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Bronchial Asthma

★ **Objectives:**

- Define asthma and its clinical features
- Have an understanding how to diagnose asthma
- Pathophysiology of asthma
- Basic Management of asthma

★ **Resources Used in This lecture:**

Doctor's note , Davidson, clinical step up,Master the boards, Guaton.

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Asthma[1]

Abnormal bronchoconstriction Characteristically defined by the following triad :

Airway hyper-responsiveness[2], reversible airflow obstruction and Inflammation of the bronchi

Reversible obstruction this is the main difference between Asthma and COPD and it can be known also by given short acting beta agonist as Salbutamol or by History (intermittent symptoms) .

Epidemiology

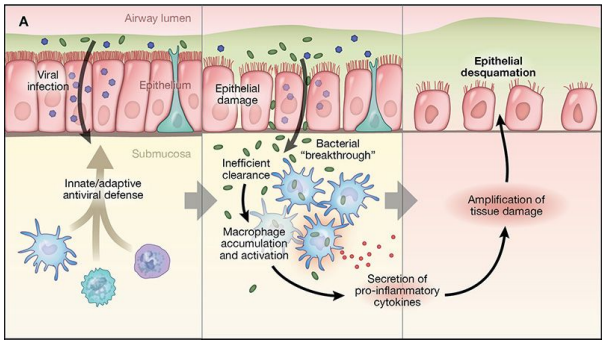
- Common in children but can be at any age.
- High prevalence in female.
- Etiology is unknown.

Pathophysiology

Extrinsic

1- Antigen of a specific allergen that triggers immune system.
2-Large amount of IgE antibodies is formed and mainly attached to mast cells.
3-When asthmatic person breaths in the allergen again it reacts with → mast cells → causing it to release the following substances:

A- Histamine
B- Leukotriene (small reacting substances of anaphylaxis)
C- Eosinophilic chemotactic factor
D-Bradykinin.



4- The combined effect of all these factors **produces:**

- Localized edema in the walls of the small bronchioles, and secretion of thick mucin into the lumin.
- Spasm of the bronchiolar smooth muscle.

So who's susceptible ? Individuals who readily develop immunoglobulin IgE antibodies against environmental antigens.

- intrinsic pathophysiology is unknown.

[1] Greek word for "panting ".
[2] The tendency for airways to narrow excessively in response to triggers that have little or no effect in normal individuals.

Classification

Extrinsic asthma (most common)

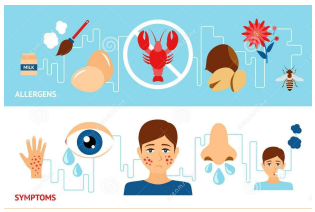
- Patients are atopic caused by environmental antigen (allergens) such as dust mite and cockroaches → produce high immunoglobulin E (IgE).
- Early onset in patients <12 years old .
- Triggers include: **Allergens** (pollens, dust, cockroaches,cats), cold air,viral infection (most common in elderly) tobacco smoke, medication (aspirin,NSAID,B-blockers), GERD, emotional stress and exercise.

Intrinsic asthma

Non-atopic individuals , not related to environmental triggers

Aspirin-sensitive asthma : characterized by asthma , chronic rhinosinusitis, and nasal polyposis.

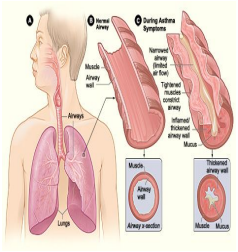
Clinical Presentation



- Recurrent episodes of Shortness of breath.
- Wheezing in both inspiration and expiration.
- Chest tightness and Cough.
- Eczema or atopic dermatitis (on extrinsic)
- Hay fever (on extrinsic)
- Increase use of accessory muscles.

Symptoms usually occur after 30 minutes of exposure to triggers and they have variable severity.

Diagnostic Tests



Initial test

- **Peak expiratory flow rate(self monitoring test)** it will be decrease.
- **Arterial blood gases** : Typically shows 1-Resp. Alkalosis 2-Hypocapnia 3-⬇PCO2 4- hypoxemia may be present.
- **Chest x-ray :** usually normal but can shows hyperinflation

Remember Best initial test is ABG or PEF .
Then use CXR to exclude Pneumothorax and pneumonia.

Conformity test

- **Pulmonary function tests (Spirometry):** *Most accurate test
  - **Before Bronchodilation (albuterol):** shows decrease in expiratory flow , FEV , FVC and FEV/ FVC
  - **After Bronchodilation(albuterol) :** shows Increase at least 12% FEV
- **Bronchoprovocation test:** *Most accurate test if the patient asymptomatic
  - Give the patient methacholine (muscarinic agent) or histamine shows decrease of FEV at least 20 %.

Management

Add more types of treatment as it progressive and there is no response.

Step 1: → **Mild asthma**(<2 times/week and minimal night symptoms)

- **Inhaled short acting B2 agonist (SABA)** as needed.

Such as: albuterol (most common), pirbuterol or levalbuterol.

Step 2: → **Moderate asthma** *Most common (symptoms most of the week, daily night symptoms)

SABA + long term agent usually low dose **Inhaled corticosteroids (ICS)**

Note: Alternate ICS agents include: Leukotriene modifiers as montelukast, Or Cromolyn (nedocromil) Or theophylline.

→ Next steps considered Severe asthma (Symptoms despite the treatment or hospitalization)

Step 3: Add long acting B2 agonists (LABA) such as salmeterol or formoterol to low dose ICS and SABA.

Step 4: Increase the dose of ICS to maximum in addition to LABA and SABA.

Step 5: Add anti-IgE such as omalizumab to LABG , ICS AND SABA.

Step 6: Add oral corticosteroids such prednisone.

- Adverse effect of ICS dysphonia and oral candidiasis (thrush).
- Leukotriene can be given with oral steroid to minimise the dose → minimise side effects.
- Cromolyn rarely adult usually but can be given to prevent exercise induced asthma, usually given in: children to avoid the use systemic steroids → to minimise side effects.

- **LABA** usually given if patient have.
  1- **Nocturnal asthma** → long duration to minimise sleep awaken.
  2- **People who are annoyed through the day from symptoms** (ex: teacher, in tv)
- **Systemic effects of corticosteroids :** osteoporosis , cataracts, adrenal suppression,fat redistribution,hyperlipidemia ,acne ,hirsutism, thinning of skin,striae,easy bruising.

Complications

1- Status asthmatics (does not respond to standard medication)

2-Acute respiratory failure.(due to resp. muscle fatigue)

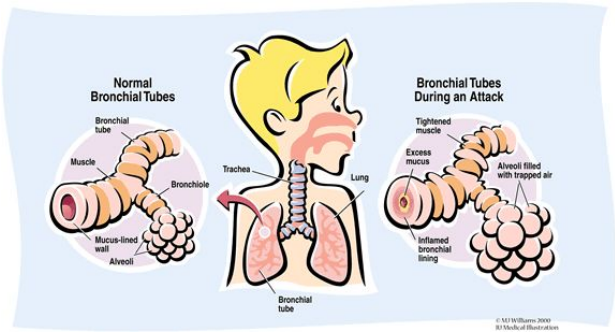
3- Pneumothorax, atelectasis, pneumomediastinum.

Catecholamines (epinephrine) and aminophylline ,theophylline not usually used → used in status asthmaticus.

Acute exacerbation of asthma

Present to the emergency department, usually with SOB & productive cough.

Diagnostic Tests



1- PEF → decreased (not done when patient has acutely shortness of breath)

2- ABG (increase A-a gradient[3])

3- Chest X-ray (because the most common cause of acute exacerbation is pneumonia).

- **IF ABG showed :** Hypoxemia -Resp.Acidosis - hypercapnia ↑ PCo2 → then this patient must be admitted in the intensive care and monitored as a severe case of Asthma. (this is sign of muscle fatigue and body can't compensate SOB)
- To assess the severity in acute cases, simply observe the respiratory rate.

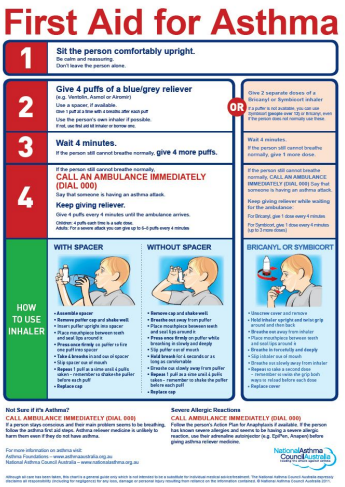
Treatment

1-Oxygen

2-Inhaled B2 agonist via nebulizer or MDI[4]→ Albuterol *First line therapy

3-Steroids I.V initially or orally.

★ If still not responding to the above therapy. Third line agent includes IV magnesium → helps with bronchospasm in acute cases.



Note : If the patient did not respond to previous treatment or developed respiratory acidosis,They have to undergo **endotracheal intubation** for mechanical ventilation and must be kept in intensive care.

Drugs not effective in Acute exacerbation :

Theophylline , Cromolyn ,Leukotriene modifiers ,Omalizumab , Salmeterol

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[3] 1. Diffusion defect (rare)
2. V/Q mismatch
3. Right-to-Left shunt (intrapulmonary or cardiac)
4. Increased O2 extraction (CaO2-CvO2)

[4] Metered-dose inhaler

MCQ's

1/ A 15-year-old boy comes to the office because of occasional shortness of breath every few weeks. Currently he feels well. He uses no medications and denies any other medical problems. Physical examination reveals a pulse of 70 and a respira- tory rate of 12 per minute. Chest examination is normal.Which of the following is the single most accurate diagnostic test at this time?

a. Peak expiratory flow
b. Increase in FEV1 with albuterol
c. Diffusion capacity of carbon monoxide
d. >20% decrease in FEV1 with use of methacholine

2/A 47-year-old man with a history of asthma comes to the emergency department with several days of increasing shortness of breath, cough, and sputum produc- tion . On physical examination his respiratory rate is 34 per minute. He has diffuse expiratory wheezing and a prolonged expiratory phase. Which of the following would you use as the best indication of the severity of his asthma?

a. Respiratory rate
b. Use of accessory muscles
c. Pulse oximetry
d. Pulmonary function testing e. Pulse rate

3/ A 30-year-old athlete with asthma is also a cigarette smoker. Which of the following is characteristic of asthma but not other obstructive lung disease?

a. Hyperinflation is present on chest x-ray
b.Airway obstruction is reversible
c.Hypoxia occurs as a consequence of ventilation-perfusion mismatch
d.The FEV1/FVC ratio is reduced

4/ A 60-year-old male has had a chronic cough for over 5 years with clear sputum production. He has smoked one pack of cigarettes per day for 20 years and continues to do so. X-ray of the chest shows hyperinflation without infiltrates. Arterial blood gases show a pH of 7.38, PCO2 of 40 mmHg, and PO2 of 65 mmHg. Spirometry shows an FEV1/FVC of 65%. Which of the following is the most important treatment modality for this patient?

a.Oral corticosteroids
b.Home oxygen
c.Broad-spectrum antibiotics
d.Smoking cessation program

ANSWERS: 1-D 2-A 3-B 4-D