Association of anxiety with perception of histamine induced bronchoconstriction in patients with asthma

Philip Spinhoven, Anke S van Peski-Oosterbaan, A J Willem Van der Does, Luuk N A Willems, Peter J Sterk

Abstract

Background – The perception of bronchoconstriction varies among patients with asthma and this perception may be related to the covariation of sensory and affective aspects of dyspnoea. A study was performed to evaluate whether there are differences in the perception of histamine induced bronchoconstriction between anxious and non-anxious perceivers and whether anxious perception of bronchoconstriction can be predicted by higher levels of baseline anxiety.

Methods – Seventy eight asthmatic subjects referred for a histamine challenge test undertook baseline measures for anxiety symptomatology and forced expiratory volume in one second (FEV1) followed by perceived breathlessness (Borg scale), anxiety (SUDS), and FEV1 measurement before and during induced bronchoconstriction. Based on the correlation between Borg and SUDS scores, the patients were divided into anxious and non-anxious perceivers.

Results – Forty one patients reported no anxiety during the challenge test. The anxious perceivers (n = 20) had higher levels of perceived breathlessness and anxiety at 20% fall in FEV1 and were more accurate in their perception of airways obstruction than non-anxious perceivers (n = 58). However, they did not report higher baseline levels of anxiety symptomatology.

Conclusions – Anxiety experienced during bronchial challenge testing may result from the accurate perception of physiological changes and further direct attention to airways obstruction.

Keywords: anxiety, asthma, dyspnoea.

Variability exists between individuals in perceived dyspnoea for a given degree of bronchoconstriction.1 Studies investigating individual differences in dyspnoea in relation to level of anxiety experienced during airways obstruction have yielded equivocal results. The frequency of retrospectively reported panic-type symptoms during typical asthmatic attacks was found to be related to a more positive medical outcome.2,3 However, in a more recent study no significant association was observed between level of anxiety and breathlessness during a methacholine inhalation test.4 Attempts have also been made to relate perception of bronchoconstriction to individual differences in baseline anxiety symptomatology or morbidity with mixed results. In some studies anxious dependent subjects (asthmatic patients as well as normal controls) had significantly greater threshold values for inspiratory and expiratory resistive loads,5,7 whereas in another study patients with insensitivity to emotional arousal performed significantly worse on an asthma perception task.8

A methodological problem associated with most of the studies into anxiety and perception of bronchoconstriction is that the role of “panic fear” personality or symptomatology3 has been investigated which differs from more contemporary psychiatric investigations of anxiety symptoms or disorders.9 Moreover, in many studies the perception of physiological changes has been measured in global terms of dyspnoea or breathlessness. However, dyspnoea is not a unidimensional concept but includes sensory and affective components.10

This study aimed to explore the perception of induced bronchoconstriction in subjects in whom sensory and affective aspects of dyspnoea were strongly correlated over successive inhalations of histamine (anxious perceivers) and subjects in whom these aspects did not covary (non-anxious perceivers).

Methods

SUBJECTS

Consecutive referrals to the University Hospital lung function laboratory for a histamine challenge test for clinical diagnosis and follow up participated in the study. Inclusion criteria were a diagnosis of asthma according to American Thoracic Society criteria11 and age between 18 and 65 years. Exclusion criteria were admission to hospital and poor Dutch speakers. The study was approved by the University Hospital medical ethics committee.

The response rate to the mailed invitation to participate in the study was 79%. The sample consisted of 78 asthmatic patients (30 men) of mean (SD) age 34.5 (12.4) years and mean duration of asthma 17.4 (12.7) years. Nineteen were smokers and 52 used daily asthma medication (31 bronchodilators, 20 corticosteroids). Fifty six patients used medication during asthma exacerbations (53 bronchodilators). The mean number of previous his-
Table 1 Mean (SD) descriptive and experimental data of anxious and non-anxious perceivers

<table>
<thead>
<tr>
<th></th>
<th>Non-anxious perceivers (n = 58)</th>
<th>Anxious perceivers (n = 20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>33.4 (12.3)</td>
<td>37.7 (12.5)</td>
</tr>
<tr>
<td>M:F</td>
<td>22:36</td>
<td>8:12</td>
</tr>
<tr>
<td>History of asthma (years)</td>
<td>16.7 (12.3)</td>
<td>18.8 (13.8)</td>
</tr>
<tr>
<td>Daily medication (yes/no)</td>
<td>40/18</td>
<td>15/5</td>
</tr>
<tr>
<td>Smoking (yes/no)</td>
<td>11/47</td>
<td>7/13</td>
</tr>
<tr>
<td>Previous challenges (n)</td>
<td>5.8 (1.7)</td>
<td>5.4 (1.5)</td>
</tr>
<tr>
<td>Median (range) PC20 (mg/ml)</td>
<td>0.89 (0.03-8.0)</td>
<td>0.81 (0.06-8.0)</td>
</tr>
<tr>
<td>FEV1, (% predicted)</td>
<td>90.8 (14.9)</td>
<td>93.0 (26.3)</td>
</tr>
<tr>
<td>Panic disorder (yes/no)</td>
<td>7/51</td>
<td>3/17</td>
</tr>
<tr>
<td>ACQ (median, range)</td>
<td>15.5 (14-24)</td>
<td>16.0 (14-45)</td>
</tr>
<tr>
<td>BSQ (median, range)</td>
<td>21.0 (17-48)</td>
<td>23.0 (17-53)</td>
</tr>
<tr>
<td>STAI-X2 (median, range)</td>
<td>37.5 (22-58)</td>
<td>39.5 (25-69)</td>
</tr>
<tr>
<td>SDS (median, range)</td>
<td>34.0 (22-53)</td>
<td>36.5 (22-58)</td>
</tr>
</tbody>
</table>

IUATLD = International Unit against Tuberculosis and Lung Disease questionnaire; PC50 = provocative concentration of histamine to cause a 20% fall in FEV1; FEV1 = forced expiratory volume in one second; ACQ = Agoraphobic Cognitions Questionnaire; BSQ = Body Sensations Questionnaire; STAI-X2 = trait subscale of State-Trait Anxiety Inventory; SDS = Self-Rating Depression Scale.

baseline forced expiratory volume in one second (FEV1) was 91.3% predicted. The median concentration of histamine provoking a fall in FEV1 of 20% (PC20) was 0.89 mg/ml (range 0.06–8.0).

STUDY DESIGN

Subjects completed questionnaires on baseline anxiety characteristics and then undertook a histamine inhalation challenge test. Immediately before the FEV1 measurements, perceived breathlessness and level of anxiety were measured.

Baseline anxiety assessment

Anxiety symptomatology was measured using several measures: (1) the International Union Against Tuberculosis and Lung Disease questionnaire (IUATLD) to assess the occurrence of 12 respiratory symptoms during the previous 12 months; (2) the Anxiety Disorders Interview Schedule (Revised) (ADIS-R), a structured psychiatric interview protocol for diagnosing panic disorder; (3) the Body Sensations Questionnaire (BSQ) to measure the degree to which subjects fear somatic sensations commonly associated with panic and the Agoraphobic Cognitions Questionnaire (ACQ) to assess the inclination to misinterpret bodily sensations catastrophically; (4) the State-Trait Anxiety Inventory (STAI) which measures generalised anxiety; and (5) the Self-Rating Depression Scale (SDS) which measures the degree of depression.

Assessment during induced bronchoconstriction

The Borg scale was used to measure perceived breathlessness and the Subjective Units of Distress Scale (SUDS) to measure the level of anxiety during the induction of bronchoconstriction. FEV1 was measured with a dry rolling seal spirometer (Morgan Spiroflow, UK) according to a standardised procedure. Baseline FEV1 was expressed as the percentage of the predicted value. Inhalations of histamine were continued until the FEV1 had fallen by 20% or more from baseline or the maximum concentration of 8 mg/ml was reached. Bronchial responsiveness was expressed as the provocative concentration of histamine causing a 20% fall in FEV1 from baseline. This was obtained from the log dose-response curve by log linear interpolation of the last two points.

DATA ANALYSIS

Non-parametric analyses were used as the values of most variables were not normally distributed. The within subject Spearman rank correlation coefficient between Borg and SUDS scores was taken as an index of the degree of anxiety of perceived breathlessness and was used to categorise subjects as anxious and non-anxious perceivers of bronchoconstriction. A rho value of 0.7 was chosen as the limit for the separation of anxious and non-anxious perceivers of airway obstruction—that is, in anxious perceivers anxiety and perceived breathlessness are strongly associated. The correlation between Borg scale and FEV1 scores was used as an index of the accuracy of the perception of airways obstruction. A correlation of 0.7 was used as the limit for the separation of good perceivers and bad perceivers.

The characteristics of anxious and non-anxious perceivers were compared by Mann-Whitney U tests or χ² analyses as appropriate. p values (two tailed) of <0.05 were considered statistically significant.

Results

The mean within subject correlation between FEV1 values in litres and Borg scale scores was relatively strong (rho = −0.76 (0.27)). Forty one patients (53%) reported no anxiety (SUDS) during the challenge test. With the chosen threshold (rho = 0.7) 20 of the 78 subjects (26%) were classified as anxious perceivers and 58 (74%) as non-anxious perceivers. Moreover, using a threshold of rho = −0.7, 53 of the 78 subjects (68%) were classified as good perceivers and 25 (32%) as bad perceivers of airways obstruction.

There was no significant difference between anxious and non-anxious perceivers with respect to age, sex, respiratory symptoms in daily life, duration of asthma, use of daily medication for asthma, smoking, number of previous challenges, bronchial responsiveness (PC20), and predicted baseline FEV1. Moreover, none of the baseline anxiety characteristics (ACQ, BSQ, STAI, SDS, and ADIS-R panic disorder) significantly differed between groups (table 1). After saline inhalation both groups showed a mean fall in FEV1 of 1%. The fall in FEV1 to the highest histamine concentration of anxious (mean fall from baseline = 28.4 (11.6)% and non-anxious perceivers (26.5 (9.6)% was highly comparable (p = 0.90). After inhalation of saline the medians on the Borg scale and SUDS were 0.25/5.0 in the anxious perceivers and 0.5/0.5 in the non-anxious perceivers (both differences not significant). When the FEV1 had fallen 20% after saline inhalation the me-
Anxiety and histamine induced bronchoconstriction in asthma

This study shows that, in an outpatient sample clinical unstructured interviews much higherlessness and level of anxiety at 20% fall in resentative.

histamine induced airways obstruction mani- over, the rather high response rate of 79.3%

be hypothesised that evoked anxiety further between anxiety or depression and asthma has

erence in anxiety at baseline between anxi-

erence between anxious and non-anxious

piral symptoms. Because of the correlational between anxiety and accuracy of perception of

tomatology were conducted on hospital inpatients26 who are likely to have more severe asthma than outpatients. In contrast to in-

The authors wish to thank A J Beekman, M Compas, J Verkerk, J Dekker, and L Stoß for their assistance with the data collection.


17 Zung WWK. A self-rating depression scale. *Arch Gen Psychiatry* 1965;12:63-70.
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