Relationship between psychological well-being and lung health status in patients with bronchiectasis


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Abstract Patients with bronchiectasis often complain of abnormal tiredness, difficulty in concentrating or low spirits. This study was carried out to examine levels of anxiety and depression in bronchiectasis and their relationship with other measures of lung health. One hundred and eleven patients with bronchiectasis determined by high-resolution computed tomography (CT) scan were studied using a range of physiological and psychological outcome measures. Patients completed anxiety and depression, health status (quality of life), fatigue and dypnoea questionnaires. Lung function was measured and exercise capacity was assessed using a shuttle walk test. Anxiety and depression scores formed a continuum. Moderate–severe anxiety was more frequent than equivalent levels of depression (17% vs 9% of patients). Anxiety and depression scores were associated with perceived health status (r = 0.33 and 0.55). Neither anxiety nor depression was associated with the extent of bronchiectasis on CT scan. Depression was correlated with breathlessness and exercise performance (r = 0.33 and 0.40), but anxiety was not. The correlation between depression and exercise performance was not simply due to the influence of somatic items in the depression questionnaire. We conclude that anxiety and depression are quite common in bronchiectasis in that 34% of patients had elevated scores for anxiety, depression or both. The non-somatic components of depression were linked to dyspnoea and exercise performance, but anxiety was only related to perceived health. Therefore, treatment aimed at reducing symptoms and improving exercise capacity will not reduce levels of anxiety which need alternative therapy. © 2002 Elsevier Science Ltd. All rights reserved.


Keywords bronchiectasis; anxiety; depression; health-related quality of life.

INTRODUCTION

Bronchiectasis is a chronic lung condition in which damage to the large airways leads to abnormal dilatation of one or more bronchi and results in poor clearance and pooling of mucus in the affected areas. Commonly reported symptoms include daily cough and sputum production, wheeze, breathlessness and fatigue. This can lead to reduced exercise capacity and a reduced ability to carry out activities of daily living. Bronchiectasis differs from other common airways diseases such as chronic obstructive pulmonary disease and asthma, in that sufferers produce a greater volume of sputum and experience recurrent or chronic infections much more frequently (1,2).

One effect of chronic disease may be mood impairment that persists despite maximum medical treatment.

This raises the possibility of using mood-altering drugs to provide symptomatic benefit in patients with chronic physical disease. This approach causes concern, however, since symptoms are an important marker of disease activity. These might be masked by the use of drugs that make patients feel better without having any effect on the underlying disease process in the lungs. A further concern is that anxiety and depression occur within individuals who have no organic disease, so if mood state impairment is present, the question arises as to whether this is a co-existent disturbance or the result of the organic disease and its consequences.

This study was carried out to examine mood impairment in bronchiectasis although it is well recognised that patients with bronchiectasis often complain of abnormal tiredness, difficulty in concentrating or low spirits (1,2), a formal study of patients mood and its relation to other measures of lung health has not been undertaken before.

Two principle hypotheses were under test: (1) that mood state and disease severity are related; (2) that there is a
subgroup of patients with clinically significant mood impairment that this is out of proportion to any lung disease-related effect. We also wished to investigate the possibility that there may be cross-contamination between measures of depression, which is characterised by psycho-motor retardation, and those that measure disturbance of physical activity secondary to organic causes. To minimise this effect, we used a mood state questionnaire that was developed specifically for use in patients with organic disease: the Hospital Anxiety and Depression Scale (3). The depression component of this instrument contains only one item of a somatic nature. We hypothesised that if there were a relationship between depression and disease severity, this may be influenced by the somatic item in the questionnaire. The present study was carried out at the same time as a study to validate the St George’s respiratory questionnaire in bronchiectasis (4).

METHODS

Patients were recruited from the Host Defence Unit outpatients clinics at the Royal Brompton Hospital over a 4 month period. Patients attending the clinic who had been diagnosed with bronchiectasis, both clinically and by high-resolution computed tomography (HRCT), were approached to take part in the study. In every case, the major clinical presentation was caused by bronchiectasis. In total, 120 patients were approached. Of these, 111 patients (44 males) agreed to take part and were recruited into the study. All patients were British or had lived in the UK for many years. Details of the aetiology were recorded from their medical records. The study was approved by the Royal Brompton Hospital Ethics Committee. Written consent was obtained.

The patients completed the Hospital Anxiety and Depression Scale (HADS), the St George’s Respiratory Questionnaire (SGRQ), a fatigue questionnaire and the Medical Research Council (MRC) dyspnoea scale in a randomised order. Further details of each of these measures are provided below. Patients also completed tests of lung function and shuttle walk test. A HRCT scan for each patient was obtained. The scan acquisition parameters were 1.5 mm sections at 10 mm intervals with the patient supine and breath-holding at near total lung capacity. Images were photographed at -500 H.U. (centre) and 1000 H.U. (width).

Questionnaires

Hospital Anxiety and Depression Scale (HADS): The HADS was developed to measure anxiety and depression specifically in patients with chronic disease (3). For both anxiety and depression scales, there are seven questions, each of which are scored on a scale of 0–3. The scores for both the Anxiety and Depression scale can be interpreted in the following way: $0–7 = \text{normal}$, $8–10 = \text{mild}$, $11–21 = \text{moderate-severe}$ (5). Measurement of psychological disturbance in any chronic disease may be complicated if physical markers that are assumed to be associated with the patient’s psychological state also occur as a direct result of the underlying disease. The HADS has been found to be free of this ‘criterion contamination’ when used in patients with rheumatoid arthritis (6). When used in the context of chronic lung disease, the HADS contains one somatic item that might relate to physical impairment as a result of the condition. This was Depression Item 4 (I feel as if I am slowed down). To investigate the impact of this item, the depression component of the HADS was calculated in two ways: using all seven items that normally make up this scale including item Depression Item 4 (Depression) and without Depression Item 4 (Depression-D4).

St George’s Respiratory Questionnaire (SGRQ): The SGRQ was developed to measure health status (quality of life) in patients with respiratory disease (7). It has recently been shown to be reliable, valid and responsive when used in patients with bronchiectasis (4). Component scores measuring symptoms (Symptoms), impacts on daily life (Impacts), disturbance to daily activities (Activity) and an overall (Total) score are produced. Each component and the Total is scored on a scale of zero to 100, with zero being the best possible score and 100 being the worst.

Fatigue questionnaire: This 14-item scale was developed to measure severity of fatigue (8). A Physical Fatigue score, a Mental Fatigue score and an Overall score are produced. The questionnaire has demonstrated validity and reliability in a general population. It has been recommended for use in both hospital and community populations.

MRC Dyspnoea scale: The Medical Research Council (MRC) Dyspnoea scale is a standardised scale used to measure breathlessness (9). Patients grade themselves on a 5-point scale from Grade 1 (breathless with strenuous exercise) to Grade 5 (too breathless to leave the house or breathless when dressing).

Shuttle walk test and lung function: The shuttle walk test is a standardised incremental paced walking test which measures symptom-limited maximal performance by requiring individuals to walk around two stationary cones placed 10 m apart at an increasing speed (10). Comprehensive lung function tests including measurement of arterial blood gases by earlobe sampling were made.

High-resolution computed tomography (HRCT)

A HRCT scan was obtained in each patient, then assessed and scored by the same pulmonary radiologist (DMH) who was blinded to all other details concerning the pa-
tient. Each available lobe was scored for bronchiectatic changes on a 0–3 scale, where 0 = no bronchiectasis; 1 = one or less than one bronchopulmonary segment involved; 2 = more than one bronchopulmonary segment involved; 3 = gross cystic bronchiectasis. This scoring system has been used in previous studies and is associated with low inter-observer variation (11, 12). To adjust the scores of those patients who had lobectomies, the bronchiectasis score was calculated as a percentage of the maximum points available.

Analysis

Parametric and distribution-independent tests were performed throughout the analyses. No major discrepancies between these two approaches were found, however, so the results are presented using results from the parametric tests to allow easier assessment of the size of the association between variables. Significance was accepted at a 5% probability level.

RESULTS

Patient details

Data from 111 (44 male) patients were used in this study. Their mean age was 52 years (SD 13). The aetiologies included: 64 with idiopathic bronchiectasis, 11 with allergic bronchopulmonary aspergillosis, 10 with hypogammaglobulinaemia, 10 with post-infective bronchiectasis, 10 with primary ciliary dyskinesia or Young’s syndrome and six in whom bronchiectasis was associated with inflammatory bowel disease. Data from the idiopathic group were analysed separately to see whether the presence of co-morbid illness affected the results. As no discrepancies were found when other aetiologies were excluded, results from the complete sample are presented. Mean HRCT bronchiectasis score was 40.9% (SD 19.6).

Mean FEV₁, expressed as a percentage of the predicted value (% pred), was 66.4% pred (SD 28.8). Mean oxygen (\(\text{PaO}_2\)) was 10.2 kPa (SD 5.9). Mean Dyspnoea score was 2.1 (SD 1.0). Mean shuttle exercise distance was 473 m (SD 258). The mean Physical Fatigue score was 4.7 (SD 2.5), Mental Fatigue was 2.2 (SD 1.9) and the Total Fatigue score was 6.0 (SD 3.8). The mean SGRQ scores were: Symptoms 71 (SD 20), Activity 49 (SD 25), Impacts 34 (SD 19), total 44 (SD 18).

Anxiety and Depression

The mean Anxiety score was 6.3 (SD 4.5). The frequency distribution for this score is shown in Fig. 1. Although it was slightly skewed with an extended tail towards the higher scores, there was no evidence of a bimodal distribution. The mean Depression score was 4.5 (SD 3.4), again the distribution was skewed but there is no evidence for the presence of two different sub-populations of patients (Fig. 2 upper panel). Scatter graphs for Anxiety and Depression scores were also examined. These did not show any cut-off point to mark a bimodal distribution for either anxiety or depression.

The Anxiety score correlated quite strongly with Depression (\(r = 0.67, P < 0.001\)). Patients were categorised as ‘normal’, ‘mild’, ‘moderate’ and ‘severe’ anxiety and depression according to the scoring bands described in the methods section. Using the Anxiety scale: 69% of patients scored ‘normal’, 14% ‘mild’, 17% ‘moderate–severe’. On the Depression scale: 85% of patients scored ‘normal’, 5% ‘mild’, 9% ‘moderate–severe’. In all, 34% of patients had elevated scores for Anxiety, Depression or both.

The distribution of the responses to the somatic Depression item (item D4) is also shown in Fig. 2 (lower panel). These are distributed along the x-axis at intervals corresponding to the comparable points for the whole 7-item Depression scale (note: a response of ‘one’ to each of the seven items produces a score of ‘seven’ for the whole scale). Responses to the single somatic component of the Depression scale were distributed towards the higher end of the scaling range compared to the scores for the whole 7-item Depression scale. The association between the full 7-item Depression score and the score from the six items excluding the somatic item (Depression-D4) was only moderate (\(r = 0.51; P < 0.0001\), i.e. 26% shared variance).

Association of anxiety and depression with gender, age and disease aetiology

Unpaired t-tests were used to test for differences in anxiety and depression between male and female patients.
There were no significant differences in Anxiety, Depression, Depression-D4 or item D4 between male and female patients (\(t = -1.5, -1.7, -1.8\) and \(-0.6\), respectively; all \(P > 0.05\)). Pearson’s \(r\), calculated to examine the relationship between age and Anxiety, Depression, Depression-D4 or item D4 was not significant (\(r = -0.02, 0.18, 0.17,\) and \(0.14\), respectively; all \(P > 0.05\)). ANOVAs calculated to examine the relationship between disease aetiology and Anxiety, Depression, Depression-D4 or item D4 were not significant (\(F = 0.41, 0.67, 0.69\) and \(0.70\); all \(P > 0.05\)).

### Association of anxiety and depression with health status

Pearson’s correlation coefficient was calculated between the HADS scores and the SGRQ. Correlations between Anxiety and the component scores of the SGRQ were weaker than those between Depression and SGRQ score (Table 1). Item D4 correlated more strongly with each SGRQ component than did the overall Depression score. Correspondingly, Depression-D4 correlated with the SGRQ scores more weakly than did the full 7-item Depression score. Neither Anxiety nor any index of Depression correlated with HRCT bronchiectasis score (Table 2).

### Association of anxiety and depression with physiological function

All three measures of depression correlated with exercise performance, with D4 being the strongest correlate (Table 2). The relationship between overall Depression and exercise performance is illustrated in Fig. 3. Since the causality in this relationship could be in either directions both \(x \text{ vs } y\) and \(y \text{ vs } x\) plots are presented. Three features are of note. First, the scatter was normally distributed around the regression. Second, there was no evidence of non-linearity. Third, with the exception of one patient with a high Depression score, none of the other patients appeared to depart from the overall Depression—exercise relationship. None of the mood state scores correlated with \(\text{FEV}_1\) or \(\text{PaO}_2\).

### Association of anxiety and depression with fatigue and dyspnoea

Anxiety and Depression correlated with Physical Fatigue, Mental Fatigue and Overall Fatigue (\(P < 0.001\) in each

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**Table 1.** Correlation between the HADS and the SGRQ

<table>
<thead>
<tr>
<th></th>
<th>SGRQ Symptoms</th>
<th>SGRQ Activity</th>
<th>SGRQ Impacts</th>
<th>SGRQ Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>HADS Anxiety</td>
<td>0.20*</td>
<td>0.23**</td>
<td>0.38***</td>
<td>0.33***</td>
</tr>
<tr>
<td>HADS Depression</td>
<td>0.34***</td>
<td>0.44***</td>
<td>0.58***</td>
<td>0.55***</td>
</tr>
<tr>
<td>HADS Depression-D4</td>
<td>0.27***</td>
<td>0.37***</td>
<td>0.50***</td>
<td>0.41***</td>
</tr>
<tr>
<td>Item D4</td>
<td>0.43***</td>
<td>0.50***</td>
<td>0.60***</td>
<td>0.60***</td>
</tr>
</tbody>
</table>

Definition of abbreviations: SGRQ = St George’s Respiratory Questionnaire, HADS = Hospital Anxiety and Depression Scale. Correlations are Pearson’s \(r\) coefficient. 
* \(P < 0.05\); ** \(P < 0.01\); *** \(P < 0.001\).
There was little difference in the strength of correlation between the different measures of mood state and the components of fatigue, although Anxiety appeared to correlate a little less strongly with Physical Fatigue (13% shared variance compared to 20–37% for all the other comparisons). Anxiety did not correlate with dyspnoea (shared variance 3%, Table 1). In contrast, dyspnoea was correlated with all Depression scores ($P < 0.001$), the weakest correlate was that with Depression-D4 where the share variance was 12%.

**DISCUSSION**

In this study, one-third of patients had evidence of clinically significant mood impairment. The scores appeared to form a continuum, with no evidence of any discrete sub-populations of clinically anxious or depressed patients. Anxiety and depression were both related to fatigue and impairment of health status, the latter being measured using a validated disease-specific questionnaire for chronic lung disease. Thus, patients with elevated anxiety and depression feel more tired and will report greater impairment of their daily life and well-being than patients without significant mood impairment.

Neither anxiety nor any index of depression correlated with the extent of bronchiectasis on CT scan. Therefore, this study did not show a relationship between mood state and disease severity. In a previous study, we found a similar lack of correlation between extent of bronchiectasis and health status (13). However, we have also shown that many features of the disease such as the level of inflammation in the lung, the type of bacterial infection, exercise capacity and the frequency of exacerbations do influence health status, but they are dependent on other factors in addition to structural abnormality (4,13,14). Future studies should investigate how these other features of bronchiectasis influence mood state.

The study raises some important issues concerning the nature of the relationship between lung disease and mood state. Whilst the Anxiety score was associated with the patients’ perception of their health and well-

### Table 2. Correlations between the HADS and fatigue, dyspnoea, Shuttle Walk test and FEV$_1$ (% pred)

<table>
<thead>
<tr>
<th></th>
<th>HRCT score</th>
<th>Shuttle walk test</th>
<th>FEV$_1$ (% pred)</th>
<th>PaO$_2$</th>
<th>Physical fatigue</th>
<th>Mental fatigue</th>
<th>Total fatigue</th>
<th>Dyspnoea</th>
</tr>
</thead>
<tbody>
<tr>
<td>HADS anxiety</td>
<td>0.05$^{ns}$</td>
<td>-0.02$^{ns}$</td>
<td>-0.06$^{ns}$</td>
<td>-0.08$^{ns}$</td>
<td>0.36*</td>
<td>0.56*</td>
<td>0.51*</td>
<td>0.16$^{ns}$</td>
</tr>
<tr>
<td>HADS</td>
<td>0.05$^{ns}$</td>
<td>-0.33*</td>
<td>-0.02$^{ns}$</td>
<td>-0.10$^{ns}$</td>
<td>0.55*</td>
<td>0.54*</td>
<td>0.62*</td>
<td>0.40*</td>
</tr>
<tr>
<td>Depression</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HADS</td>
<td>0.02$^{ns}$</td>
<td>-0.29*</td>
<td>0.02$^{ns}$</td>
<td>-0.09$^{ns}$</td>
<td>0.47*</td>
<td>0.52*</td>
<td>0.57*</td>
<td>0.35*</td>
</tr>
<tr>
<td>Depression-D4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item D4</td>
<td>0.13$^{ns}$</td>
<td>-0.39*</td>
<td>-0.13$^{ns}$</td>
<td>-0.10$^{ns}$</td>
<td>0.60*</td>
<td>0.45*</td>
<td>0.61*</td>
<td>0.51*</td>
</tr>
</tbody>
</table>

*Definition of abbreviations: FEV$_1$ = forced expiratory volume in 1 s, HADS = Hospital Anxiety and Depression scale
Correlations are Pearson $r$ coefficient
$^{ns}$ $P > 0.05$; * $P < 0.001$

Note: Only 96 of the 111 patients had PaO$_2$ measured by earlobe oximetry.
being. It was not associated with any patho-physiological marker of disease activity. In contrast, depression was associated with the patients’ level of exercise impairment in the laboratory and their level of breathlessness in daily life. This association appears to have been due in part to a linkage between the somatic manifestations of depression and physical limitation due to organic disease. Restricting the depression questionnaire to those items that did not have somatic features reduced the strength of the association with exercise performance and dyspnoea in daily life, but did not abolish it. We conclude that the link between depression and exercise tolerance is not simply due to cross-contamination in the methods of assessment.

Bronchiectasis patients may complain of tiredness in the middle of the day, difficulty in concentrating and low spirits (1,2). In this study, patients with reduced exercise capacity and a high level of breathlessness experienced a poor level of health status and depression. Those who experienced high levels of both physical and mental fatigue were also likely to experience reduced health status and depression. This suggests that these symptoms were related to bronchiectasis-related disease activity, although a true endogenous component in those patients with clinically significant depression cannot be ruled out on the basis of this study. A longitudinal designed study would be required to answer this question. Physiotherapy forms the basis of bronchiectasis management, but is poorly adhered to by patients (1,2). The patients’ mental state may influence how often they carry out postural drainage. Treatment aimed at improving bronchiectasis symptoms, which are largely thought to be due to neutrophilic inflammation in the airways caused by bacterial infections (1,2) is likely to improve health status and depression, although any change in health status or depression should be measured directly rather than inferred.

In these patients, anxiety appeared to be a more specific variable than depression since the latter was related to both objective and subjective measures of impaired health, including exercise tolerance. In contrast, anxiety only related to perceived health. In anxious individuals, there may be a mismatch between perception and actual ability, with patients perceiving themselves to be less able than they actually are, and needlessly avoiding various situations. This phenomenon was observed by Yellowses and Kalucy (15) in an asthmatic population. Anxiety was not related to exercise capacity, lung function or breathlessness. They reported that asthmatics with high levels of anxiety experienced a cycle of fear and avoidance, which may cause ‘significant levels of personal handicap with social and functional restriction much greater than would be expected from the objectively measured physiologic level of impairment’. A treatment aimed at reducing symptoms and improving exercise capacity may not have a direct impact upon levels on anxiety, since it may be the patient’s perception of their health which needs to be addressed. Carr et al. (16) have suggested that asthmatics with high levels of anxiety might benefit from cognitive techniques designed to address expectations, beliefs and exaggerated interpretation of body sensations. This form of therapy might also be appropriate for bronchiectasis patients experiencing high levels of anxiety.

In conclusion, patients with bronchiectasis may experience elevated levels of anxiety, depression and reduced health status. There is no evidence of any distinct sub-populations of patients with high levels of anxiety or depression. Whilst the non-somatic components of depression appear to be linked to dyspnoea and exercise performance, the mechanisms underlying anxiety appear more complex. High levels of impaired mood were related to poor subjectively perceived health, although the nature of this link is not clear. Causality in the relationship between mood and impaired health and well-being can only be established through trials of interventions directed specifically at one or other aspect of impaired mood state.

REFERENCES


