Asthma

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Asthma Definition

- Chronic inflammatory disease of airways, with increased responsiveness to a variety of stimuli, and due to a variety of cells and cellular elements. This inflammation causes recurrent episodes of airway reactivity, especially at night or early morning. These episodes show widespread but variable airflow obstruction, which is often reversible either spontaneously or with treatment.
- (NAEPP guidelines)

Asthma Definition:

- Asthma is inflammatory: This process involves a wide variety of cells and cellular components. In particular, mast cells, eosinophils, T-lymphocytes, macrophages, neutrophils, and epithelial cells play important roles.

Stimuli

- Many stimuli interact with hyper-responsive airways and incite acute episodes of asthma. These stimuli can be broadly grouped into seven major categories:
  - Allergies
  - Pharmacologic
  - Environmental/Air pollution
  - Occupational
  - Infectious
  - Exercise
  - Emotional Stress

Airway Inflammation

- Airway inflammation causes recurrent episodes of wheezing, breathlessness, chest tightness and coughing, particularly at night and in the early morning. Typically these attacks are short lived, lasting minutes to hours, and reversible, interspersed by symptom-free periods of complete recovery.

Causes of Obstruction

- Asthma episodes exhibit a variable degree of airflow obstruction. This obstruction is caused by multiple changes within the airway, including:
  - Bronchoconstriction
  - Airway edema
  - Chronic mucous plug formation
  - Airway remodeling.
- The episodes are usually reversible either spontaneously or with treatment.

Epidemiology

- Prevalence:
  - Very common: 5% of US population.
  - One-half of cases develop prior to age 10
  - Another third before age 40

Asthma Diagnosis:

- Determine the following:
  - Presence of episodic symptoms of airflow obstruction.
  - Airflow obstruction is at least partially reversible
  - Alternative diagnoses are excluded.

Asthma Diagnosis Key Points:

- Presence of episodic symptoms, (wheeze, SOB, chest tightness, cough)
- Symptoms vary throughout the day and are often worse in early morning or at night. The absence of symptoms at the time of evaluation doesn't exclude the diagnosis of asthma.

Asthma Diagnosis Key Points:

- Airflow obstruction is reversible:
  - Establish obstruction:
    - FEV_1 <80% predicted
    - FEV_1 / FVC < 65% or below the lower limit of normal
    - Provocation with methacholine may be needed.
  - Establish reversibility:
    - FEV_1 increase ≥ 12% and ≥ 200 ml after short-acting inhaled beta-2-agonist (albuterol).

Asthma Diagnosis Key Points:

- Alternative diagnoses are excluded: Differential would include foreign body, vocal cord dysfunction, COPD, CHF (“cardiac asthma”), ABPA, etc.

Asthma History

- Recurrent episodes of coughing or wheezing
- Cough may be the sole symptom
- Symptoms worsen in the presence of known stimuli
- Symptoms worsen at night, often awakening the patient
- Close relatives have asthma, allergy, sinusitis or rhinitis.

Asthma History; Stimuli

- Stimuli that interact with responsive airways:
  - **Allergens: Antigen interacts with mast cell IgE**
  - **Pharmacologic: ASA, Beta blockers**
  - **Environmental: Ozone, sulfur dioxide, nitrogen dioxide**
  - **Occupational: Metal, wood, industrial plastics, etc.**
  - **Infectious: rhinovirus, influenza virus**
  - **Exercise: cold air, extreme exertion**
  - **Emotional: vagal efferent activity, endorphins**

Asthma Exam:

- Wheezing or a prolonged phase of expiration(absence of wheeze does not rule out asthma)
- Hyper-expansion of thorax (exam or CXR)
- Increased nasal secretions, mucusal swelling, sinusitis, nasal polyps
- Eczema, other signs of allergic skin problems
- Dyspnea, cough

Asthma Exam - Severe Exacerbation

- Pulsus paradoxus
- Diaphoresis, orthopnea, altered mental status
- Cyanosis unreliable - usually very late finding
- Accessory muscle use
- Higher pitch or disappearance of wheeze

Asthma Classification of Severity

	Days With Symptoms	Nights With Symptoms	PEF or FEV_1
Step 4 Severe Persistent	Continual	Frequent	≤ 60%
Step 3 Moderate Persistent	Daily	≥ 5/month	>60% - <80%
Step 2 Mild Persistent	3-6/week	3-4/month	≥ 80%
Step 1 Mild Intermittent	≤ 2/week	≤ 2/month	≥ 80%

*** Percent predicted values for forced expiratory volume in 1 second (FEV_1) and percent of personal best for peak expiratory flow (PEF) (relevant for children 6 years old or older who can use these devices).**

Asthma Classification Key Points

- 1 step has “intermittent” symptoms
- 3 steps have “persistent” symptoms
- Implications in management
- (daily therapy vs. prn therapy)

Asthma Pearl; ABG’s

- Significant abnormalities usually not seen, unless very late in severe attack.
- Hypoxemia is usually not a feature of asthma exacerbations
- Hypercapnia is a late sign of impending respiratory failure; also look for nasal flaring, anxiety, accessory muscle use, inability to speak full sentences, etc.

Asthma Therapy

- Medications in two broad categories:
  - Long term control of persistent asthma
  - Quick relief of symptoms/exacerbations.

Asthma Therapy

- Long term control: Anti-inflammatory properties, such as corticosteroids and cromolyn; long acting beta-2-agonists, theophylline, and leukotriene modifiers.

Asthma Therapy

- Quick relief meds:
  - short acting beta-2-agonists,
  - anticholinergics
  - systemic corticosteroids

Asthma Therapy Goals

- Reduce inflammatory component
- Avoidance of triggers / stimuli
- Return symptoms to baseline/normal (reversibility)
- Avoid scheduled use of bronchodilaters alone

Asthma Therapy Stepwise Approach

- Step 4: Severe persistent; Daily meds
- Step 3: Moderate persistent; Daily meds
- Step 2: Mild persistent: Daily meds
- Step 1: Mild intermittent: Prn meds

All patients: PRN meds available

Asthma Therapy

Step 1 Mild Intermittent	❖ No daily medication needed

- PRN use of short acting beta-2-agonist (albuterol)
- If needed more than twice/week, "step-up" to next level of therapy
- Before any "step-up", review compliance, inhaler technique, triggers/stimuli

Asthma Therapy Step 2: Mild Persistent

- One daily medication needed
- Anti-inflammatory: low-dose inhaled steroid or possibly cromolyn
- Less preferred: Theophylline or leukotriene antagonist
- Short acting inhaled-beta-agonist, prn

Asthma Therapy Step 3: Moderate Persistent

- Medium-dose inhaled steroid daily, or
- Low/medium dose inhaled steroid and long acting beta agonist (salmeterol) or theophylline, daily.
- High-dose inhaled steroids, long acting beta agonist, or theophylline may be added to above regimens, prn
- Short acting inhaled beta agonist, prn

Asthma Therapy Step 4: Severe Persistent:

- Anti-inflammatory: High dose inhaled steroid, daily, and,
- Long-acting bronchodilator: Long acting inhaled beta-agonist (salmeterol) and,
- Systemic steroids; possible need for long term oral steroids
- Short acting bronchodilator; inhaled beta-agonist, prn

Stepwise Approach for Managing Asthma

Long-Term Control:

Step 4 Severe Persistent (Daily medications)
1. Anti-inflammatory: inhaled steroid (high dose)* AND
2. Long-acting bronchodilator: either long-acting inhaled beta-agonist, or theophylline, AND
3. Steroids-systemic/tablets

Step 3 Moderate Persistent (Daily medications)
1. Either – Anti-inflammatory: inhaled steroid (medium-dose)* OR
2. Inhaled steroid (low-to-medium dose)* and add either long-acting inhaled beta-agonist or theophylline
3. If needed – Anti-inflammatory: inhaled steroids (medium-to-high dose)* AND either long-acting inhaled beta-agonist or theophylline

Step 2 Mild Persistent (Daily medications)
1. Anti-inflammatory: either inhaled steroid (low-dose)* or cromolyn
2. Theophylline is an altenative, but not preferred
3. Zafirlukast or zileuton may also be considered

Step 1 Mild Intermittent (No Daily Medications needed)

All Patients

Short-acting bronchodilator; Inhaled beta-agonist (2-4 puffs) as needed for symptoms. Intensity of treatment will depend on severity of exacerbation.

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