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PHARMACOLOGY - III

UNIT 1

TOPIC :

- **Pharmacology of drugs acting on Respiratory system**
 - a. Anti-asthmatic drugs



Pharmacology of drugs acting on Respiratory system

ANTI-ASTHMATIC DRUGS

Anti-asthmatic drugs are used in the **management of asthma**, a chronic inflammatory airway disease characterized by:

- Bronchoconstriction
- Airway inflammation
- Mucus hypersecretion

Therapeutic Goals

- Rapid relief of symptoms
- Prevention of chronic inflammation
- Reduction in frequency and severity of attacks

Classification

A. Bronchodilators (Relievers)

- β_2 -agonists
- Methylxanthines
- Anticholinergics

B. Anti-inflammatory (Controllers)

- Corticosteroids
- Leukotriene modifiers
- Mast cell stabilizers

C. Targeted Biological Therapy

- Anti-IgE, Anti-IL drugs

A. Bronchodilators

β_2 -Adrenergic Agonists

Examples

- **SABA:** Salbutamol, Terbutaline
- **LABA:** Salmeterol, Formoterol

Mechanism of Action

- Stimulate β_2 -receptors on bronchial smooth muscle
- Activate adenyl cyclase $\rightarrow \uparrow$ cAMP
- Leads to:
 - Bronchodilation
 - Inhibition of mediator release
 - Improved mucociliary clearance

Pharmacological Actions

- Relax bronchial smooth muscle
- Reduce airway resistance
- Improve airflow

Pharmacokinetics

- Administered via inhalation (preferred)
- Rapid onset (SABA: 5–15 min)
- Duration:
 - SABA: 4–6 hours
 - LABA: 12 hours

Therapeutic Uses

- Acute asthma attack (SABA)
- Exercise-induced asthma
- Maintenance therapy (LABA + ICS)

Adverse Effects

- Tremors (due to β_2 stimulation in skeletal muscle)
- Tachycardia (β_1 spillover effect)
- Hypokalemia
- Nervousness

Methylxanthines

Examples

- Theophylline
- Aminophylline

Mechanism of Action

- Inhibit phosphodiesterase $\rightarrow \uparrow$ cAMP
- Block adenosine receptors
- Mild anti-inflammatory effect

Pharmacological Effects

- Bronchodilation
- CNS stimulation
- Increased diaphragmatic contraction

Pharmacokinetics

- Oral or IV
- Narrow therapeutic index
- Metabolized in liver (CYP450)

Adverse Effects

- Nausea, vomiting
- Insomnia
- Arrhythmias (serious toxicity)
- Seizures (high dose)

Limitations

- Requires plasma level monitoring
- Drug interactions common

Anticholinergic Drugs

Examples

- Ipratropium bromide
- Tiotropium

Mechanism

- Block M₃ muscarinic receptors
- Prevent acetylcholine-induced bronchoconstriction

Pharmacological Effects

- Bronchodilation
- Reduced mucus secretion

Uses

- COPD (first-line)
- Add-on therapy in asthma

Adverse Effects

- Dry mouth
- Blurred vision
- Throat irritation

B. Anti-inflammatory Drugs

Corticosteroids

Examples

- **Inhaled:** Beclomethasone, Budesonide, Fluticasone
- **Systemic:** Prednisolone, Hydrocortisone

Mechanism of Action

- Inhibit phospholipase A₂ → ↓ arachidonic acid pathway
- Reduce:
 - Prostaglandins
 - Leukotrienes
- Suppress inflammatory cytokines

Pharmacological Effects

- Decrease airway inflammation
- Reduce edema
- Decrease mucus secretion
- Increase β_2 receptor sensitivity

Uses

- First-line for persistent asthma
- Severe acute asthma (systemic steroids)

Adverse Effects

Inhaled:

- Oral candidiasis
- Hoarseness

Systemic:

- Osteoporosis
- Hyperglycemia
- Immunosuppression
- Adrenal suppression

Leukotriene Modifiers

Examples

- Montelukast
- Zafirlukast
- Zileuton

Mechanism

- Block leukotriene receptors OR inhibit synthesis

Effects

- Reduce bronchoconstriction
- Decrease inflammation
- Reduce mucus secretion

Uses

- Mild to moderate asthma
- Aspirin-induced asthma
- Exercise-induced asthma

Advantages

- Oral route
- Safe in children

Adverse Effects

- Headache
- Liver toxicity (Zileuton)

Mast Cell Stabilizers

Examples

- Cromolyn sodium
- Nedocromil

Mechanism

- Stabilize mast cells → prevent mediator release

Uses

- Prophylaxis of asthma
- Allergic asthma

Limitations

- No role in acute attack

Adverse Effects

- Throat irritation
- Cough

C. Biological Agents (Advanced Therapy)

Examples

- Omalizumab (Anti-IgE)
- Mepolizumab (Anti-IL-5)

Mechanism

- Target specific immune pathways
- Reduce allergic and eosinophilic inflammation

Uses

- Severe persistent asthma
- Not controlled by conventional therapy

Administration

- Subcutaneous injection

Adverse Effects

- Injection site reactions
- Rare anaphylaxis