Clinical Topics

Asthma—expiratory dyspnoea?

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Recent work suggesting that expiration is passive even in severe airflow obstruction led us to question the generally held belief among doctors that expiration is more difficult for the asthmatic patient than inspiration. To pursue this, we asked 119 asthmatic patients whether they found inspiration or expiration more difficult during an asthmatic attack (questionnaire I (fig 1)). We then asked 106 doctors to answer questionnaire II (fig 2) to determine what most doctors thought patients felt during an attack of asthma.

Methods

Patients attending an adult asthma clinic were handed questionnaire I (fig 1) and asked to answer it while they were in the clinic. Questionnaires II were mailed to 30 asthmatic children (between 12 and 17 years) on the health visitor’s list, and 23 returned the completed questionnaire. Questionnaire II was sent to each of 106 physicians, these being all the medical consultants and post-registration junior physicians in the Radcliffe Infirmary, Churchill, and John Radcliffe Hospitals, Oxford. Seventy-two questionnaires were completed and returned.

Results

Only 22 patients (19%) found expiration more difficult than inspiration during an asthmatic attack (table I). On the other hand, 56 doctors (78%) expected that asthmatic patients would find expiration more difficult (table II). Analysis of the doctors’ reasons for thinking this showed that 66% of them did not base this belief on a history taken from their patients or their own experience of an asthmatic attack, but on their understanding of the physiology of airflow obstruction backed up by the appearance of the patient (table II, reasons 3, 4, and 5). Four doctors chose breathing out for reasons 4 or 5 both (table II), but added handwritten reservations on their questionnaire forms such as “Some patients say breathing in.”

Discussion

The pronounced discrepancy between the answers received from patients and doctors is disquieting. A limited historical review of medical textbooks shows that the idea of expiration being more difficult than inspiration was probably first introduced in the 1920s and has gradually been discarded since 1970. In Oster’s first edition 1892 the “asthma fit” is described as follows: “... the patient is aroused with a distressing sense of want of breath and a feeling of great oppression in the chest. Soon the respiratory efforts become violent, all the accessory muscles are brought into play, and in a few minutes the patient...
is in a paroxysm of the most intense dyspnoea... speech is impossible and in spite of the most strenuous inspiratory efforts very little air enters the lungs. Expiration is prolonged and also wheezy...

TABLE II

<table>
<thead>
<tr>
<th>Age range</th>
<th>Mean age</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-25</td>
<td>23.7</td>
<td>39</td>
<td>41</td>
</tr>
<tr>
<td>18-21</td>
<td>22.9</td>
<td>37</td>
<td>37</td>
</tr>
<tr>
<td>16-18</td>
<td>22.1</td>
<td>36</td>
<td>35</td>
</tr>
<tr>
<td>14-16</td>
<td>21.3</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>12-14</td>
<td>20.5</td>
<td>32</td>
<td>32</td>
</tr>
</tbody>
</table>

In the ninth edition 1920, expiration becomes "laboured" rather than "leisurly." Price (first edition 1922) describes asthma as "inspiratory dyspnoea," and this nomenclature is not dropped until 1973. The current edition of Davidson still teaches that dyspnoea is predominantly expiratory. "The dyspnoea, which may be intense, is chiefly expiratory in character. Expiration becomes a conscious and exhausting effort in contrast to inspiration which is short and gasping."

Why has the error of thinking expiration more difficult than inspiration arisen? The reasons include:

1. Expiration is longer than inspiration.
2. Forced expiration is limited by airway closure at higher lung volumes than in normal lungs.
3. Tidal expiratory flow rates cannot be increased by expiratory muscular effort.
4. Most assessments of degree of airways obstruction are made during maximally forced manoeuvres. In asthma maximum expiratory flow rates are more reduced than maximum inspiratory flow rates.

What the patient is experiencing during an attack of asthma, however, is tidal breathing at a lung volume close to total lung capacity, through airways that are narrow in both inspiration and expiration.

In the sequence of an asthma attack an early response to the narrowing of airways is for hyperinflation to occur. This is necessary to pull open the airways sufficiently for adequate ventilation to occur. A consequence of the life-saving hyperinflation is that there is a pronounced increase in the elastic work of breathing—that is, in the inspiratory work. The work done taking in a breath into a lung already expanded to near total lung capacity is much more than taking in the same size breath when the lungs are normally deflated. This can be easily appreciated by doing this manoeuvre yourself. The pronounced effort needed to breathe in at high lung volumes is necessary to overcome the significant recoil pressures of overexpanded lungs and chest wall. Once the patient has breathed in, however, these high recoil pressures are sufficient to drive expiratory flow even through narrow airways, so that expiration remains passive.

As the asthma becomes more severe and hypoxia develops increased ventilation is necessary. Inspiratory flow rates can be increased by working harder during inspiration, but expiratory ventilation can be increased only by further hyperinflation (making more inspiratory work) or by breathing in even faster to allow more time for the slower expiration to occur.

Inspiration thus requires more and more effort, whereas expiration remains passive until asthma is very severe. Not surprisingly, most patients remember breathing in as being more difficult than breathing out during an asthma attack. The early descriptions of violent ineffective inspiration followed by slow leisurely expiration are accurate and have a sound physiological basis.

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References


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