

## Asthma

- Chronic inflammatory disease of the airways – increase responsiveness of the Tracheobronchial tree to a variety of stimuli
- Narrowing of the airways with cough, dyspnea, wheezing, inability to expel air completely
- Episodic in nature – symptoms free time periods
- Allergens, exercise, infections, occupational stress, environmental stress, pharmacologic stress, emotional stress
- PCO<sub>2</sub>- initially-30-35 mmHg, later-above 45 mmHg
- 1 kilopascal =
- 7.50061683 mmhg

## Asthma

- Reversible inflammation & obstruction
- Intermittent attacks
- Sudden onset
- Varies from person to person
- Severity can vary from shortness of breath to death

## What Causes Asthma Attacks?

**AN ASTHMA TRIGGER IS...**  
anything that sets off asthma symptoms



# Asthma

## Triggers:

- Allergens
- Exercise
- Respiratory infections
- Drugs and food additives
- Nose and sinus problems
- GERD
- Emotional stress

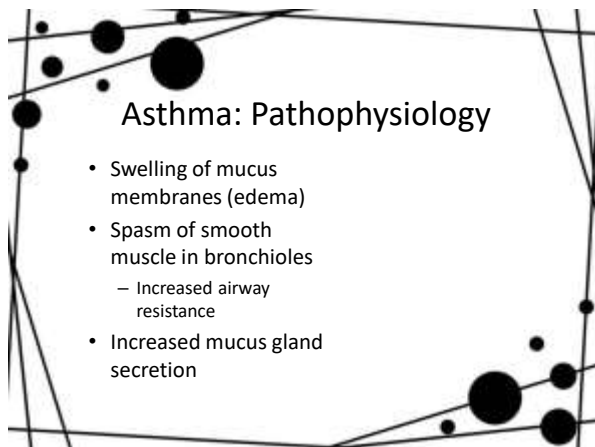
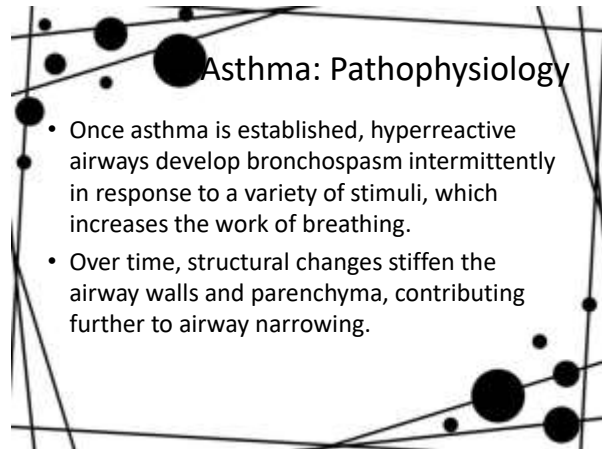
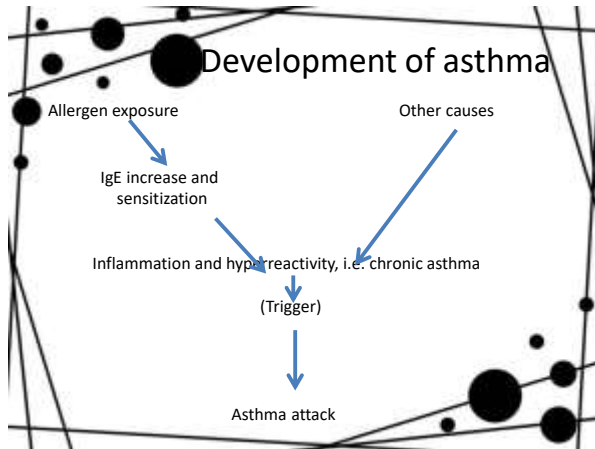
## Asthma: Pathophysiology

- Two phases of response occur:
  1. **The sensitization stage**, which occurs in atopic people: exposure to allergens, especially in foetal or early life, stimulates production of excess immunoglobulin-E antibodies (IgE) in the serum. IgE becomes fixed to mast cells, which then react to antigens by releasing bronchoconstrictor mediators such as histamine. Serum IgE levels are five-times higher in asthma patients than in controls.
- An atopic person is one who is prone to allergy and who may develop asthma if exposed to allergens, e.g. certain foods, or the faeces of house-dust mite

## Asthma: Pathophysiology

- 2. **The hyperreactive stage**: continued exposure to allergens, or response to other stimuli, leads to mast cell degranulation and release of inflammatory cytokines such as interleukins and eosinophils .
- Chronic low-grade inflammation damages the surface epithelial layer, causing bronchial hyperreactivity.

**Degranulation** is a cellular process that releases antimicrobial cytotoxic molecules from secretory vesicles called granules found inside some cells. It is used by several different cells involved in the immune system, including granulocytes (neutrophils, basophils and eosinophils) and mast cells.



## Asthma: Pathophysiology

- **Early phase response: 30 – 60 minutes**
  - Allergen or irritant activates mast cells
  - Inflammatory mediators are released
    - histamine, bradykinin, leukotrienes, prostaglandins, platelet-activating-factor, chemotactic factors, cytokines
  - Intense inflammation occurs
    - Bronchial smooth muscle constricts
    - Increased vasodilation and permeability
    - Epithelial damage
  - Bronchospasm
    - Increased mucus secretion
    - Edema

## Asthma: Pathophysiology

- **Late phase response: 5 – 6 hours**
  - Characterized by inflammation
  - Eosinophils and neutrophils infiltrate
  - Mediators are released, mast cells release histamine and additional mediators
  - Lymphocytes and monocytes invade as well
  - Future attacks may be worse because of increased airway reactivity that results from late phase response
    - Individual becomes hyperresponsive to specific allergens and non-specific irritants such as cold air and dust
    - Specific triggers can be difficult to identify and less stimulation is required to produce a reaction

## Asthma: Early Clinical Manifestations

- Wheezing
- Chest tightness
- Dyspnea
- Cough
- Prolonged expiratory phase
- Anxious & Agitated
- Increased respiratory & heart rate

## Asthma: Severe Clinical Manifestations

- Hypoxia
- Confusion
- Increased heart rate & blood pressure
- Respiratory rate up to 40/minute
- Use of accessory muscles
- Diaphoresis & pallor
- Cyanotic nail beds

## Classification of Asthma

- Mild intermittent
- Mild persistent
- Moderate persistent
- Severe persistent

## Asthma

### Status asthmaticus

This term is sometimes used interchangeably with severe acute asthma, but specifically describes an asthma attack prolonged over 24 hours, leading to dehydration and exhaustion.

## Asthma: Diagnostic Tests

- Pulmonary Function Tests
  - FEV1 decreased
  - PEFR decreased
- Symptomatic patient
  - eosinophils  $\geq 5\%$  of total WBC
  - Increased serum IgE
  - Chest x-ray shows hyperinflation
- ABGs
  - Early: respiratory alkalosis, PaO<sub>2</sub> normal or near-normal
  - severe: respiratory acidosis, increased PaCO<sub>2</sub>,

## Types of Medications

- Long-term “controller” medicine
- Quick-relief “rescue” medicine

## Long-Term Medications

- Long-term “controller” medicine prevents swelling and inflammation of the airway and should be used every day, even when feeling well.

## Quick-Relief Medications

- Quick-relief “rescue” medicine works quickly to open the tightened airway.
- Quick-relief medicine is usually used on an as-needed basis.

## Asthma: Collaborative Care

- Mild intermittent
  - Avoid triggers
  - Premedicate before exercising
  - May not need daily medication
- Mild persistent asthma
  - Avoid triggers
  - Premedicate before exercising
  - Low-dose inhaled corticosteroids

## Asthma: Collaborative Care

- Moderate persistent asthma
  - Low-medium dose inhaled corticosteroids
  - Long-acting beta2-agonists
  - Can increase doses or use theophylline or leukotriene-modifier [singulair, accolate, zflo]
- Severe persistent asthma
  - High-dose inhaled corticosteroids
  - Long-acting inhaled beta2-agonists
  - Corticosteroids if needed

## Asthma Medications: Anti-inflammatory

- Corticosteroids
  - Not useful for acute attack
  - Beclomethasone: vanceril, beclovent, qvar
- Cromolyn & nedocromil
  - Inhibits immediate response from exercise and allergens
  - Prevents late-phase response
  - Useful for premedication for exercise, seasonal asthma
- Leukotriene modifiers
  - Interfere with synthesis or block action of leukotrienes
  - Have both bronchodilation and anti-inflammatory properties
  - Not recommended for acute asthma attacks
  - Should not be used as only therapy for persistent asthma
  - Accolate, Singulair, Zflo

## Asthma Medications: Bronchodilators

- $\beta$ 2-adrenergic agonists
  - Rapid onset: quick relief of bronchoconstriction
  - Treatment of choice for acute attacks
  - If used too much causes tremors, anxiety, tachycardia, palpitations, nausea
  - Too-frequent use indicates poor control of asthma
  - Short-acting
    - Albuterol [proventil]; metaproterenol [alupent]; bitolterol [tornalate]; pirbuterol [maxair]
  - Long-acting
    - Useful for nocturnal asthma
    - Not useful for quick relief during an acute attack
    - Salmeterol [serevent]

## Asthma: Client Teaching

- Correct use of medications
- Signs & symptoms of an attack
  - Dyspnea, anxiety, tight chest, wheezing, cough
- Relaxation techniques
- When to call for help, seek treatment
- Environmental control
- Cough & postural drainage techniques