Module 1

Pathophysiology and Clinical Features of Asthma

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Pre-Assessment Exercise
Question #1

How many people in the US have asthma?

a. 5 million  
b. 10 million  
c. 15 million  
d. 20.5 million

Question #2

Which of the following is NOT an element of the diagnosis of asthma?

a. Prescription records  
b. History  
c. Spirometry  
d. Physical exam
Question #3

Which of the following best describes the typical symptom(s) of asthma?

a. Wheezing and chest tightness
b. Wheezing, cough, and chest tightness
c. Wheeze
d. Dry productive cough and nighttime apnea episodes

Question #4

Which of the following best describes the basic pathophysiology of asthma?

a. Autoimmune destruction of the bronchioles
b. Hypertrophy of the small and large airway musculature
c. Inflammation and airway hyperreactivity
d. Cellular infiltration of the airways
Question #5

Which of the following is a category in the classification of asthma severity?

a. Episodic
b. Intrinsic
c. Moderate persistent
d. Severe intermittent

Choose your option below.

Next Topic: Overview of Asthma
Overview of Asthma

Asthma
Asthma is a Disease of Special Interest to Pharmacists

- Drug therapy is critical to positive outcomes
- Treatment guidelines exist that detail care/management
- Undertreatment and inappropriate treatment are major contributors to asthma morbidity and mortality
- Preventing acute episodes has a proven and quick payoff in reducing hospitalization and emergency room visits
- Asthma is typically the 1st or 2nd chosen target of disease management programs run by Managed Care Organizations

Prevalence of Asthma

- 20.5 million people in the U.S.
- Nine million U.S. children under 18 have been diagnosed with asthma
  - More than four million children have had an asthma attack in the previous year
- Most common chronic disease of childhood (boys > girls)
- Women affected more often than men
- Prevalence is decreasing
Morbidity and Mortality

- 12.7 million physician office visits and 1.2 million outpatient department visits due to asthma/year
- 500,000 hospitalizations/year
- 2 million asthma-related visits to emergency departments/year

Morbidity and Mortality (cont.)

- Race discrepancy
  - Asthma prevalence is 39% higher in African Americans than in Caucasians
- Approximately 5,000 deaths from asthma yearly
  - 80-90% of the deaths are PREVENTABLE
Economic Impact of Asthma

$16.1 billion

Direct Medical Costs of Asthma

$11.5 Billion

- Inpatient: 43%
- Physician: 24%
- Emergency: 5%
- Outpatient: 25%
- Medication: 3%
### Indirect Costs of Asthma

- $4.6 billion
- Lost Productivity – $1.7 billion
  - 14.5 million lost work days
- 10 million missed school days
- Asthma impacts social and physical activities
- Indirect costs are especially important to employers

### Healthy People 2010

- Asthma related goals
  - Reduce asthma related deaths, hospitalizations, and emergency room visits
  - Reduce activity limitations among persons with asthma
  - Increase the proportion of persons with asthma who receive formal patient education, including information about community and self-help resources, as an essential part of the management of their condition
- www.healthypeople.gov
National Asthma Education and Prevention Program (NAEPP)

- Initiated by NIH in 1989
- Has convened three expert panels
  - First report in 1991
  - Revised edition in 1997 (EPR-II)
  - Update on selected topics 2002
  - Revised edition in 2007 (EPR-III)
- www.nhlbi.nih.gov

Pediatric Asthma: Promoting Best Practice Guide for Managing Asthma in Children

- Coordinated by American Academy of Allergy, Asthma and Immunology, American Academy of Pediatrics, and NAEPP
- Published in 1999, updated in 2004
- Recommendations based on NAEPP EPR-II
- Available at www.aaaai.org
Global Initiative for Asthma (GINA)

- GINA
  - Guidelines last updated in 2006
  - www.ginasthma.org
  - Publications include:
    - Global Strategy For Asthma Management And Prevention
    - Pocket Guide for Asthma Management and Prevention
    - Promotional materials for World Asthma Day

Choose your option below.

Next Topic: Pathophysiology of Asthma
Pathophysiology of Asthma

Basic Review of the Pathophysiology of Asthma

- Old theory – Airway hyperresponsiveness
- New theory – Airway inflammation
A chronic airway disorder in which many cells and cellular elements such as macrophages, neutrophils, epithelial cells, mast cells, eosinophils, T lymphocytes and other cells play a prominent role. Asthma is characterized by airway hyperresponsiveness, airway inflammation, airway wall remodeling and bronchoconstriction which changes in severity spontaneously or as a result of treatment.

Episodes of asthma symptoms are usually associated with widespread but variable airflow obstruction that is reversible.
Main Features of Asthma

- Airway inflammation
- Bronchial hyperreactivity
  - Bronchoconstriction
  - Mucus hypersecretion
  - Mucosal edema
  - Epithelial desquamation

Model of the Pathogenesis

Triggers → Antigens → Cytokines → Lymphocyte
  Mast Cell
  Eosinophil
  Macrophage
  Neutrophil
  Epithelial Cell

Inflammatory Mediators

Airway Hyperresponsiveness
Bronchoconstriction
Mucus Hypersecretion
Airway Edema
Inflammatory Cell Recruitment
Pathophysiology of Asthma

Other Factors

- Structural changes in airway wall due to chronic airway inflammation
  - Increase in smooth muscle mass
  - Increase in goblet cells
  - Deposition of collagen beneath basement membrane
- Leukotrienes
Inflammatory Process

• Early Asthmatic Response (EAR)
  – Due to mast cell degranulation in response to trigger
  – IgE response results in preformed chemical mediator release
  – Develops within 15 minutes of exposure and resolves within 2 hours

Inflammatory Process

• Late Asthmatic Response (LAR)
  – Further production of mediators
  – Results in increased vascular permeability, vascular leakage, airway wall swelling and bronchospasm
  – 3-8 hours after exposure and lasts for up to 24 hours
Asthma is no longer considered synonymous with bronchospasm or constriction. It is an inflammatory disease in which bronchospasm occurs secondary to airway inflammation.

Factors Contributing to Development of Asthma

- Genetic predisposition
- Male gender
- Having few older siblings
- Western environment
- Allergen exposure *

*Appears to be most important factor
Choose your option below.
Next Topic: Signs and Symptoms of Asthma

Signs and Symptoms of Asthma
Signs and Symptoms of Asthma

- Classic Symptoms
- Wheezing
  - High-pitched, whistling sound
  - Created by turbulent airflow through obstructed airways
  - Usually heard during expiration

Interactive Check Point

Which of the following is an often overlooked symptom of asthma?

a. Rales
b. Chest pain
c. Palpitations
d. Cough
Interactive Check Point Answer

d. Cough
   – In addition to wheezing, cough is one of the classic symptoms of asthma. It is a common and often overlooked symptom of asthma
   – Rales, palpitations and chest pain are not typical symptoms of asthma

Signs and Symptoms of Asthma

• Classic Symptoms
• Coughing
   – Common and often overlooked
   – Dry or productive
   – May be only symptom
   – Often seen in children
Symptoms of Asthma

Classic Symptoms
• Dyspnea
• Chest tightness

Signs of Asthma

• Increased pulse
• Increased respiratory rate
• Accessory muscle use
Signs and Symptoms of Asthma

- Highly variable between patients
- Episodic
- Generally worse at night and early morning
- May become irreversible over time

Choose your option below.
Next Topic: Diagnosis and Classification of Asthma
Diagnosis and Classification of Asthma

Diagnosis of Asthma

- History
- Physical exam
- Spirometry
Diagnosis of Asthma

• History
  – Have you had coughing, wheezing or shortness of breath (SOB):
    • At night?
    • In the early morning?
    • After physical activity?
    • Have you had these symptoms during a particular time of year?
  – Have you used any medications to help you breath better?

Diagnosis of Asthma

• Physical exam
  – Chest auscultation
    • Expiratory wheezes
    • Decreased breath sounds
    • Cough
  – Patient using accessory muscles for respiration
  – Evidence of allergy
    • Eczema
    • Nasal polyps
    • Inflamed turbinates
    • Eyelid edema
Diagnosis of Asthma

• Spirometry
  – Peak expiratory flow rate (PEFR) increases at least 12% after inhaling a $\beta_2$ agonist
  – PEFR varies at least 20% from morning to early afternoon

Exclusions

• Adults
  – COPD
  – Heart failure
  – Obstruction of large airways (tumor, sarcoidosis)
• Children
  – Congenital malformation
  – Viral infections
  – Foreign body obstruction
  – Cystic fibrosis
  – Immunodeficiency diseases
Critical Elements in the Diagnosis of Asthma

• History
• Reversible airway obstruction

Classification of Asthma

• Based on severity of disease
  – Symptom presentation
• Asthma severity is the intrinsic intensity of disease
How To Classify Asthma Severity

• BEFORE therapy is started
• Classify according to clinical features
• Includes domains of current impairment and future risk
• Helps guide clinical decisions on appropriate medication selection

Domains

• Impairment
  – Frequency and intensity of symptoms
  – Functional limitations the patient is experiencing
• Risk
  – Likelihood of either asthma exacerbations, progressive decline in lung function, or medication adverse effects
Intermittent Asthma

- **Impairment**
  - Intermittent symptoms ≤ 2 times/week
  - Nighttime symptoms ≤ 2 times/month
  - Short acting β2 agonist (SABA) use ≤ 2 days/week
  - No interference with normal activity
  - Forced expiratory volume in one second (FEV1) > 80% predicted
  - Normal lung function between exacerbations
- **Risk**
  - One or fewer exacerbations per year

Mild Persistent Asthma

- **Impairment**
  - Symptoms > 2 days/week but not daily
  - Nighttime symptoms 3-4 times/month
  - SABA use is > 2 days/week but not > 1x/day
  - Minor interference with daily activities
  - FEV1 > 80% predicted
- **Risk**
  - 2 or more exacerbations/year
Moderate Persistent Asthma

- Impairment
  - Daily symptoms
  - Nighttime symptoms > 1 time/week but not every night
  - Daily use of SABA required
  - Some limitation of usual activities
  - FEV1 > 60%, but < 80% predicted value
- Risk
  - 2 or more exacerbations/year

Severe Persistent Asthma

- Impairment
  - Symptoms throughout the day
  - Nighttime asthma symptoms often 7x/week
  - SABA use several times per day
  - Physical activity extremely limited by asthma symptoms
  - FEV1 < 60% predicted
- Risk
  - 2 or more exacerbations/year
Advantages of a Classification System

• Aids in treatment selection
• Standardization for research studies
Application Exercise

Assessing Patient Symptoms and Classifying Asthma Severity

Case Presentation

• Mrs. Jones is a 34 year old who comes to your pharmacy seeking something for a dry nonproductive cough. She does not have a fever or other symptoms of a respiratory infection.
Case Presentation

• Medical History
  – Asthma – diagnosed 1 year ago
  – Hypertension
• Current Medications
  – Albuterol inhaler 2 puffs qid prn
  – Enalapril 5 mg qd

Which of the following symptoms of asthma does she have?

a. Chest tightness
b. Cough
c. Wheezing
d. Increased heart rate
Best Answer

b. Cough

– Her dry nonproductive cough may be a symptom of her asthma not being well controlled but it also may be an adverse effect from her enalapril therapy.

Case Presentation

• In addition to her cough, Mrs. Jones says she needs something to help her breathe better. She uses the inhaler at least 4 times daily because of shortness of breath and some wheezing during the day.
• She wakes at night with shortness of breath about twice a week.
• Based on prescription refill records she is using 2 inhalers per month.
How would her asthma be classified?

a. Intermittent Asthma
b. Mild Persistent Asthma
c. Moderate Persistent Asthma
d. Severe Persistent Asthma

Best Answer

• Moderate Persistent Asthma
  – Daily symptoms
  – Nighttime symptoms > 1 time/week but not nightly
  – Daily use of inhaled short-acting medication required
Thank you for your participation.

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