHPT in non-CF bronchiectasis and most of these contained small numbers of patients.[9] This review concluded that there was insufficient evidence to support the use of BHPT in non-CF bronchiectasis. The aim of our study was to investigate the effect of BHPT on health-related QOL in patients with stable non-CF bronchiectasis.

Methods

Patients

Consecutive patients diagnosed with bronchiectasis were identified from those attending adult respiratory outpatient clinics. Bronchiectasis was diagnosed if patients had characteristic clinical features and typical radiological appearance of bronchiectasis (chest radiograph and/or high resolution computerised tomography scan; HRCT scan).[10] All but four patients had bronchiectasis confirmed on HRCT. Only clinically stable patients with no significant change in symptoms in the preceding 4 weeks were recruited. No patient had BHPT previously. Patients with radiological appearance of traction bronchiectasis and recent respiratory tract infection (<8 weeks) were excluded. Localised bronchiectasis was defined as disease confined to a single pulmonary lobe.

Leicester Cough Questionnaire (LCQ)

Heath status was assessed with the LCQ which is a 19 item, self-completed, cough specific health-related QOL questionnaire. [11] The LCQ has been extensively validated and has been shown to be valid, reproducible and responsive. The LCQ has three domains: physical, psychological and social (domain score range 1–7; higher score = better QOL). The overall QOL scores range from 3 to 21, 21 being normal. The minimal important difference for total LCQ total score is 1.3.[12]

Protocol

All patients with bronchiectasis were referred for outpatient BHPT. The LCQ and cough symptom severity visual analogue score (0–100 mm; 100 mm worst cough) were administered at initial assessment and >4 weeks later at a follow-up visit. BHPT comprised two sessions at least 2 weeks apart.

Session 1 (1 h)

- General assessment of condition, symptoms, social circumstances and medications.
- Introduction to physiotherapy and aims of treatment.
- Education about disease and self-management rationale.
- Selection of appropriate chest clearance techniques to establish a home programme from the following:
  - Active cycle of breathing techniques (ACBT)
  - Autogenic drainage (AD)
  - Flutter
  - Modified postural drainage (MPD)
  - Breathing retraining advice (BR)
  - Cough control techniques (CC)
- Written information given to reinforce education, management and physiotherapy techniques.

Session 2 (30 min–1 h)

- Progress review assessing compliance with physiotherapy manoeuvres.
- Refine self-management as necessary and discuss any concerns.
- Reinforce aims of physiotherapy including short and long-term goals.
- Holistic advice as indicated: coping strategies for breathlessness, breathing pattern correction, monitoring exercise levels.

Analysis

Data is presented as mean (SEM: standard error of mean). Paired *t*-tests were used to compare VAS and QOL scores before and after BHPT. The relationship between FEV_1 and change in health status was assessed with Pearson's correlation coefficient. Graphpad Prism (Graphpad software Inc) and Minitab software were used for analysis. The study protocol was approved by the local research ethics committee and all subjects gave informed consent.

Results

Fifty-three patients met the inclusion criteria during the study period (Table 1). No patient declined participation or withdrew from the study. The cause of the bronchiectasis was idiopathic ($n = 39$), previous non-tuberculous infection ($n = 10$), previous tuberculosis ($n = 2$), allergic bronchopulmonary aspergillosis ($n = 1$) and immunoglobulin

Table 1 Patient characteristics

n	53
Female	30 (55%)
Mean age, years	67 (1.4)
Mean duration of cough, years	8 (2.8)
Non-productive cough	8 (15%)
Localised Bronchiectasis	6 (11%)
Mean FEV_1	2.1 ($\pm$0.1)
Current smokers	4 (7.5%)
Ex smokers	20 (37%)
Pseudomonas colonisation	2 (3%)

Data expressed as *n*(%): number; Mean (SEM): standard error of mean; FEV_1 = forced expiratory volume in 1 s, litres; localised bronchiectasis = bronchiectasis confined to one pulmonary lobe; *Pseudomonas* colonisation = >2 positive *Pseudomonas* sputum cultures; and ex-smoker = >10 pack year smoking history.

deficiency ($n = 1$). All patients complained of cough and 45 (85%) had a productive cough (Table 1). The mean (SEM) duration between administration of the first and second LCQ was 8 (1.6) weeks. The combinations of BHPT techniques administered are presented in Table 2. At the follow-up visit, all patients reported administering their BHPT regime at least once a day.

There was a significant reduction in cough VAS after BHPT. The mean (SEM) cough VAS before and after BHPT were 43 (4) and 27 (3); mean difference 16; 95% confidence interval of difference 10—22; $p < 0.0001$ (Fig. 1). Health-related QOL was impaired in patients with bronchiectasis at baseline; mean (SEM) total LCQ score 14.3 (0.6) (normal = 21, Fig. 2). There were reductions in physical, psychological and social health domain scores of the LCQ at baseline (Fig. 2). A significant improvement was seen in cough specific QOL after BHPT; total LCQ score before 14.3 vs 17.4 after BHPT; mean difference 3.0; 95% confidence interval of difference 2.3—3.7; $p < 0.0001$; Fig. 2. A significant improvement was seen in all LCQ health domains with BHPT (Fig. 2). Forty-eight (90%) patients had an improvement in health status greater than the LCQ minimal important clinical difference (LCQ score > 1.3).

Table 2 Bronchopulmonary hygiene therapy regimes

Physiotherapy techniques	Number of patients
ED + ACBT + AD	25
ED + ACBT	10
ED + ACBT + AD + BR	9
ED + ACBT + BR	2
ED + ACBT + MPD	2
ED + ACBT + MPD + BR	1
ED + ACBT + AD + MPD + BR	1
ED + ACBT + AD + MPD	1
ED + ACBT + AD + CC	1
ED + ACBT + AD + CC + BR	1

ACBT: activated cycle of breathing technique; AD: autogenic drainage; BR: breathing retraining advice; ED: education; MPD: Modified postural drainage; and CC: cough control techniques.

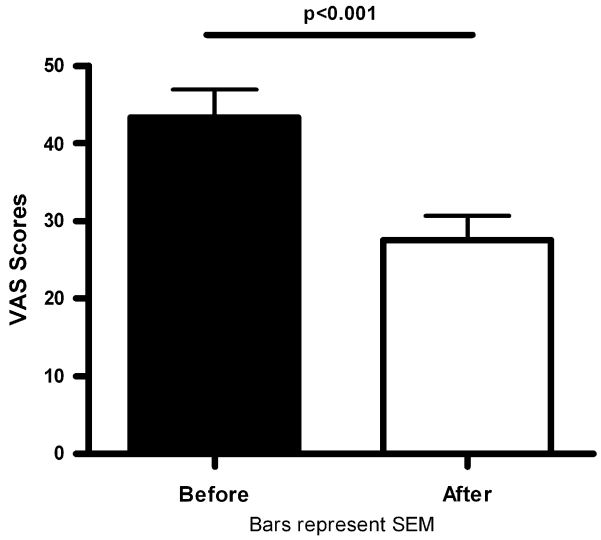

Figure 1 Cough VAS scores before and after bronchopulmonary hygiene physical therapy. Bars represent mean (SEM). *$p < 0.0001$.

A significant improvement in cough specific health-related QOL was seen after BHPT in male patients $p = 0.017$; female patients $p = 0.0014$; patients with localised bronchiectasis $p = 0.02$; generalised bronchiectasis $p = 0.001$; non-smokers $p = 0.004$; current or ex smokers $p = 0.003$. There were no significant differences in QOL improvements of males (mean change in total LCQ 3.1) compared with females (3.1; $p = 0.9$) nor in the LCQ domains ($p = 0.4$—0.6). There was no relationship between baseline FEV_1 and change in LCQ total score after BHPT ($r = 0.2$; $p = 0.2$). No adverse effects of BHPT were reported by patients in this study.

Discussion

We have shown that BHPT leads to a reduction in cough symptoms and an improvement in health-related QOL in patients with non-CF bronchiectasis. This is the largest study of BHPT in non-CF bronchiectasis and the first to assess the impact of BHPT on health-related QOL. The improvement in QOL was large, greater than the LCQ minimal important clinical difference and was seen in most patients.

Most patients with bronchiectasis have a productive cough which can be a distressing symptom associated with significantly impaired quality of life.[13,14] The mechanism of cough is unclear but is thought to result from airway inflammation and heightened cough reflex sensitivity.[15] In a recent report, heightened cough reflex sensitivity in patients with bronchiectasis was associated with increased cough symptoms and reduced health-related QOL.[16] Pooling of airway secretion in bronchiectasis is thought to be an important factor in the development of airway inflammation, heightened cough reflex sensitivity, recurrent respiratory tract infections and exacerbations. Current therapy for bronchiectasis aims to minimise pooling of airway secretions and reducing airway inflammation. BHPT is widely used for patients with stable bronchiectasis but evidence for its efficacy is limited. There are a few published studies of

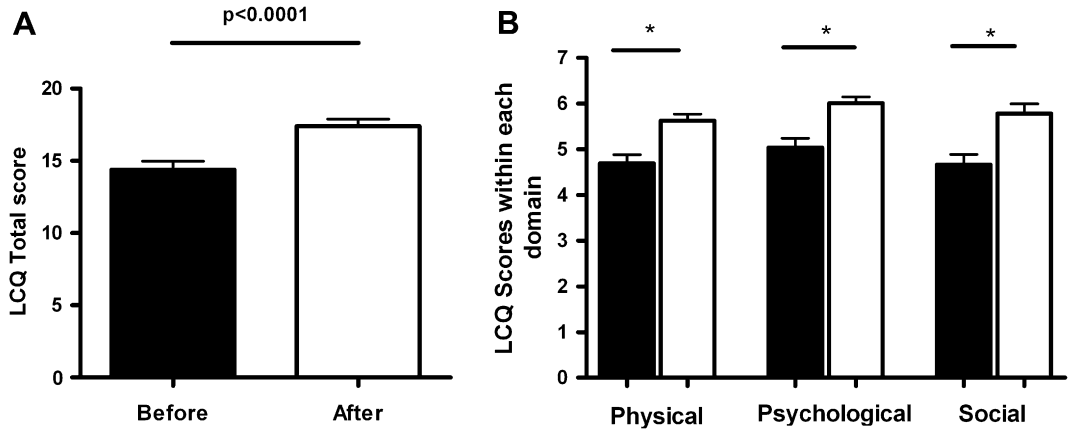

Figure 2 Cough specific health-related quality of life before and after bronchopulmonary hygiene physical therapy; (A) overall QOL and (B) physical, psychological and social domains. Leicester Cough Questionnaire (LCQ: range 3—21; high score = better quality of life); LCQ domain score range 1—7 (high score = better quality of life); Solid bars: baseline; Open bars: after BHPT; mean (SEM); and $*p < 0.0001$.

BHPT efficacy; all contain small numbers of patients, assess only single sessions of BHPT and none have evaluated its impact on QOL. A large meta-analysis of chest physiotherapy in cystic fibrosis patients with bronchiectasis reported that standard physical therapy did aid sputum expectoration compared to no treatment.[5] In non-CF bronchiectasis, a recent Cochrane database review concluded that there was insufficient published evidence to support the use of BHPT and also suggested that future studies should assess health-related QOL.[17] BHPT can be labour intensive, expensive, inconvenient for some patients, associated with potential adverse effects, hence evaluation of this therapy in bronchiectasis is needed.[18,19] Our data suggests that BHPT can significantly reduce in cough symptoms and result in a large improvement in health status without adverse effects.

There are limitations to this study most notably the lack of a control group. The placebo effect is common in clinical trials of patients with cough but this is usually more prominent in patients with acute cough. In our study, all patients had a stable chronic cough of longstanding duration, many of whom had unsuccessful trials of other therapies previously. It is possible that some patients may not have been compliant with BHPT since we did not measure compliance objectively. Compliance is difficult to assess in this setting but a compliance check at the follow-up visit, although subjective, indicated that patients administered at least one session of BHPT daily and this was associated with an improvement in symptoms and QOL. Another limitation is that only subjective outcome measures were assessed. The patients recruited in this study had mild to moderate lung function impairment and low rates of *Pseudomonas* colonisation so we cannot be sure that the quality of life benefits of BHPT extend to patients with more severe bronchiectasis. Our findings should be considered preliminary and provide a platform for a larger randomised controlled trial. Further studies should assess long-term benefits, effects on lung function, exacerbations, cost effectiveness and incorporate objective outcome measures such as cough frequency monitoring and cough reflex sensitivity measurements.

We tailored BHPT individually for patients according to symptoms, practicability and acceptability. BHPT consists of several components and the relative efficacy of each component is not known or how they compare to education alone. We were unable to carry out this sub-analysis since the prescribed BHPT program often comprised of several components at one sitting. Further study of the efficacy of BHPT components and determination of optimal number of sessions would be valuable to design a clinically cost effective program. The effectiveness of BHPT in bronchiectasis according to aetiology also deserves further investigation.

In conclusion, BHPT is a safe, well-tolerated and acceptable form of therapy for patients with non-CF stable bronchiectasis that leads to an improvement in cough symptoms and health-related quality of life. Further studies are required to confirm our findings in a randomised controlled trial and determine the optimum duration of therapy and efficacy of BHPT components.

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Conflict of interest statement

The authors have no conflict of interest.

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