Prevalence of dysfunctional breathing in patients treated for asthma in primary care: cross sectional survey

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Abstract

Objectives To estimate the prevalence of dysfunctional breathing in adults with asthma treated in the community.

Design Postal questionnaire survey using Nijmegen questionnaire.

Setting One general practice with 7033 patients.

Participants All adult patients aged 17-65 with diagnosed asthma who were receiving treatment.

Main outcome measure Score \( \geq 23 \) on Nijmegen questionnaire.

Results 227/307 patients returned completed questionnaires; 219 (71.3\%) questionnaires were suitable for analysis. 65 participants scored \( \geq 23 \). Those scoring \( \geq 23 \) were more likely to be female than male (46/132 (35\%) v 17/87 (20\%), \( P = 0.016 \)) and were younger (mean (SD) age 44.8 (14.7) v 49.0 (13.8, \( P = 0.05 \)). Patients at different treatment steps of the British Thoracic Society asthma guidelines were affected equally.

Conclusions About a third of women and a fifth of men had scores suggestive of dysfunctional breathing. Although further studies are needed to confirm the validity of this screening tool and these findings, these prevalences suggest scope for therapeutic intervention and may explain the anecdotal success of the Buteyko method of treating asthma.

Introduction

Abnormal breathing patterns have been shown to cause breathlessness, chest tightness, chest pain, light-headedness, paraesthesiae, and anxiety. This symptom complex has been described in different clinical situations and has been referred to as the hyperventilation syndrome, behavioural breathlessness, and dysfunctional breathing. It often occurs in association with hyperventilation.

Other abnormalities have been shown in patients with dysfunctional breathing. These include unsteadiness of breathing in response to stimuli such as exercise or a period of voluntary overbreathing, increased respiratory rate, abnormal orthostatic increases of respiratory gas exchange, a predominantly intercostal respiratory effort, and frequent sighing. The overbreathing aspect of the symptom complex may, however, be episodic and difficult to show without prolonged measurement of the end tidal or arterial carbon dioxide tension. Furthermore, some symptoms associated with the syndrome have been shown to be unrelated to hypocapnia and may be mediated by other mechanisms.

Diagnosis of dysfunctional breathing can therefore be difficult; the characteristic symptoms are common to other diseases and there is no standard diagnostic test. This may lead to under-recognition of the effects of abnormal breathing patterns, and symptoms may be wrongly attributed to other causes, resulting in inappropriate investigations and ineffective treatment.

There is evidence linking dysfunctional breathing with respiratory disorders. Large series of patients with the hyperventilation syndrome have been reported in specialist respiratory clinics. Asthma has been linked with symptomatic hyperventilation in several studies, and this may be related to the increased anxiety and depression indices found in asthmatic patients. In one series, 42\% of patients attending a hospital asthma clinic showed evidence of hyperventilation disorder as assessed by capnographic responses and Nijmegen questionnaire scores. Hyperventilation may be a compounding factor contributing to the symptoms of patients with asthma.

The prevalence of dysfunctional breathing in asthmatic patients treated in primary care has not been investigated. We studied the prevalence of dysfunctional breathing in patients treated for asthma in one general practice.

Participants and methods

We identified patients aged 17-65 with a diagnosis of asthma from the medical records of a semirural general practice with a list size of 7033. We included all patients who had had asthma diagnosed on clinical grounds and who had received one or more prescriptions for inhaled or oral bronchodilator or prophylactic asthma in the past year. The study was approved by the local research ethics committee.

Patients were sent the Nijmegen questionnaire for self completion. The questionnaire assesses 16 symptoms associated with abnormal breathing on a five point scale (table 1). A total symptom score of \( \geq 23 \) has been reported as showing a sensitivity of 91\% and a specificity of 95\% as a screening instrument in patients with diagnosed hyperventilation syndrome. We therefore used this value to divide participants into...
two groups. We also obtained the age and sex of participants from patient records and calculated the step of treatment in the British Thoracic Society guidelines from the electronic prescribing records as a guide to severity of asthma.

We entered data on a computerised spreadsheet and analysed them using standard SPSS software. Data on sex and asthma severity in the two groups were compared with the $\chi^2$ test. We analysed differences in age using Student’s $t$ test.

Results

Of the 4381 patients aged 17 to 65 registered with the practice, 307 (7%) met the entry criteria and were posted the questionnaire (128 men, 170 women, mean (SD) age 44 (14.7) years). A total of 227 questionnaires were returned after one mailing (response rate 74%, 89 men, 138 women), of which 219 were suitable for analysis (87 men, 132 women, mean (SD) age 46.7 years). Eight questionnaires were returned incorrectly completed, unlabelled, or illegible. Sixty three respondents (29%, 95% confidence interval 23% to 35%) had scores $\geq 23$ on the Nijmegen questionnaire.

The mean age was 44.8 (14.7) years for patients scoring $\geq 23$ and 49.0 (13.8) years for those scoring $<23$ (difference $=4.2$ years, $P=0.05$). Table 2 shows that women were more likely than men to have scores $\geq 23$ (46/132 (35%), 95% confidence interval 27% to 43%) vs 17/87 (20%, 11% to 28%); $\chi^2=5.83$, df $= 1$, $P=0.016$).

Table 3 shows the numbers of respondents at each British Thoracic Society treatment step who had positive and negative screening scores. There were no significant differences in severity of asthma between those who did and did not achieve questionnaire scores indicative of dysfunctional breathing ($\chi^2=3.17$, df $= 4$, $P=0.53$).

Discussion

This study shows that about one third of women and one fifth of men with asthma in a single practice had symptom scores on the Nijmegen questionnaire suggestive of dysfunctional breathing. The Nijmegen questionnaire is a simple self completed questionnaire that takes only a few minutes to complete and is thus a practicable screening instrument in primary care. The high prevalence of positive scores suggests that in this practice there may be an important unrecognised diagnostic overlap between asthma and dysfunctional breathing. As a result, a large minority of patients may be experiencing avoidable morbidity because of inappropriate diagnoses and ineffective treatment. The problem affects patients at all levels of asthma treatment but particularly women and younger adults.

Limitations of study

The limitations of this study are twofold. The first applies to its generalisability; the practice may have been more or less likely than others to diagnose asthma. However, the prevalence of asthma and the levels of treatment by British Thoracic Society treatment step in the practice are similar to the national figures. We did not require objective confirmation of the diagnosis of asthma, such as showing reversible airflow obstruction on spirometry or variation in peak flow. This is appropriate in a general practice based study because asthma remains a clinical diagnosis supported by, but not reliant on, objective measurements. Larger studies will be needed to confirm the suggested high prevalence of dysfunctional breathing among patients with asthma and the validity of the diagnostic label of asthma in patients with symptoms suggestive of dysfunctional breathing.

The second limitation applies not only to this study but to much of the data on the hyperventilation syndrome and dysfunctional breathing—that of definition and diagnosis. The Nijmegen questionnaire identifies patients with characteristic symptom patterns, but the lack of a standard diagnostic test means the diagnosis cannot be certain. The questionnaire has been used extensively as a research and diagnostic tool, and studies have validated the questionnaire against other accepted diagnostic methods, including production of symptoms by voluntary hyperventilation (the hyperventilation provocation test) and capnography measurements during various manoeuvres and exposure to stressors. The validity of the hyperventilation provocation test, and even the existence of the hyperventilation syndrome, has been questioned because isocapnic hyperventilation studies showed that many of the symptoms produced by

Table 1 Nijmegen questionnaire. Respondents are asked to ring the score that best describes the frequency with which they experienced the symptoms listed

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Never</th>
<th>Seldom</th>
<th>Sometimes</th>
<th>Often</th>
<th>Very often</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest pain</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Feeling tense</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Blurred vision</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Dizziness</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Confirmation of touch reality</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Fast or deep breathing</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Shortness of breath</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Tightness across chest</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Bloating in stomach</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Tingling in fingers and hands</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Difficulty in breathing or taking a deep breath</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Stiffness or cramps in fingers and hands</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Tightness around the mouth</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Cold hands or feet</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Palpitations in the chest</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Anxiety</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 2 Numbers (percentages) of respondents with positive scores for dysfunctional breathing by age and sex

<table>
<thead>
<tr>
<th>Age &lt;40 years</th>
<th>Age $\geq$ 40 years</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>21/25 (28)</td>
<td>18/62 (29)</td>
</tr>
<tr>
<td>Women</td>
<td>4/28 (14)</td>
<td>32/84 (38)</td>
</tr>
<tr>
<td>Total</td>
<td>25/33 (33)</td>
<td>43/146 (27)</td>
</tr>
</tbody>
</table>

Table 3 Numbers (percentages) of patients with positive and negative screening scores for dysfunctional breathing according to British Thoracic Society asthma treatment steps

<table>
<thead>
<tr>
<th>British Thoracic Society treatment step</th>
<th>Positive score $n=63$</th>
<th>Negative score (n=156)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14 (22)</td>
<td>36 (22)</td>
</tr>
<tr>
<td>2</td>
<td>21 (33)</td>
<td>51 (33)</td>
</tr>
<tr>
<td>3</td>
<td>14 (22)</td>
<td>45 (29)</td>
</tr>
<tr>
<td>4</td>
<td>14 (22)</td>
<td>23 (14)</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>2 (1)</td>
</tr>
</tbody>
</table>

* $>23$ on Nijmegen questionnaire.
Abnormal breathing patterns may cause characteristic symptoms and impair quality of life.

Effective interventions exist for dysfunctional breathing.

Dysfunctional breathing has been described in patients attending hospital respiratory clinics.

29% of adults treated for asthma in primary care had symptoms suggestive of dysfunctional breathing.

Affected patients were more likely to be female and younger, but no differences were found with severity of asthma.

Some patients with asthma may benefit from breathing therapy.

Implications

It is important to recognise dysfunctional breathing because interventions are available to improve symptoms and quality of life. These interventions include explanation, reassurance, reattribution of symptoms, relaxation exercises, and specific breathing retraining exercises. Teaching diaphragmatic breathing exercises has been shown to be highly effective in sec-

retraining exercises. Teaching diaphragmatic breathing symptoms, relaxation exercises, and specific breathing include explanation, reassurance, reattribution of with the hyperventilation syndrome has been ques-

retraining breathing improves symptoms in patients

however, had limited scientific scrutiny.

Our data suggest that large numbers of asthmatic patients may have developed abnormal breathing patterns, causing symptoms that could be improved by appropriate interventions. Further studies are needed to investigate the effects of breathing retraining on patients identified by questionnaire tools and to confirm the high prevalence of dysfunctional breathing in asthmatic patients.

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Contributors: MT coordinated the study and drafted the paper. RKM&K advised on the study design and revised the text. EF and CF advised on the study design and execution and commented on the text, and CF did the statistical analyses. MT acts as guarantor.

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