

Allergic Rhinitis & Bronchial Asthma

Prepared by:
Dr.Mohibullah salih

Atopy & Allergen

- **Atopy** is a result of a complex interaction between multiple genes and environmental factors.
- It implies specific IgE-mediated diseases, including allergic rhinitis, asthma, and atopic dermatitis.
- **An allergen** is an antigen that triggers an IgE response in genetically predisposed individuals.

Hypersensitivity reactions

Hypersensitivity disorders of the immune system are classified into four groups, based on the mechanism that leads to tissue inflammation

Type 1

(1) Early onset

(2) Late onset

Antibody-
cytotoxicity

IgM, IgG, or IgA antibodies binding to the cell surface and activating the entire complement pathway resulting in lysis of the cell or release of anaphylatoxins, such as C3a, C4a, and C5a. These anaphylatoxins trigger mast cell degranulation, resulting in inflammatory mediator release.

Immune
complex

Involve the formation of antigen-antibody or immune complexes that enter into the circulation and are deposited in tissues such as blood vessels and filtering organs (liver, spleen, and kidney). These complexes initiate tissue injury by activating the complement cascade and recruiting neutrophils that release their toxic mediators.

Cell mediated
immunity

Involve recognition of antigen by sensitized T cells. Antigen-presenting cells form peptides that are expressed on the cell surface in association with MHC class II molecules. Memory T cells recognize the antigen peptide/major histocompatibility complex class II complexes. Cytokines, such as interferon- γ , tumor necrosis factor- α , and granulocyte-macrophage colony-stimulating factor, are secreted from this interaction, which activates and attracts tissue macrophages.

Allergic rhinitis

- **Definition:**

Inflammation of the nasal and sinus mucosa, associated with sneezing, swelling, increased mucus production, and nasal obstruction.



Classification

- **Seasonal:**

periodic symptoms, involving the same season for at least 2 consecutive years; most often as a result of pollens (tree, grass, weed) and outdoor spores.

- **Perennial:**

occurring at least 9 months of the year; may be more difficult to detect because of overlap with other infections; may be as a result of multiple seasonal allergies or continual exposure to allergens (such as dust mites, cockroaches, molds, and animal dander).

- **Perennial with seasonal** exacerbations.

Causes

- **Indoor allergens:** house dust mite, cockroaches, animal dander, cigarette smoke, hair spray, paint, molds
- **Pollens:** tree pollens in early spring, grass in late spring and early summer, ragweed in late summer and autumn
- **Multiple environmental** factors
- **Changes in air** temperature

Associated conditions

- Asthma
- Allergic conjunctivitis
- Atopic dermatitis (eczema)
- Urticaria
- Otitis media
- Sleep, taste, and/or smell disturbance
- Nasal polyps
- Mouth breathing
- Snoring
- Adenoidal hypertrophy and sleep apnea

Epidemiology

- **Most common** allergic disease, affecting more than **20 million** Americans; **affects 8% to 20% of children** and **15% to 30% of adolescents**.
- Estimated that up to 75% of children with asthma also have **allergic rhinitis**.
- **Most commonly** begins during childhood and young adulthood, with the peak incidence being in midadolescence; symptoms of allergic rhinitis develop in 80% of cases before age 20.
- **Perennial allergic** rhinitis can occur at any age.
- **seasonal allergic** rhinitis is rare before age 3 years.

Genetics

- **Increased incidence** in families with atopic disease
- **If one parent has allergies**, each child has a 30% chance of having an allergy; if both parents have allergies, each child has a 70% chance of having an allergy.

Complications

- Chronic sinusitis
- Recurrent otitis media
- Hoarseness
- Loss of smell
- Loss of hearing
- High-arched palate and dental malocclusion from chronic mouth breathing.

Data gathering/ history

- **Question:** What are typical symptoms?
 - **Significance:** Patient often reports stuffy nose, sneezing, itching, runny nose, noisy breathing, snoring, cough, halitosis, and repeated throat clearing. Sensation of plugged ears and wheezing may occur.
- **Question:** Are eyes red and itchy?
 - **Significance:** Suggestive of allergic conjunctivitis
- **Question:** Are symptoms seasonal, perennial, or episodic?
 - **Significance:** May help to identify potential allergens
- **Question:** Any exacerbating factors including pollen, animals, cigarette smoke, dust, molds?
 - **Significance:** Useful information to prevent symptoms from occurring
- **Question:** Is there a family history of atopic disease, such as asthma or atopic dermatitis?
 - **Significance:** Supports the diagnosis
- **Question:** Any related illnesses?
 - **Significance:** Asthma, urticaria, eczema, & ear infections, are commonly associated conditions.

Physical examination

- **Allergic shiners:** dark discoloration beneath the eyes as a result of obstruction of lymphatic and venous drainage, chronic nasal obstruction, and suborbital edema.



- **Dennie-Morgan lines:** creases in the lower eyelid radiating outward from the inner canthus; caused by spasm in the muscles of Müller around the eye as a result of chronic congestion and stasis of blood.

Physical examination

- **Allergic salute:** a gesture characterized by rubbing the nose with the palm of the hand upward to decrease itching and temporarily open the nasal passages.
- **Allergic crease:** transverse crease near the tip of the nose, secondary to rubbing



- **Nasal mucosa** may appear pale and/or edematous; mucoid or watery material may be seen in the nasal cavity; check for nasal polyps, septal deviation.

Laboratory aids

- **Nasal cytology:**
 - specimen of nasal discharge to check for the presence of eosinophils. Greater than 10% eosinophils are considered positive for nasal eosinophilia.
- **RAST (radioallergosorbent tests):**
 - in vitro test to measure allergen-specific IgE; expensive; useful in patients who have diffuse atopic dermatitis.
- **Total IgE:**
 - elevated in allergic rhinitis; not routinely indicated, but may come as part of specific IgE testing; >100 ku/L is considered elevated.

Skin test

- **Prick test:**

- percutaneous, qualitative test in which antigen concentrate is placed on the skin of the volar surface of the arm or upper back, and a needle is inserted; the skin reaction is subjectively graded from zero to four.

- **Intradermal test:**

- qualitative test in which antigen is introduced intradermally (0.02 mL with a 26- to 30-gauge needle); more sensitive than the prick test and often used if prick test is negative or equivocal; the degree of swelling and erythema is graded from zero to four.

- **Procedures:**

- Rhinoscopy to assess the nasal turbinates and to look for nasal polyps

Treatment of allergic rhinitis

- **Mucolytics:** act to thin the mucus and thereby improve mucociliary flow
 - Steam inhalation
 - Normal saline drops
 - Oral guaifenesin
- **Antihistamines:**
 - **Loratadine:** FDA-approved for children as young as 2 years. Dose: ages 2 to 5 years 5 mg PO daily; ages 6 years or older 10 mg PO daily.
 - **Cetirizine HCl:** FDA-approved for children as young as 6 months. Dose: age 6 months to 5 years: 2.5 mg = 1/2 tsp (1 mg/mL banana-grape flavored syrup) PO daily with maximum dose of 5 mg per day (must be divided into 2.5 mg twice a day for children under 2 years of age).
 - **Fexofenadine:** 6 to 11 years: 30 mg tab bid.; 12 years: 60 mg bid. or 180 mg daily.

Treatment of allergic reaction

- **First-generation antihistamine**

- Side effects include drowsiness, performance impairment, paradoxical excitement; anticholinergic side effects (e.g., dry mouth, tachycardia, urinary retention, and constipation).
- Diphenhydramine (Benadryl) 5 mg/kg per day divided q.i.d.

- **Intranasal steroids:**

- Blunt early phase reactions and block late phase reactions; may not be fully effective until several days to 2 weeks after initiation of therapy.
- **Beclomethasone:** for use in children 6 years
- **Fluticasone propionate** (Flonase 0.05%): for use in children 4 years
- **Budesonide:** for use in children 6 years
- **Triamcinolone acetonide** (Nasacort): 6 years

Treatment of allergic rhinitis

- **Topical Cromolyn:**

- mast-cell stabilizer; minimal side effects; does not provide immediate relief (may take 2 to 4 weeks to see clinical effect): for use in children 2 years.

- **Oral decongestants:**

- beta1 and beta2-adrenergic agonists (e.g., ephedrine, pseudoephedrine and phenylephrine) act to cause vasoconstriction, decreased blood supply to the nasal mucosa, and **decreased mucosal edema**. **Cardiovascular and CNS side effects** include tremors, agitation, hypertension, insomnia, and headaches.

- **Topical decongestants:**

- Sympathomimetic such as short-acting **phenylephrine** and long-acting **oxymetazoline** may be useful for a few days to open nasal passages to allow for delivery of topical steroids; side effects include drying of the mucosa and burning. Use for more than a few (3 to 5) days may result in rebound vasodilatation and congestion (**rhinitis medicamentosa**).

Immunotherapy

- **Hyposensitization or desensitization.**

- Consists of a series of injections with specific allergens, with increasing concentrations of allergens, once or twice weekly
- Recommended for patients who have not responded to pharmacologic therapy
- Extremely effective and long-lasting. After several months to years of treatment, total serum IgE levels decrease, and the intensity of the early-phase response is reduced.
- Side effects include urticaria, bronchospasm, hypotension, and anaphylaxis

- **SURGERY**

- Removal of allergic polyps
- Inferior turbinate surgery to reduce the size of the turbinate and relieve obstruction.



Bronchial Asthma

Definition

Definition: Asthma is a chronic inflammatory disorder of lung parenchyma which is characterized by three components:

1. Reversible airway obstruction
2. Airway inflammation
3. Airway hyperresponsiveness to a variety of stimuli



BRONCHIAL ASTHMA

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Epidemiology

- Nearly 7 million children younger than 18 years
- Most common chronic illness in children
- Death from asthma in children nearly tripled from 1980 to 1995, and incidence of death from asthma does not seem to correlate with severity.
- Wheezing in children is extremely common in the industrialized world.
- In younger children, most episodes occur following viral infections.
- Over 50% of children who wheeze in early childhood stop wheezing by age 6 years.
- 14% of all young children (40% of those who wheeze during infancy) continue to wheeze.

Pathophysiology

- Smooth muscles contraction
- Inflammation
- Cellular infiltration
- Accumulation of cellular debris

Etiology

- Airborne allergens
- Respiratory infections
- Physical activity
- Cold air
- Air pollutant & irritant

Genetics

- Children of asthmatics have higher incidence of asthma:
 - 6% to 7% risk if neither parent has asthma
 - 20% risk if one parent has asthma
 - 60% risk if both parents have asthma
- Several genes are known to be associated with the development of atopy and bronchial muscle

Complications

- Morbidity
 - Frequent hospitalizations and absence from school
 - Psychologic impact of having a chronic illness
 - Decline in lung function over time

Diagnosis

Asthma is diagnosed with three R's.

1. **Recurrence:** symptoms are recurrent
2. **Reactivity:** symptoms brought on by specific occurrence or exposure (trigger)
3. **Responsive:** symptoms diminish in response to bronchodilator or anti-inflammatory agent

Differential diagnosis

- **Infectious disorders**

- Pneumonia
- Bronchiolitis
- Laryngotracheobronchitis
- Sinusitis

- **Extrinsic airway compression**

- Vascular ring
- Foreign body
- Tracheobronchomalacia
- Pulmonary edema
- Gastroesophageal reflux (GER)
- Recurrent aspiration

Data gathering

- **History**
- Inquire about these symptoms:
coughing, wheezing, shortness of breath, chest tightness
 - Frequency of symptoms defines severity
 - Precipitating factor (trigger)
 - Response to bronchodilator or anti-inflammatory medication

Data gathering

○ **Pattern of symptoms**

- Perennial versus seasonal
- Continuous versus acute
- Duration and frequency of episodes
- Diurnal variation/nocturnal symptoms

Data gathering

- Do any of the following *set off* the breathing difficulty?
 - 1) Infections (upper respiratory, sinusitis)
 - 2) Exposure to:
 - Dust (mites)
 - Animal dander
 - Pollen
 - Mold
 - 3) Cold air or weather changes - Exercise or play
 - 4) Environmental stimulants
 - Cigarette smoke
 - Strong odors
 - Pollutants
 - 5) Drug intake
 - Aspirin
 - Nonsteroidal anti-inflammatory drugs
 - beta²-blockers
 - 6) Family history of asthma or atopy

Data gathering

- **Review of systems**
- Symptoms of complicating factors (GER, sinusitis, allergies)
 - Dyspepsia, sour taste (**Gastro-Esophageal-Reflux**)
 - Throat clearing, purulent nasal discharge, halitosis, cephalalgia, or facial pain (**sinusitis**)
 - Nasal itching, (allergic salute & allergic shiners) eye rubbing, sneezing, watery nasal discharge (**allergies**)

Data gathering

- **Impact of asthma**

- Number of hospitalizations/ICU admissions
- Number of ER visits/doctor's office visits
- Asthma attack frequency
- Number of missed school days/parent workdays
- Limitation on activity
- Number of courses of systemic steroids needed

Physical examinations

- Pulmonary examination may be normal when asymptomatic.
- Assess work of breathing
 - Level of distress
 - Intercostal/supraclavicular muscle retractions
- Chest shape (i.e., normal vs. barrel-shaped)
- Lung auscultation
 - Wheezing/ Ronchi
 - End-expiratory involuntary cough
 - Prolonged expiratory phase
 - Crackles or coarse breath sounds
 - Stridor (indicates extrathoracic airway obstruction)

HEENT examination

- **Signs of allergies** or sinusitis
 - Watery or itchy eyes
 - Allergic shiners
 - Dennie lines
 - Nasal congestion
 - Nasal polyps
 - Postnasal drip
- **General examination:** vital signs
 - Blood pressure (pulsus paradoxus)/ Temperature
 - Respiratory rate (tachypnea)/ Heart rate
- **Skin:** evidence of eczema
- **Extremities:** digital clubbing (suggests alternative diagnosis)

Laboratory Aids & Tests

● Pulmonary function tests

- Essential for the assessment and ongoing care of children with asthma.
- Spirometry measures the degree of airway obstruction and the response to bronchodilators.

● Provocational testing

- Exercise challenge: determines effect of exercise on triggering airway obstruction
- Cold air challenge: indirect test of airway hyperresponsiveness

● Allergy evaluation

- Blood tests (eosinophil count, IgE level)
- Skin testing (best test for assessing allergen sensitivity)
- Sputum/nasal examination for presence of eosinophilia

● Other studies

- GER evaluation
- pH probe

● Bronchoscopy to rule out:



*Anatomic malformations- Foreign bodies-
Mucus plugging- Vocal cord dysfunction*

Imaging

- **Chest radiograph** to rule out congenital lung malformations or obvious vascular malformations. Findings can be normal. Common findings are peribronchial thickening, subsegmental atelectasis, and hyperinflation.
- **Indications** for chest radiography are:
 - Fever, unilateral physical findings, suspected pneumothorax, tachycardia more than 160b/min, silent chest.
- **Sinus CT** is useful if symptoms suggest sinusitis.
- **Chest CT** should be performed if bronchiectasis or anatomic abnormality is suspected.

Treatment of asthma

- **Corticosteroids**

- Most effective anti-inflammatory agent

1. **Reduce** airway inflammation and hyperresponsiveness
2. **Inhibit** production and release of cytokines and arachidonic acid associated metabolites
3. **Enhance** beta²-adrenoceptor responsiveness
4. Side effects: oral thrush; may minimally affect growth velocity at moderate or high doses

- Inhaler

- **Fluticasone** (44, 110, 220 µg/puff pMDI) (Flovent)
- **Budesonide** (200 µg/puff DPI; 250 and 500 µg vials for nebulizer)
- **Beclomethasone** (42, 84 µg/puff) (Beclovent, Vanceril)
- **Triamcinolone** (100 µg/puff) (Azmacort)

Treatment of bronchial asthma

- **Oral used** for asthma exacerbations or for severe asthma that cannot be otherwise controlled
 - **Exacerbations:** prednisone 1-2 mg/kg per day 3 to 7 days or longer; usually tapered if more than 7 days of therapy required or if systemic steroids are used frequently
 - **Ongoing therapy:** 0.5 to 1 mg/kg per day daily or every other day for patients with severe asthma
 - Undesirable Side-Effect Profile
- **Intravenous**
 - Methylprednisolone 1 mg/kg IV q6-12h until able to take oral medication.

Treatment of asthma

- **Leukotriene Modifiers**

- **Zileuton**

- Block the synthesis and/or action of leukotrienes
- 5-Lipoxygenase inhibitors;
- May cause hepatic dysfunction.

- **Zafirlukast (10mg) & Montelukast (4,5 & 10 mg)**

- Leukotriene receptor antagonists
- Indicated as monotherapy for mild or exercise-induced asthma and in combination with an inhaled corticosteroid for more effective symptom control or using a lower dose of inhaled corticosteroid.

Treatment of asthma

- **Mast-Cell Stabilizers**
- Weak anti-inflammatory agents
- Preparations
- **Cromolyn sodium (Intal)**
- **Nedocromil sodium (Tilade)**
 1. Decrease bronchial hyperresponsiveness
 2. Can be used prior to exercise for exercise-induced symptoms
 3. No significant side effects
- **Inhaled**
 - Nebulizer
 - MDI

Treatment of bronchial asthma

- **Bronchodilators**
 - Relax airway smooth muscle
- Three classes described below
 - Beta2-Agonists
 - Theophylline
 - Anticholinergic Agents

Beta2-agonists

- Quick relief medicine
- Used as needed in people with asthma who have breakthrough symptoms
- Used prior to exercise in exercise-induced bronchospasm
- Routes
 - Inhaled (most effective): metered dose inhaler or nebulizer
 - Oral (least effective; most side effects)
- **Preparations:** Short-acting (effect lasts 4-6 hours):
 - Albuterol (Ventolin)
 - Terbutaline
 - Metoproterenol
- **Preparation:** Long-acting (lasts up to 12 hours)
 - Salmeterol (Serevent) available as pMDI and DPI
 - Can be used daily in conjunction with anti-inflammatory agent for improved symptom control

Theophylline

- Second line agent used when more conventional therapies are unsuccessful
- Indications
 - Chronic, poorly controlled asthma
 - Nocturnal asthma (if no GER)
 - Adjunctive therapy with beta2 drugs and steroids in hospitalized patients in selected cases
- Route: oral or IV
- Therapeutic levels: 5 to 15 mg/mL
- Many factors affect theophylline levels.
- Decreased levels seen with:
 - Phenobarbital
 - Phenytoin
 - Rifampin

Anticholinergic

- Adjunctive bronchodilator, may be useful in patients who only partially respond to beta2-agonists
- Preparations
 - Ipratropium bromide MDI or ampule for nebulization

Duration of therapy

- Anti-inflammatory agents
 - Use every day
 - May be decreased in patients as asthma comes under long-standing control
- Bronchodilators
 - Should be used as needed

EDUCATION/ENVIRONMENTAL CONTROL

- Patient and caregiver education is mandatory.
- Every patient/caregiver should be taught that asthma is a chronic, inflammatory condition that can be controlled with proper therapy.
- All medications should be explained and potential risks (side effects) and benefits reviewed.
- A written asthma management plan should be provided, outlining daily therapy and an action plan or managing exacerbations of asthma.

Prognosis

- With proper therapy and good adherence with treatment regimen: excellent

Follow-up

- When to suspect improvement?
 - In acute asthma attacks, with appropriate therapy, improvement is usually seen within 24 to 48 hours.
 - Long-term control of symptoms can usually be obtained within 2 to 4 weeks



Thank you