Sideline Management of Respiratory Events

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Sports & Orthopaedic Specialists

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Disclosures

- None

Goals and Objectives

- Goals
  - Outline differential diagnoses for dyspnea in an athlete.
  - Define exercise induced bronchoconstriction (EIB) and exercise induced laryngeal obstruction (EILO) and differences in presentation and treatment.
  - Provide brief overview of traumatic pulmonary injury.
- Objectives
  - At the end of the this presentation one should be able to define the most common respiratory issues in athletes, differentiate presentation and treatment options for EIB and EILO, and be able to recognize the clinical presentation of traumatic pulmonary injuries.

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Differential Diagnosis for Dyspnea

- Exercise Induced
  - Exercise Induced Bronchoconstriction (EIB)
  - Exercise Induced Laryngeal Obstruction (EILO)
  - Physiologic exercise limitations
  - Shortness of breath with exercise due to lung diseases (other than asthma)
  - Spontaneous pneumothorax
- Traumatic
  - Traumatic pneumothorax, pulmonary contusion, hemothorax, pneumomediastinum,
- Metabolic and cardiac diseases (sickle cell, iron deficiency, arrhythmia, congenital heart disease, coronary artery disease, pulmonary embolism, etc)

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Exercise Induced Bronchoconstriction (EIB)

- Defined as transient airway narrowing that occurs as a result of exercise.
- Inflammatory mediators released when airway osmolarity increases during hyperventilation → results in airway edema and bronchoconstriction.
- EIB with asthma (EIBa) and EIB without asthma (EIBwa).
- Prevalence:
  - 5-20% in general population, up to 90% in asthmatic subjects.
- Signs and symptoms are non-specific
  - Shortness of breath, fatigue, and underperformance used interchangeably by athletes.

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Asthma

- Patients with asthma, who do not require inhaled corticosteroid treatment, the prevalence of EIB is 70% to 80%
- Only 50% of those treated with inhaled corticosteroids have bronchospastic response to vigorous exercise

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Initial Screening

- Thorough history regarding symptoms:
  - General health
  - Exercise specific
  - Environment specific
- Baseline spirometry w/ and w/o short-acting bronchodilator
  - Assess airway reactivity should be performed on all athletes as the first diagnostic test to rule out underlying asthma

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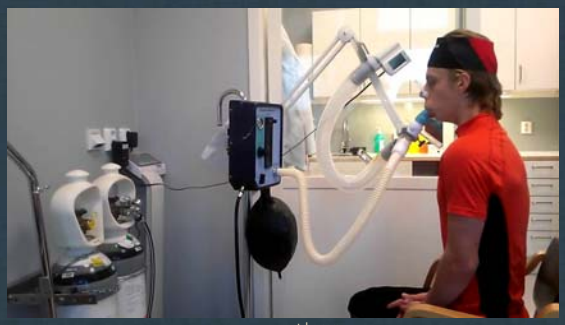
Diagnosis

- Trial of bronchodilator (may lead to misdiagnosis)
- Decrease in FEV1 by 10% with:
  - Dry-air exercise challenge at 80-90%
  - Eucapnic voluntary hyperventilation
    - Endorsed by International Olympic Committee



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Endurance Athletes with EIB

- "Occupational Asthma"
- Endurance athletes have increased minute ventilation through mouth
- Swimmers and cold weather endurance athletes have even higher prevalence
  - Cold dry air as a trigger
  - Chlorine exposure

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Pharmacological Treatment of EIB

- Inhaled short-acting β-agonist (SABA) - 15min before exercise
- Leukotriene receptor antagonist - if using SABA daily
- Inhaled corticosteroid - if using SABA daily
  - May take 2-4 weeks for improvement
- Combination of bronchodilators and inhaled corticosteroids
  - Used when airway inflammation present
- Other considerations:
  - Daily leukotriene receptor agonist
  - Mast cell stabilizing agent

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Non-pharmacologic treatment of EIB

- Interval warm up
  - 10-15min of vigorous exercise results in refractory period ~2 hours.
- Face mask or scarf
  - humidifies and warms air
- Dietary modification
  - Questionable evidence
  - Low salt diet, fish oil supplements, lycopene, vitamin C

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Can I train through it?

- Exercise load is related to degree of bronchial hyperreactivity
- In athletes that have stopped intensive training, EIB has been shown to improve.
- So in theory…..no
- But….there may be a fitness component
  - Improved fitness allows for decreased ventilation rate and therefore decrease respiratory dehydration.

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Doping considerations

- Inhaled Albuterol (SABA), Salmeterol and Formoterol (LABAs) are the only β-agonists allowed by WADA.
  - Written for "as needed" is deemed not appropriate, needs specific action plan.
  - Oral or injected form is not allowed
  - Clenbuterol is banned for its anabolic properties
  - Urine albuterol 1000 ng/ml is a positive drug screen (albuterol abuse well above recommended inhaled dosage)
- Systemic glucocorticoids are prohibited in competition unless a TUE is obtained

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Exercise Induced Laryngeal Obstruction (EILO)

- Paradoxical closure of vocal cords during inspiration.
  - Also referred to as vocal cord dysfunction (VCD)
- EILO more accurate term
- Frequently misdiagnosed as EIB
  - Up to 25% of those referred for EIB

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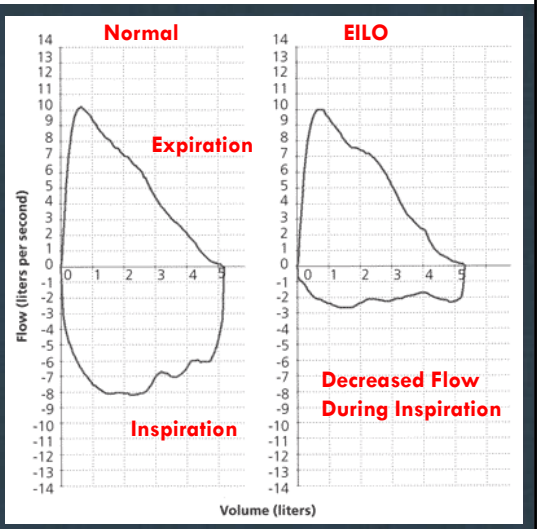
EILO Presentation and Diagnosis

- Intermittent shortness of breath
- Voice changes, stridor, cough
- Usually harder to get air out
- Usually improves after cessation of activity (as opposed to EIB)
- May be linked to environmental triggers
- Link to stress and anxiety
- Diagnosis: spirometry, laryngoscopy



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EILO Treatment

- Reassure (usually best initial step)
- Diaphragmatic breathing control/laryngeal exercise under guidance of speech therapist
- Sideline Tip:
  - Teach them to breath in through nose and out through pursed lips
  - Or try panting
- Heliox in ED for persistent/severe symptoms

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Sideline Pearls

Exercise Induced Bronchospasm	Exercise Induced Laryngeal Obstruction
▫ Expiratory symptoms/wheezing ▫ May take >10 min to start symptoms ▫ Symptoms persist after cessation of activity	▫ Inspiratory symptoms, noisy breathing ▫ Fast onset and quick resolution of symptoms.

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Upper Respiratory Tract Diseases

- Upper Respiratory Tract Infection
- Allergic Rhinitis
- Exercise Induced Rhinitis

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Upper Respiratory Tract Infection

- Intense exercise has been linked to increased incidence of URTI's.
- May be a genetic component that allows for an increased risk of infection when exposed to high physical stress.
- Treat symptomatically
- Ephedrine and derivatives prohibited by WADA.

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Return to Play Considerations

Upper Respiratory Tract Symptoms	Systemic Symptoms
Training below 70% of maximum heart rate	Systemic symptoms such as fatigue
Focusing on skill training	Fever >100.4
Advance activity as tolerated	Cardiac rate at rest increased by 10/min
	No activity until regression of symptoms

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Allergic Rhinitis

- 10-45% of world's population - even more prevalent in athletes.
- ~20-40% with AR have symptoms of asthma.
- ~80-90% with asthma have symptoms of AR.
- Affects sleep, decreases concentration and performance.
- most frequent allergic triggers include inhalant allergens: dust mites, pollens, animal dander and molds.
- DX: skin testing
- TX: Allergen immunotherapy, antihistamine, intranasal steroids, avoid allergen
- Screening: Recommendations are for those with AR to undergo spirometry and bronchial hyperresponsiveness testing

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Exercise Induced Rhinitis

- Defined by Alves et al., 2010 as a fall in peak nasal inspiratory flow above 20% from baseline during exercise
- Unknown mechanism – likely inflammatory mediated
- Exacerbating factors: cold air, chlorine
- Tx: antihistamines or local ipratropium in the form of nasal inhalation, inhaled corticosteroids for chronic symptoms.

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Exercise Induced Anaphylaxis

- Spectrum of exercise induced symptoms
  - Pruritus, urticaria, angioedema, wheezing, syncope
- More prevalent in females, 50% have history of atopy
- Can be any activity, but usually endurance sports
  - Food dependent variant, typically exercise is 30min – 120min after food ingestion.
- Mechanism unclear, but mast cells degranulation plays a role.
  - Medication, food, or exposure may prime the cells and exercise triggers degranulation.

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Exercise Induced Anaphylaxis

- Presents as pruritus, warmth, redness → hives → angioedema → systemic anaphylaxis (wheezing, syncope, N/V, abdominal pain)
- Exercise testing in controlled environment, potential for false negatives
- Treatment:
  - Identify triggers, avoid exercise 4-6 hours after eating, avoid exercise in extremely hot or cold weather.
  - Limited benefit from antihistamines.
  - Injectable epinephrine – make sure coaches, teammates, medical staff are aware and able to administer.

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Traumatic Pulmonary Injury

- May occur as injury from direct force, barotrauma, or rapid deceleration of organs against chest wall.
- Injuries may include:
  - Pneumothorax
  - Hemothorax
  - Pulmonary contusion

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Traumatic Pulmonary Injury

- Pulmonary injury from blunt thoracic trauma is relatively uncommon in athletics
- Most common injury:
  - Pulmonary contusion
- Symptoms:
  - Dyspnea, Chest pain, Dysphonia, Dysphagia, Cough, Hemoptysis
- Management:
  - Stabilize ABCs, decision to transport based on severity and mechanism of injury

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Table 1
Clinical signs and symptoms of pulmonary injury

Pneumothorax	Hemothorax	Pneumomediastinum	Pulmonary Contusion
Dyspnea	Dyspnea	Dyspnea	Dyspnea
Pleuritic chest pain	Chest pain	Retrosternal chest pain Neck pain Dysphonia Dysphagia Odynophagia Cough	Chest pain Hemoptysis
Tachypnea	Tachypnea	Subcutaneous emphysema	Tachypnea
Tachycardia	Tachycardia	Hamman crunch	Hypoxia
Anxiety	Anxiety	Fever	Wheezing
Hyperresonance to percussion	Dullness to percussion		Rales
Diminished breath sounds	Diminished breath sounds		
Tension PTX: Hypotension Hypoxia Tracheal deviation Distended neck veins	*Massive hemothorax:* Hypotension		

Felden J. Closed Lung Trauma. Clin Sports Med 2013. 32: 255-265

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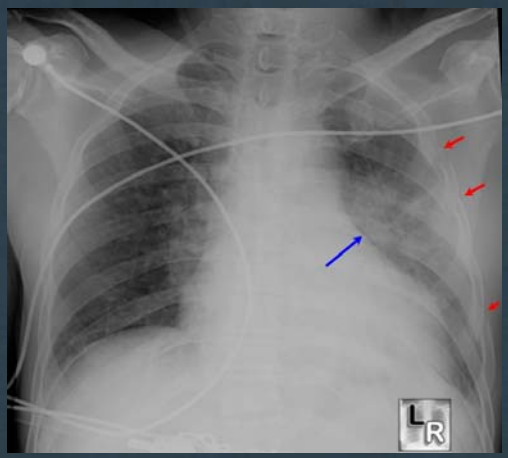
Return to Play After Pulmonary Contusion

- No specific guidelines
- Uncomplicated cases resolve within 7 days
- Respiratory symptoms must have resolved
- Chest wall pain is usually inhibitory



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Return to Play After Pneumothorax

- No specific guidelines
- Gradual goal oriented progression after radiographic resolution ~3-4 weeks.
- No air travel until 2 weeks after radiographic resolution. (risk of tension pneumothorax)

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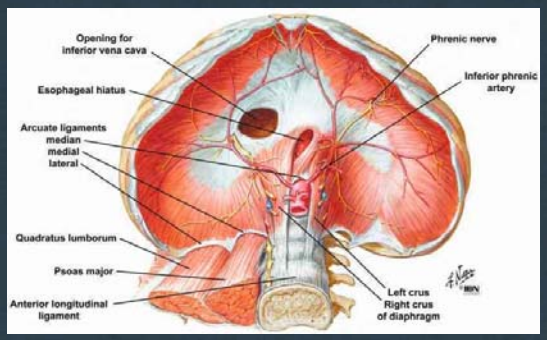
Diaphragm spasm

- "Getting wind knocked out"
  - blow to the epigastric region
- Celiac "solar" plexus = diaphragm spasm
- Tx:
  - supine with knees bent, slow deep breaths
  - focus on abdominal breathing
  - should improve 10-15min



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Pulmonary Embolism

- Thromboembolism (usually from legs) to the pulmonary vasculature.
- SOB, chest pain, tachycardia, leg pain/swelling.
- Risk Factors:
  - Long travel
  - Family history of clotting disorder
  - Smoker
  - Oral contraceptive pills
  - Recent immobilization or surgery
- Treatment: emergent evaluation, 3-6 months daily anticoagulation.
  - Avoidance of sport is usually recommended until completion of anticoagulation

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Take Home Points

- Understand difference between EIB and EILO to avoid mismanagement.
- "Above the neck" infections symptoms are cleared to play as tolerated.
- Systemic infections symptoms need to resolve before return to play.
- Traumatic pulmonary injury is rare, but need to be able to recognize and have plan to transport if necessary.
- No clear return to play guidelines for traumatic pulmonary injuries, rather case by case basis with goal oriented progression.

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Thank You!

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