The Bbases Expert Statement on Assessment and Management of Non-asthma Related Breathing Problems in Athletes

Produced on behalf of the British Association of Sport and Exercise Sciences by Dr John Dickinson, Prof Alison McConnell FBASES, Dr Emma Ross FBASES, Dr Peter Brown and Dr James Hull.

Introduction
Exercise respiratory symptoms including wheezing, tight chest, difficulty to breathe, shortness of breath, coughing and breathlessness are commonly reported by athletes. These symptoms are non-specific and could be due to a variety of causes outlined in Table 1. It is imperative that clinical assessment and advice is sought initially to either confirm or eliminate the presence of cardio-pulmonary causes. The prevalence of asthma and exercise induced bronchoconstriction (EIB) can be up to 70% in sports with high breathing requirements, and/or sports undertaken in environments where inhaled air is dry and/or polluted. Given this high prevalence, it is tempting to assume that exercise-induced respiratory symptoms in athletes are most likely due to asthma or EIB. However, symptoms alone are misleading; Dickinson et al. (2005) reported that 21% of elite British athletes received an inappropriate diagnosis of asthma/EIB. In the majority of these cases, athletes had not undergone an objective airway challenge to confirm diagnosis before therapy was initiated. Current guidelines state that if either asthma or EIB is suspected, an athlete should undergo an airway challenge (e.g., eucapnic voluntary hyperpnoea) to confirm the diagnosis, thus reducing the potential for inappropriate diagnosis (Parsons et al., 2013).

Dysfunction breathing
The term ‘dysfunctional breathing’ (DB) encapsulates a variety of idiopathic breathing abnormalities that have no obvious organic, pathological origin. DB may be underpinned by abnormal breathing mechanics caused by respiratory muscle dysfunction and/or reduced respiratory system compliance, as well as to anxiety and/or hyperventilation syndrome (see Table 2).

Table 1. Potential causes of exercise induced respiratory symptoms

<table>
<thead>
<tr>
<th>Cause</th>
<th>Hyperventilation syndrome</th>
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<td>Asthma</td>
<td>Cardiovascular disease</td>
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<tr>
<td>Exercise induced bronchoconstriction</td>
<td>Anaemia</td>
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<tr>
<td>Lack of fitness</td>
<td>Cardiac dysfunction</td>
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<tr>
<td>Obesity</td>
<td>Pneumothorax</td>
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<tr>
<td>Exercise induced laryngeal dysfunction</td>
<td>Parenchymal lung diseases</td>
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<tr>
<td>Dysfunctional breathing patterns</td>
<td>Pulmonary vascular disorders</td>
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<td>Anxiety</td>
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It is possible that athletes’ respiratory symptoms may not be due to asthma/EIB. Further, athletes with asthma/EIB may still report exercise respiratory symptoms, despite being adequately medicated for their airway disease. The purpose of this BASES expert statement is to provide an overview of the differential diagnosis for exercise-induced respiratory symptoms and to discuss interventions that may help to manage symptoms.

Differential causes of exercise respiratory symptoms

Exercise-induced laryngeal obstruction (EILO)
It is not uncommon to encounter athletes who report troublesome exercise-associated respiratory symptoms in the absence of objective evidence of airway narrowing. It is now recognised that, in a significant proportion of these individuals, symptoms that were attributed to EIB/asthma, may actually arise from a transient exercise-induced narrowing at the level of the larynx (voice box). This phenomenon, termed exercise-induced laryngeal obstruction (EILO), manifests as dyspnoea, wheeze and cough on peak exertion and will not respond to a therapeutic strategy targeting EIB (Nielsen et al., 2013). Confirmation of EILO requires direct nasendoscopy to be performed during exercise (see Figure 1), and it should be recognised that there is a considerable overlap between EIB and EILO; i.e., some athletes will have both conditions thus rendering them ‘refractory’ to EIB treatment alone.

Table 2. Signs and symptoms of dysfunctional breathing during exercise

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Description</th>
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<td>1 Bias towards chest breathing (rather than diaphragm breathing)</td>
<td>Inability to synchronise breathing to movement cadence with a consistent rhythm</td>
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<td>2 Rapid, shallow breathing pattern during exercise, and possibly also at rest (breathing pattern can be regular, or irregular)</td>
<td>Blunted ventilatory compensation for metabolic acidosis (supra-lactate threshold VE/VO2 ratio &lt;25 units)</td>
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<tr>
<td>3 Blunted ventilatory compensation for metabolic acidosis (supra-lactate threshold VE/VO2 ratio &lt;25 units)</td>
<td>Inappropriate ventilatory distress, especially during high intensity exercise</td>
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In dysfunctional breathing the primary symptom is breathlessness, resulting in premature exercise intolerance. Physiologically, dysfunctional breathing can result in diametrically opposed signs at rest, compared with exercise. At rest, there may be hyperventilation and hypocapnia, whilst during exercise there may be hyperventilation and hypercapnia. An overreliance upon breathing frequency to meet ventilatory requirements (tachypnoea) leads to an inability to increase minute ventilation (VE) sufficiently to meet metabolic demand. The tachypnoeic breathing pattern, combined with an under-compensated
metabolic acidosis, leads to intense breathing discomfort. Diagnosis of dysfunctional breathing is not straightforward, but an incremental exercise challenge can reveal clear evidence of an abnormal exercise hyperpnoea. Assessment of breathing pattern and expired gases during exercise, as well as observations of breathing at rest and during exercise is therefore recommended.

Conclusions and recommendations

1. Athletes who report exercise-induced respiratory symptoms should have a full patient history and objective airway challenge before assuming a diagnosis of conditions such as asthma and/or EIB.

2. Initial reports suggest that breathing pattern retraining and IMT can be effective interventions to treat exercise-induced respiratory symptoms due to conditions such as EILO and dysfunctional breathing.

3. Understanding the mechanisms of EILO and dysfunctional breathing will allow methods of prevention and treatment for these conditions to be optimised.