

# Exercise-Induced Asthma

## Background

### 1. Definition

- Episodic bronchoconstriction during or following exercise

### 2. General information

- More suitably called "exercise-induced bronchoconstriction"
- See also Asthma

## Pathophysiology

### 1. Pathology of dz

- Hyperosmolarity theory
  - Hyperventilation during exercise causes evaporative water loss
  - Water loss causes hypertonicity/hyperosmolarity of cells
  - Change in cell composition causes release of bronchoconstricting mediators
    - Histamine
    - Prostaglandins
    - Leukotrienes
- Airway rewarming theory
  - Large volume of cold air overwhelms ability of airways to warm air
  - Cold air reaches distal airways causing airway narrowing and edema
- Inflammatory mediator theory
  - People that exercise freq, especially in cold air, develop chronic inflammatory changes
  - Incr levels of IL-8, LTC<sub>4</sub>, LTD<sub>4</sub>, and histamine
  - TH-2 lymphocytes are incr
    - Incr IgE
    - Incr activation of eosinophils

### 2. Incidence/ prevalence

- Approx 90% of pts known to have asthma will have an exercise component of their underlying dz
- Between 7-20% of pts w/o dx of asthma will have bronchospasm w/exercise

### 3. Risk factors

- High ventilation sports
- Endurance sports
  - Cross country skiing
  - Swimming
  - Long-distance running
- Winter sports
- Participation in a location w/environmental pollutants

### 4. Morbidity/ mortality

- Unrecognized and inadequately treated cases incr risk of sudden death in a given athlete
- All individuals involved in physical activity should be aware of risks of exercise-induced asthma
- Specific training in tx of exercise-induced asthma provided to coaches/trainers decr morbidity associated w/this disorder

## Diagnostics

### 1. History

- Personal or family hx of asthma
- Symptoms
  - Cough
  - Wheeze
  - Chest tightness
  - Dyspnea
  - Peak at 5 to 10 min into exercise
  - May last up to 60 min
  - Refractory period
    - Period during which repeated exertion causes less bronchoconstriction

### 2. Physical exam

- Generally negative when pt is evaluated
- Careful ENT exam
  - Rule out nasal allergies, sinusitis, or otitis
- Careful cardiac exam
  - Rule out cardiac arrhythmias and murmurs
- During exacerbation, will resemble that of an asthmatic
  - Wheeze/ rhonchi
  - Prolonged expiratory phase
  - Poor inspiratory effort
  - Incr work of breathing
    - Nasal flaring
    - Substernal/subcostal retractions

### 3. Diagnostic testing

- Peak flow
  - Crude, yet efficient, form of exercise field testing
  - Does not differentiate exercise induced bronchoconstriction from chronic asthma
  - Method
    - Determine peak flow at baseline
    - Recheck peak flow 10 min into exercise (60-80% of max intensity)
    - 15% drop in peak flow indicates exercise induced bronchospasm
    - Repeat a positive test
      - Admin a short-acting bronchodilator
      - Document a smaller decr in peak flow
- Exercise testing
  - Performed during exercise provocation
    - Sport-specific testing is ideal
    - Best done under specific humidity and temp controls
  - Spirometry done before and after bronchodilator therapy
  - Dx criteria: decr in FEV1 greater than or equal to 15%
  - NOTE: if baseline FEV1 <90%, suspect underlying asthma
- Eucapnic voluntary hyperventilation (EVH)
  - Hyperventilation of a gas mixture of 5% CO2 and 21% O2 at 85% max voluntary ventilation for 6 min

- FEV1 is assessed at specified intervals
- High specificity, high sensitivity
- Methacholine or histamine challenge
- Mannitol inhalation
  - Newer alternative to EVH
  - Currently a research tool only

### **Differential Diagnosis**

1. Vocal cord dysfunction
2. Central airway obstruction
3. Cystic Fibrosis
4. Laryngomalacia
5. Cardiac arrhythmias
6. Congestive Heart Failure (CHF)
7. Pulmonary or cardiac shunt
8. Gastroesophageal reflux dz
9. Normal physiologic exercise limitation

### **Therapeutics**

1. Acute tx
  - Short-acting bronchodilators
    - Example: albuterol
    - First-line tx
    - Use: 2-4 puffs given 15 min before exercise as prophylaxis
    - Quick onset of action
    - Provides relief for up to 4 hrs
    - IS a rescue medication and admin can be repeated if prophylaxis is ineffective
    - Problem: overuse can lead to tachyphylaxis
    - Should be used w/spacer to ensure more efficient delivery of medication
  - Mast cell stabilizers
    - Example: cromolyn
    - Use: 4-8 puffs given 15 min before exercise as prophylaxis
    - May be used in combo w/short-acting bronchodilator for added benefit
  - Nonpharmacologic therapy
    - Pre-competition warm-up/ conditioning
      - Release of catecholamines causes bronchodilation and depletion of mast cell contents
    - Facemask
      - Wearing facemask during activity warms and humidifies inspired air when conditions are cold and dry
    - Avoidance
      - Triggers such as pollen, grasses, trees, cold air, should be avoided when possible
    - Nose breathing
      - Humidifies, warms, and filters air
    - Cool down
      - Do not abruptly cease activity

- Control of chronic asthma
  - Athletes w/chronic asthma should not exercise on days in which their asthma is not adequately controlled
  - Peak flow meter can help determine how well athlete's asthma is being controlled on a given day

## 2. Subacute mgmt

- Inhaled corticosteroids
  - Example: fluticasone
  - Used first line as a stabilizing medication in athletes that have frank asthma
  - 1st or 2nd line prophylaxis for athletes w/persistent symptoms of exercise induced asthma
  - Improves airway hyper-responsiveness over wks to mos
  - Does not have short term effects in an acute exacerbation
- Leukotriene modifiers
  - Example: montelukast
  - May be used as first or second line prophylaxis for athletes w/persistent symptoms
  - Once daily dosing makes this quite useful in children
- Long-acting bronchodilators
  - Example: salmeterol
  - Prophylactic use in athletes w/exercise induced symptoms
  - Has become second or third line d/t multiple SE
    - Cardiovascular stimulation
    - Anxiety
    - Skeletal muscle tremor
  - Always recommended for use w/low to medium dose corticosteroid, never alone

## 3. Long-term care

- Improve overall asthma control
- Combo medications may facilitate tx when multiple therapies are required
- Ensure that pt is taking above medications as prescribed and w/proper technique
- If there is no improvement w/conventional therapy, consider a different dx

## 4. Prescribing asthma medications in athletes

- Bronchodilators
  - Must be given in inhaled route
    - No injections or oral preparations
  - Must be accompanied by a therapeutic use exemption (TUE) form
  - Acceptable bronchodilators (US Anti-Doping Agency)
    - Formoterol
    - Salbutamol
      - Concentration >1,000 ng/mL is considered a doping violation
    - Salmeterol
    - Terbutaline
- Corticosteroids, leukotriene inhibitors, and mast cell stabilizers are not restricted by USADA

## Follow-Up

1. Return to play
  - Monitor closely after an acute attack
  - An athlete's peak flow should be >85% of baseline
    - Should be free of wheezing before returning to field of play
  - Incomplete response to "rescue" medications on sideline
    - Restrict from play
    - Refer for further medical eval
2. Return to office
  - Routine follow-up yearly is appropriate if symptoms are under control
  - Reassess tx strategies w/any exacerbation
3. Refer to specialist
  - For uncontrolled symptoms despite maximal therapy
  - May be utilized earlier in more competitive athletes
4. Admit to hospital
  - For respiratory compromise requiring intubation
  - For exacerbations requiring continuous bronchodilator therapy or continuous oxygen admin

## Prognosis

1. Excellent prognosis as long as athlete, coach, and trainer are well educated about disorder

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