Asthma: Overview

- Chronic inflammatory disease of the airway
- More than 70% also have allergies
- Prevalence has increased by almost 40% in all ages in the past decade.
- Typically develops in childhood—50% before 3 years of age, and the majority before 8 years of age.
- 470,000 hospitalizations per year
Peak flow metering
Pathogenesis

- Airway inflammation also contributes to airflow limitation, which includes:
  - Bronchoconstriction
  - Edema
  - Chronic mucus plugging
  - Airway wall remodeling
- All this leads to **bronchial obstruction**
ASTHMA

• Four categories of asthma severity:

  – Intermittent
  – Mild persistent
  – Moderate persistent
  – Severe persistent
Classifying of asthma and initiating treatment

- **Intermittent Asthma**
  - ≤ 2 days/week
  - <2 nights/mo
  - FEV₁/FVC: >85%
  - No activity limit.
  - SABA PRN

- **Mild Persistent Asthma**
  - >2 days/week (3-6 d/w)
  - >2 night/mo (3-4 nights)
  - FEV₁/FVC: >80%
  - Minor activity limit.
  - Low dose of ICS

- **Moderate Persistent Asthma**
  - Daily symptoms
  - > 1 night per week
  - FEV₁ 60-80%
  - FEV₁/FVC 75-80%
  - Some activity limit.
  - Medium dose ICS
  - Consider-short course OCS

- **Severe Persistent Asthma**
  - Throughoug (days)
  - Often (nights)
  - FEV₁<60%
  - FEV₁/FVC <75%
  - Activity Extre. Limit.
  - Same as step 3
  - Medium dose ICS+LABA and Cons.
  - Short course OCS
Pulmonary Function Testing

- Determines
- Degree of airway obstruction
- Other lung disorders
Normal Trace Showing FEV$_1$ and FVC

- FEV$_1$ = 4L
- FVC = 5L
- FEV$_1$/FVC = 0.8
Spirometry

- FVC
- FEV₁

Volume (I)

Time (s)

Normal
Asthma
COPD
A 7 year-old boy who had asthma since 2 years, presents with increasingly frequent cough, his symptoms occurs daily, they get worse when playing football, they wake him up at night 3-4 times per week.

What is the best description of the severity of his asthma?

- A. Intermittent
- B. Mild persistent
- C. Moderate persistent
- D. Sever persistent
- E. Asthma variant
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ASTHMA

• Risk factors
  – Parental history of asthma
  – Atopic dermatitis
  – Sensitization to aeroallergens
  – Sensitization to foods
  – More than 4% eosinophilia
ASTHMA

• Triggers
  – Respiratory viral infections (most common trigger)
  – Allergens, airway irritants (e.g., smoking and air pollution)
  – Exercise

• Medications
  • Nonsteroidal anti-inflammatory medications
  • Beta blockers
ASTHMA

• Infants and young children suffering a severe episode of asthma may present with:
  – Breathless during rest
  – Not interested in feeding
  – Sit upright
  – If able to talk uses word not sentence
  – Usually agitated
ASTHMA

- Clinical Presentation
  - Wheezing
    - A musical, high-pitched whistling sound produced by airflow turbulence
  - Cough
    - Usually nonproductive and nonparoxysmal
    - Coughing may be present with or without wheezing
  - Cough at night or with exercise
ASTHMA

- Clinical Presentation
  - Chest tightness
    - Chest tightness or pain with or without cough or wheezing
  - Shortness of breath
  - Sputum production
ASTHMA

• Physical Examination
  – Tachypnea
  – Tachycardia
  – Accessory muscles of respiration are usually used
  – Wheezing can be heard
  – Pulsus paradoxus is often present (20-40 mm Hg)
  – Oxyhemoglobin saturation with room air is less than 91%
Status asthmaticus

- Respiratory distress
  - Paradoxical thoraco-abdominal movement occurs

- Severe airway obstruction
  - Wheezing may be absent

- Bradycardia
  - Severe hypoxemia

- Pulsus paradoxus may disappear:
  - Suggests respiratory muscle fatigue and impending failure
Status asthmaticus

- Confusion
  - Child may become worse, drowsy and confused

- Adolescents
  - May not have these symptoms until they are in frank respiratory failure.
Status asthmaticus

- Signs of impending respiratory failure
  - Tachypnea
  - Retractions
  - Dysspnea
  - Pulsus paradoxus > 20mmHg
  - Normal or rising CO2 on ABG in presence of tachypnea
  - Anxiety
  - Tachycardia or bradycardia in severe hypoxemia
  - Drowsiness and confusion
Status asthmaticus

- Management of status asthmaticus
  - Oxygen monitoring and therapy
  - Hydration
  - Beta 2 agonist (albuterol)
  - Ipratropium
  - IV Steroids
  - Nebulized steroids
  - Magnesium sulfate
Acute Asthma Exacerbation

- Clinical Presentation
  - Dyspnea at rest
  - Peak flow <40%
  - Retractions
  - Failure to respond to initial treatment
Acute Asthma Exacerbation

- Management
  - Beta 2 agonist (albuterol)
  - Inhaled anticholinergic (Ipratropium)
  - Oxygen (to most of the patient)
  - Systemic steroids (early in the treatment)
  - Home administration of SABA and oral steroids 3-10 days course
  - No antibiotic for atelectasis
ASTHMA

• Diagnosis
  – Pulmonary function tests:
    • Spirometry: obstructive pattern with response to bronchodilators
  – Exercise challenge
    • Treadmill or Bicycle
    • Baseline spirometry followed by exercise
    • Repeat spirometry documenting drop in airflow rates
ASTHMA

- Diagnosis
  - Radiography
    - May reveals hyperinflation
    - Increased bronchial markings
    - Evidence of parenchymal disease
    - Atelectasis
    - Pneumonia
    - Congenital anomalies
    - Foreign body
ASTHMA

• Allergy testing:
  – Can identify allergic factors that may significantly contribute to asthma
    • Skin testing
    • In Vitro Allergy testing
      – ELISA
Exercise-Induced Asthma

- Poorly controlled asthma may worsen with exercise
- Asthma with exercise can be the only presentation
- Symptoms may start during or after exercise
- Symptoms may last 90 minutes or longer
Exercise-Induced Asthma

Management

- Warm up exercise before vigorous exercise
- Premedication 15 minutes before exercise with a SABA is typical the first line
- ICSs or leukotriene inhibitor (montelukast)
  - if premedication is not sufficient to alleviate asthma symptoms
  - If the patients needs it more than once per day
ASTHMA

• Management of Asthma
  – Assessment and monitoring
  – Self-management education
  – Medication use and adherence
  – Control of environmental factors and comorbid conditions
ASTHMA MEDICATIONS

- **β₂-AGONISTS**
  - Relieve the constriction by relaxation of smooth muscles
  - Frequent use of β₂-agonists indicates poor asthma control
  - SABAs e.g: albuterol
    - Onset of action within 15 minutes
    - Duration of action approximately 3-4 hours
ASTHMA MEDICATIONS

- $\beta_2$-AGONISTS
  - LABAs e.g.: salmeterol, formoterol
    - Effect can last up to 12 hours
  - Use of LABAs alone is not recommended
    - Put the patient at risk for sudden death
    - Can cause life threatening asthma exacerbation
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ASTHMA MEDICATIONS

• $\beta_2$-AGONISTS
  – Potential Adverse effects
    – Agitation, irritability, tremors
    – Insomnia
    – Tachycardia, arrhythmia
    – Hypokalemia
    – Patients with diabetes mellitus are at risk of hypoglycemia
Inhaled corticosteroids are standard of care for all categories except for mild intermittent asthma

- Long term prevention of symptoms; suppression, control and reversal of inflammation.
- Block late reaction to allergen
- Reduce airway hyperresponsiveness
- Inhibit inflammatory cell migration and activation
- Increase B2 receptor affinity
INHALED CORTICOSTEROIDS

- Inhaled corticosteroids
  - The most commonly prescribed maintenance therapy for asthma
  - They effectively decrease airway inflammation
  - Decrease bronchial hypersensitivity
  - Relieve asthma symptoms
  - Improve lung function
Inhaled Steroids

- Budesonide (Pulmicort®)
- Fluticasone propionate (Flovent®)
- Mometasone (Asmanex®)
- Beclomethsasone (Qvar®)
- Ciclesonide (Alvesco®)
- Flunisolide (Aerospan®)
- Fluticasone furoate (Arnuity Ellipta®)
Combination Therapy

- Fluticasone + Salmeterol (Advair®)
- Budesonide + Formoterol (Symbicort®)
- Mometasone + Formoterol (Dulera®)
- Fluticasone + Salmeterol (AirDuo Respliclick®)
INHALED CORTICOSTEROIDS

• Adverse effects
  – High dose of ICS
    • Slowing growth (they catch up during growth spurt)
  – Oral thrush
    • Rinse the mouth after taking the medication
    • Using spacer may help
  – Osteoporosis
    • Using high dose ICS or oral steroids
    • Exercise, adequate Ca intake and vitamin D can decrease the risk
LEUKOTRIENE ANTAGONISTS

- E.g.: montelukast or Singulair
  - Block inflammatory pathways that are active in the disease
  - It is usually well tolerated
  - Frequently used as add-on therapy in addition to ICSs
  - May benefit
    - Allergic rhinitis
    - Recurrent viral-induced asthma exacerbation
    - Exercise-induced asthma
ASTHMA

• Children at significant risk of having asthma symptoms later in life
  • <3 years of age
  • 3 or more episode of wheezing per year
  • Eczema or parental eczema
  • Allergic rhinitis
  • Wheezing unrelated to colds
  • Blood eosinophil count >4%
Medication Delivery Devices

- Meter Dose Inhaler (MDI)
- HFA
- Jet Nebulizer
- Dry powder inhaler (DPI)
- Aerochamber

Albuterol 4 puffs by MDI=2.5mg nebulized