

BREATHING ISSUES IN ATHLETES

James B. Robinson, M.D.

Head Team Physician, University of Alabama

Objectives

- To define the terms Exercise induced Asthma (EIA) and Exercise Induced Bronchospasm (EIB)
- To discuss the pathogenesis of Exercise Induced Bronchoconstriction
- To discuss the methods of diagnosing exercise induced breathing problems
- To discuss the various treatments
- To discuss the conditions that may mimic exercise induced bronchoconstriction, including exercise induce laryngeal obstruction

Asthma

- A chronic ***inflammatory*** disorder of the airways
- Inflammation makes the airways more sensitive to stimuli:
 - Allergens, chemical irritants, smoke, cold air, exercise
- When exposed to stimuli, airways become swollen, constricted, filled with mucus, hypersensitive
- This all results in airway narrowing
- Usually an early phase that begins immediately after exposure, peaks at 15-20 minutes and lasts about an hour
- Often late phase may occur 2-4 hours later and peaks after 6-8 hours

Definitions

Exercised Induced Asthma

- Occurs in individuals already diagnosed with asthma
- Asthma is an airway disease characterized by chronic airway inflammation that varies over time in intensity with a variable amount of expiratory airflow limitation

Exercise Induced Bronchospasm

- Occurs in individuals with no previous history of asthma or atopy
- Same signs and symptoms as asthma but occurs only after exercise
- A state of airway hyperresponsiveness

Definitions

Exercised Induced Asthma

- Occurs in 8% of population
- Occurs in 25-50% of athletes with asthma
- Concomitant allergies in 45%

Exercise Induced Bronchospasm

- Occurs in 10-20% of population
- Occurs in up to 55% of athletes
- 8% of Olympic athletes
- Occurs 70-90% of asthmatics
- Concomitant allergies in 73%

Pathophysiology

- Airway cooling: worse in cold-air sports
- Airway dehydration
 - Results from increased ventilation rate
 - Increases osmolarity of airway lining
 - Triggers release of chemical mediators from airway inflammatory cells:
 - Histamine
 - Cysteinyl leukotrienes
 - Prostaglandins
 - Causes bronchial smooth muscle contraction and bronchial edema
- Transient immunosuppression from intense training may predispose to infection (viral)
- Chemical irritants (chlorine, air pollution) induce an inflammatory reaction
- May be triggered by drugs: β blockers, NSAIDs

Diagnosis History

- Shortness of breath with exercise
 - Tire more quickly than others
 - Post-exercise cough
 - Chest tightness/pain with exercise
 - Wheezing
 - Increased sputum production
-
- ***Poor predictive value for diagnosis in athletes when taken alone***

Diagnosis

Physical Exam

- Tachypnea
- Audible wheezing

Diagnosis

Field Testing-ATC

- Decrease in peak flow rate of 10%
- Measure three resting peak flows and average
- Repeat peak flow when symptomatic

Diagnosis

Testing- Physician

- Formal pulmonary function testing
- Pre and post bronchodilator
- Increase in FEV₁ by 12% with 200-400 µg of inhaled albuterol

- ***Athletes may have supranormal PFTs (>120% predicted normal)***

Diagnosis

Testing- I.O.C. or Resistant Cases

- Rely on airway hyperresponsiveness with the use of bronchoprovocation testing
 - Eucapnic Voluntary Hyperpnea
 - Mannitol Challenge
 - Hypertonic saline challenge
 - Methacholine challenge

Diagnosis

Testing- Eucapnic Voluntary Hyperpnea (EVH)

- Attaining a minute ventilation of 85% of predicted maximal voluntary ventilation rate for 6 minutes
- Dry (<2% relative humidity), CO₂ rich air (5% CO₂) is inhaled
- Drop in FEV₁ by 10%
- Adopted as diagnostic measure of choice by IOC when evaluating for TUEs
- Can also be used to identify misdiagnosis

Diagnosis

Testing- Mannitol/Saline Challenge

Diagnosis

Testing- Methacholine Challenge

Treatment Goals

- Achieve and maintain asthma control
- Optimize pulmonary function
- Prevent risk factors for acute exacerbation
- Improve performance
- Avoid positive drug tests: Adverse analytical findings

Treatment

Non-Pharmacologic

- Education
 - Environmental triggers
 - Inhaler use
 - Management plan for exacerbations
 - Nasal breathing
- Masks: reduce cold air and pollutants
- Pre-exercise warm up
- Treat coexisting conditions:
 - Reflux
 - Infection
- Avoidance of irritants:
 - Pollutants
 - Pollen
 - Cold
- Well ventilated venues:
 - Pools- chloramine
 - Hockey rinks-
- Others:
 - Fish oils
 - Vitamins
 - Anti-oxidants

Treatment Pharmacological

- Rescue Inhalers
 - Short-acting β_2 agonist
- Maintenance
 - Inhaled glucocorticoid
 - Leukotriene-receptor antagonist
- Uncontrolled
 - Add Long-acting β_2 agonist

Treatment

Short-acting β_2 Agonists

- Most effective to relieve bronchoconstriction
- Only treat symptoms, not pathology
- Available as inhaler, tablet, liquid, dry powders, injection, nebulized
- Used as prophylaxis 5-10 minutes prior to exercise
 - Albuterol (Proair, Maxair)
 - Levalbuterol (Xopenex)
 - Terbutaline
- Duration: 4 hours
- May increase airway responsiveness to stimuli
- May lead to tolerance

Treatment

Inhaled Glucocorticoids

- Mainstay of treatment
- Reduces inflammation
- Should be used if rescue inhaler used more than twice weekly

Treatment

Leukotriene-Receptor Antagonists

- Reduce bronchoconstriction
- Protective effects against irritants

Treatment

Long-Acting β_2 Agonists

- Never use alone
- Should always be used with an inhaled corticosteroid
 - Salmeterol (Seravent)
 - Formoterol (Foradil)
 - Indacaterol (Arcapta)
 - Olodaterol (Striverdi)
 - Arformoterol (Brovana)
- Often is combined product
 - Fluticasone furate/vilanterol (Breo)
 - Fluticasone propionate/salmeterol (Advair, AirDuo)
 - Budesonide/formoterol (Symbicort)
 - Mometasone/formoterol (Dulera)
- Duration: 12 hours

Treatment Others

- Cromolyn
- Theophylline

Adverse reactions

- Short-acting β_2 agonists:
 - Tremor
 - Tachycardia
 - Headaches
- Long-acting β_2 agonists
 - Headaches
 - Tremor
 - URI symptoms
- Inhaled corticosteroids
 - Adrenal suppression
 - Growth retardation
 - Oral/esophageal Candidiasis (Thrush)

Anti-Doping Considerations

- β_2 Agonists are classified as S_2 and are on the WADA prohibited list
- Potentially performance enhancing:
 - Increase oxygen uptake by bronchodilation
 - Anabolic effects- clenbuterol
- Require a Therapeutic Use Exemption (TUE)