I CAN’T BREATHE when I run! Is it exercise-induced asthma?

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Disclosure

NO COMMERCIAL TIES
Objectives

• Describe the pathophysiology of exercise-induced bronchoconstriction (EIB)
• Outline an approach to diagnosing EIB
• List treatment options for EIB
Exercise-induced asthma
What is your biggest challenge in managing children with exercise-induced asthma?
What is exercise-induced asthma?
Exercise-induced bronchoconstriction (EIB)
PREVALENCE of EIB

- 5-20% general population
- 50-90% persistent asthma

Pathogenesis

Temperature
Osmolarity

BRONCHOCONSTRICTION
Not the whole story
EIB is associated with atopy

Koh, Y. I. et al.. *Clinical & Experimental Allergy* 32 (4), 532-536.
EIB is associated with endurance sports

- 5-20% General population
- 90% persistent asthma
- 30-70% elite Winter athletes and endurance sports
- 50% US Olympic Cross country skiiers

Elite athletes with EIB have more/different inflammation than asthmatics

• Elite skiers vs asthmatics
  – More neutrophilic inflammation in biopsy

• Cold air while running
  – More granulocytes and macrophages in BAL

• EVH
  – Higher levels of inflammatory mediators in induced sputum: cysteiny1 leukotrienes, PGE2, histamine, TXB2, LTB4
Hyperventilation and EIB

Airway drying and increased osmolarity

- Allergen
- Mast cell
- IgE
- IL-4
- IL-5
- Leukotrienes
- Histamine
What factors make EIB worse?

- ASTHMA!!!
- High intensity exercise
- Cold air
- Poor air quality
  - Air pollution
  - Indoor swimming pools
  - Ice rinks
- Upper respiratory infections
- Allergens
I CAN’T BREATHE when I run! Is it exercise-induced asthma?
I CAN’T BREATHE when I run! Is it EIB?
Which of these kids have EIB?

Of all kids who complained of SOB with exercise: Only **7-24%** actually had EIB

Symptoms don’t predict EIB in kids

De Baets et al. *Pediatric Pulmonology*. 2005
Symptoms don’t predict EIB in elite athletes, either

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Proportion of True Diagnosis</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Self-reported symptoms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cough</td>
<td>0.66</td>
<td>0.61</td>
<td>0.69</td>
</tr>
<tr>
<td>Wheeze</td>
<td>0.61</td>
<td>0.17</td>
<td>0.82</td>
</tr>
<tr>
<td>Chest tightness</td>
<td>0.63</td>
<td>0.20</td>
<td>0.83</td>
</tr>
<tr>
<td>Excess mucus</td>
<td>0.65</td>
<td>0.22</td>
<td>0.85</td>
</tr>
<tr>
<td>B. No. of self-reported symptoms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 or more</td>
<td>0.57</td>
<td>0.61</td>
<td>0.55</td>
</tr>
<tr>
<td>2 or more</td>
<td>0.67</td>
<td>0.44</td>
<td>0.78</td>
</tr>
</tbody>
</table>

What else could it be?

- Physiologic limitation
- Deconditioning
- Obesity
- Dysfunctional breathing: vocal cord dysfunction
- Anxiety/Hyperventilation
- Anemia

(Rare) Imitators of EIB

- Pulmonary
  - Restrictive
    - Scoliosis
    - Interstitial lung disease
  - Airway
    - Tracheobronchomalacia
    - Laryngomalacia
- Pulmonary AVM
- Cardiac
- Pulmonary hypertension
- Myopathy
Danger signs

• General fatigue or weight loss
• Shortness of breath sitting or with mild exercise
• Passing out during or after exercise (dizzy, faint)
• Palpitations
Which of these kids have EIB?
DIAGNOSIS
Exercise testing

But it’s not readily available to you!

<table>
<thead>
<tr>
<th>TIME</th>
<th>FVC</th>
<th>FVC %BL</th>
<th>FEV1</th>
<th>FEV1 %BL</th>
<th>FEF25-75%</th>
<th>FEF2575</th>
<th>FEFmax</th>
<th>FEFMax %BL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>2.08</td>
<td>100</td>
<td>1.93</td>
<td>100</td>
<td>2.42</td>
<td>100</td>
<td>3.05</td>
<td>100</td>
</tr>
<tr>
<td>1 min</td>
<td>1.82</td>
<td>87</td>
<td>1.76</td>
<td>91</td>
<td>2.19</td>
<td>90</td>
<td>3.56</td>
<td>116</td>
</tr>
<tr>
<td>5 min</td>
<td>1.88</td>
<td>91</td>
<td>1.45</td>
<td>75</td>
<td>1.81</td>
<td>75</td>
<td>2.37</td>
<td>78</td>
</tr>
<tr>
<td>10 min</td>
<td>1.74</td>
<td>84</td>
<td>1.29</td>
<td>67</td>
<td>1.31</td>
<td>54</td>
<td>1.99</td>
<td>65</td>
</tr>
<tr>
<td>15 min</td>
<td>1.83</td>
<td>88</td>
<td>1.51</td>
<td>78</td>
<td>1.31</td>
<td>54</td>
<td>3.48</td>
<td>114</td>
</tr>
<tr>
<td>20 min</td>
<td>1.98</td>
<td>95</td>
<td>1.78</td>
<td>92</td>
<td>2.28</td>
<td>94</td>
<td>3.38</td>
<td>111</td>
</tr>
<tr>
<td>REVERSAL</td>
<td>2.01</td>
<td>97</td>
<td>1.83</td>
<td>95</td>
<td>2.74</td>
<td>113</td>
<td>3.17</td>
<td>104</td>
</tr>
</tbody>
</table>
I feel SOB running.......
Problems with:
Colds
Bronchitis
Pneumonia
Cold air
Animals
## Classification of Asthma Severity: (≥12 years and adults)

<table>
<thead>
<tr>
<th>IMPAIRMENT</th>
<th>Intermittent</th>
<th>Persistent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms</td>
<td>&lt;2 days/wk</td>
<td>Mild persistent</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>≤2x/month</td>
<td>&gt;2 days/wk but not daily</td>
</tr>
<tr>
<td>Short-acting β2-agonist for symptoms</td>
<td>≤2 days/wk</td>
<td>Daily</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
<td>&gt;1x/wk but not nightly</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
<td>Often, nightly</td>
</tr>
<tr>
<td>Lung function</td>
<td>Normal FEV₁ between exacerbations</td>
<td>Some limitation</td>
</tr>
<tr>
<td>Normal FEV₁/FVC: 8-19 yr 85%</td>
<td>FEV₁ &gt; 80% predicted</td>
<td>FEV₁ &gt; 60% but &lt; 80%</td>
</tr>
<tr>
<td>Exacerbations</td>
<td>0-1/yr</td>
<td>FEV₁ &lt; 60% predicted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FEV₁/FVC reduced &gt;5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FEV₁/FVC reduced 5%</td>
</tr>
</tbody>
</table>

**Risk**

- 0-1/yr
- ≥2/yr
Treatment

**PERSISTENT ASTHMA**
ASTHMA THERAPY (≥ 12 YEARS)

Step 1
Preferred: SABA
Alternative: Cromolyn, Nedocromil, LTRA or Theophylline

Step 2
Preferred: Medium dose ICS OR Low dose ICS+LABA
Alternative: Low dose ICS + either LTRA, Theophylline or Zileuton

Step 3
Preferred: Medium dose ICS+LABA
Alternative: Medium dose ICS + either LTRA, Theophylline or Zileuton

Step 4
Preferred: High dose ICS+LABA AND Consider Omalizumab for allergic patients

Step 5
Preferred: High dose ICS+LABA AND Consider Omalizumab for allergic patients

Step 6
Step up if needed, (First check adherence, environmental control, and comorbid conditions)
Assess Control
Step down if possible (and asthma is well controlled for 3 months)

Each step: Patient education, environmental control, management of comorbidities
Steps 2-4: Consider immunotherapy for patients with allergic asthma
Effect of Medications on EIB

McFadden et al. NEJM. 330(19), 1994
Inhaled corticosteroids and EIB

The dose response reduction of EIA severity to inhaled corticosteroids

Prevention for both groups: albuterol preexercise
8 year old with moderate persistent asthma is in your office complaining of SOB after playing outside during recess. He’s tired because he’s been coughing every night for the last two weeks. He’s been in the ED twice in the last 4 months with asthma exacerbations. He was prescribed beclomethasone 40 and montelukast.

What is your approach?
Assess ICE

- Inhaler technique
- Compliance
  - Comorbid condition
- Environmental change
  - Exercise intensity change
Technique
How do you know if they’re getting medications into their lungs?

In-check dial
## Optimum Inspiratory Flow

<table>
<thead>
<tr>
<th>Inhaler</th>
<th>L/Min</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diskus</td>
<td></td>
<td>1, 2, 3, 4, 5</td>
</tr>
<tr>
<td>Turbuhaler</td>
<td></td>
<td>1, 3, 6, 7, 8, 9</td>
</tr>
<tr>
<td>Autohaler</td>
<td></td>
<td>10, 11, 12, 13</td>
</tr>
<tr>
<td>Low resistance inhaler</td>
<td></td>
<td>12, 13, 14, 15</td>
</tr>
</tbody>
</table>
How do you know if they’re getting medications into their lungs?

In-check dial
PERSISTENT ASTHMA

Treat as poorly controlled asthma

? Montelukast vs Exercise test
ASTHMA THERAPY (> 12 YEARS)

Step 1

Preferred: SABA

Alternative: Cromolyn, Nedocromil LTRA or Theophylline

Step 2

Preferred: Medium dose ICS OR Low dose ICS+LABA

Alternative: Low dose ICS + either LTRA, Theophylline Or Zileuton

Step 3

Preferred: Medium dose ICS+LABA

Alternative: Medium dose ICS + either LTRA, Theophylline Or Zileuton

Step 4

Preferred: High dose ICS+LABA AND

Consider Omalizumab for allergic patients

Step 5

Preferred: High dose ICS+LABA + oral corticosteroid AND

Consider Omalizumab for allergic patients

Step 6

Step up if needed,
(First check adherence, environmental control, and comorbid conditions)

Assess Control
Step down if possible
(and asthma is well controlled for 3 months)

Each step: Patient education, environmental control, management of comorbidities
Steps 2-4: Consider immunotherapy for patients with allergic asthma
Inhaled corticosteroids and EIB

The dose response reduction of EIA severity to inhaled corticosteroids

Additive effect of LTRA and beta-agonist

Coreno et al. Chest (127), 2005
Nonpharmacologic treatment of EIB

- Warm up/Cool down
- Nose breathe
- Scarf
Asthma management

- Bronchodilator
- Asthma action plan

All patients with asthma should have a rescue inhaler available during games and practices, and the certified athletic trainer should have an extra rescue inhaler for each athlete for administration during emergencies.....

Athletic trainers should incorporate into the existing emergency action plan an asthma action plan for managing....all patients who may experience significant....attacks of breathing difficulties.

Bronchodilator and action plan

- Do you have an action plan for each child?
- Are there inhalers on the field for sports?
  - What happens for away games?

- What barriers do you face in trying to adhere to these guidelines?
- Any solutions to share?
Thank you!