**Pharmacology**

**Lecture 1 (Anticholinergic)**

|  |  |  |  |
| --- | --- | --- | --- |
| Muscarinic Antagonists | Drug | Uses/Effects | |
| **Natural alkaloids** | Atropine (protype) | 1. CVS: **Tachycardia**, ↓ vasodilation, ↑ AV conduction . /Toxic dose: Cutaneous vasodilatation (**atropine flush**) 2. CNS: Depressor, Antiemetic effect, Anti-parkinsonian effect . /Toxic dose: Hyperthermia, excitement, hallucination. 3. UT: Urinary retention. 4. Respiratory system: **Bronchodilator**, ↑ viscosity. 5. Eye: Mydriasis, Cycloplegia, ↑ IOP, Loss of light reflex, sandy eye. 6. Glands: ↓ Secretion → Dry mouth, sandy eye, fever. 7. GIT: **constriction**, **paralytic ileus.**   **Uses: Pre-anesthetic medication Antispasmodic.** | |
| Hyoscine | Same as Atropine, only difference:   * **Short** duration of action. * **Less** CVS effects. * **More** CNS depressant. * **More** antiemetic (Used in **motion sickness**) * Can produce amnesia.   **Uses: Pre-anesthetic medication, motion sickness, antispasmodic.** | |
| **Synthetic atropine substitute** | Benztropine | CNS | Parkinson’s disease |
| Homatropine | Eye | Fundus examination of eye |
| Tropicamide |
| Ipratropium | RS | Asthma, COPD, (By inhalation to reduce side effects) |
| Pirenzepine | Stomach | Peptic ulcer |
| Glycopyrrolate | GIT | Antispasmodics in hypermotility |
| Oxybutynin | UT | Urinary urgency, Urinary incontinence |

**Lecture 3 (COPD)**

|  |  |  |  |
| --- | --- | --- | --- |
| Drugs used in chronic obstructive pulmonary disease (COPD) | | | |
| What is it:  a chronic irreversible  Obstruction, lung damage and inflammation of the air sacs (alveoli). | **Risk factor: Smoking** + pollution & genetic factors. | **Treatment:**   * Inhaled **bronchodilators** * Inhaled **glucocorticoids** * Oxygen therapy * **Antibiotics** specifically macrolides such as azithromycin to reduce the number of exacerbations. * Lung transplantation. | **Inhaled bronchodilators in COPD:**  **Inhaled antimuscarinics**   * Ipratropium & tiotropium. * are superior to β2 agonists in COPD   **β2 agonists**  these drugs can be used either alone or combined  **Salbutamol** + **Ipratropium**  **Salmeterol** + **Tiotropium** (long acting-less dose frequency). |

**Lecture 2 (Asthma)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Class | | | Drug | | Function | | | | | | | | | | |
| 1) Quick relief medications: (Bronchodilators) = to relieve acute episodic attacks of asthma. | | | | | | | | | | | | | | | |
| Short acting  2-agonists |  | | | epinephrine  Non-selective | **Uses:** *acute anaphylaxis.* **(hypersensitivity reactions) (Drug of choice). ←** epinephrine.  **ADRS:** Hyperglycemia/Not effective orally/tremor/**CNS** (tachycardia, arrhythmia, hypertension).  **Contraindications**: CVS patients, diabetic patients. | | | | | | | | | **Mechanism:**  Stimulate ***adenyl cyclase***  • ↑ mucus clearance.  • Stabilize Mast cell. | |
| isoprenaline |
| Selective | | | Salbutamol (albuterol) | **inhalation**, orally, **i.v.** | | | | **Used for:** *acute attack of asthma* (**Drugs of choice**). | | | | **Advantages:**  Minimal CVS side effects, suitable for patients with CV disorders.  **ADRS:** Tremors, nervousness, tolerance. Tachycardia (**Overdose**). | | |
| Terbutaline | **inhalation**, orally, **s.c.** | | | |
| Muscarinic antagonists  Less effective than β2-agonists | | | | Ipratropium | Short duration | | | Given by aerosol **inhalation**.  **Quaternary derivatives** of atropine (**polar**).  Minimal systemic side effects.  **Uses**: Main choice in **COPD**  In acute severe asthma combined with β2 agonists & corticosteroids. / Never use as a rescue medication. | | | | | | | |
| Tiotropium | Longer duration | | |
| Methylxanthines | | | | Theophylline | orally | **Mechanism:**  Phosphodiestrase inhibitors.  • Block adenosine receptors (A1).  • Stabilize Mast cell membrane.  • ↑ diaphragmatic contraction. | | | | **Pharmacokinetic:**  Metabolized by **Cyt P450** enzymes in liver.  T ½= 8 hr.  **drug interactions:**  (with theophylline)  **Enzyme inducers:**  Phenobarbitone & rifampicin  ↑ Metabolism/↓T ½.  **Enzyme inhibitors:**  Erythromycin  ↓ Metabolism/↑T ½. | | | | **Uses:**  •Second line drug in asthma (theophylline).  •Status asthmatics (aminophylline).  **ADRS:**  Low therapeutic index.  **GIT:** nausea & vomiting  **CVS:** hypotension, arrhythmia.  **CNS:** tremors, nervousness, insomnia, convulsion (overdose) | |
| aminophylline | slow infusion |
| **Pharmacologic effects:**  **GIT:** ↑ secretions.  **Kidney:** ↑renal blood flow, weak diuretic action | | | | | | | | | |
| 2) Prophylactic therapy: (Anti-inflammatory Agents) = Not effective in acute attack of asthma. | | | | | | | | | | | | | | | |
| Glucocorticoids  (Immunosuppressant effects) | | | | **Mechanism:**  Inhibition of **phospholipase A2** (Anti-inflammatory action)  **Upregulate β2 receptors.** | **Uses:** Inflammatory & autoimmune disorders, Antiemetics, prophylactic medications, **Systemic corticosteroids** for Status asthmaticus (IV) | | | | | | **Metabolic effects:** Hyperglycemia, Stimulation of lipolysis.  ↑protein catabolism, ↓protein anabolism.  **Mineralocorticoid effects: hypertension**, **hypokalemia**, sodium-fluid retention.  **Depression** **/ Osteoporosis.** | | | | |
| **Inhalation**: Budesonide & Fluticasone, beclomethasone. (Best choice)  Orally**:** Prednisone, methyl prednisolone.  Injection: Hydrocortisone, dexamethasone. | | | | | | | **Systemic ADRS:** Adrenal suppression. **/**Psychosis. **/**Fat distribution. **/**Growth retardation in children. **/**Cataract. **/**Susceptibility to infections. **/**Fluid retention, weight gain, hypertension. | | | |
| Leukotrienes antagonists | | | | zafirlukast | Selective, reversible antagonists of cysteinyl leukotriene receptors (CysLT1receptors)  Are bronchodilators. / Have anti-inflammatory action. / Taken orally.  **Uses:** Prophylaxis of mild to moderate asthma. / Aspirin-induced asthma. / Antigen and exercise-induced asthma. **Side effects:** Elevation of liver enzymes, headache, dyspepsia | | | | | | | | | | |
| montelukast |
| pranlukast |
| Mast cell stabilizers | | | | Cromoglycate | **Side effects:** Bitter taste, minor upper R.T. irritation.  **Uses:** Prophylactic therapy, allergic rhinitis, conjunctivitis. | | | | | | | | | | By **inhalation** / poor oral absorption (10%) |
| Nedocromil |
| Anti-IgE monoclonal antibody | | | | Omalizumab | A monoclonal antibody directed against human IgE – prevents IgE binding with its receptors on mast cells & basophiles. / ↓ release of allergic mediators. / Given by injection (s.c.)/ Expensive-not first line therapy. **Side effects: Bitter taste**, minor **irritation.**  **Used for:** moderate to severe allergic asthma which doesn’t respond to corticosteroids. | | | | | | | | | | |
| Long acting  2-agonists | |  | | Salmeterol  Selective | by **inhalation** | | Long acting bronchodilators (12 hr).  **Used for:** nocturnal asthma.  Combined with: inhaled corticosteroids. | | | | | | **Advantages:**  Minimal CVS side effects, suitable for patients with CV disorders.  **ADRS:** Tremors, nervousness, tolerance. Tachycardia (**Overdose**). | | |
| Formoterol |

**Lecture 4 (Anaphylaxis)**

|  |  |
| --- | --- |
| Drug | Function |
| 1st line therapy | |
| Adrenaline - IM or IV | A Sympathomimetic, nonselective. (DRUG OF CHOICE FOR ANAPHYLAXIS)  **Contraindications**: > 40 y cardiac patient / **ADRS:** Dysrhythmias. |
| 2nd line therapy | |
| CORTICOSTEROIDS (can’t be used alone, not lifesaving) | |
| Hydrocortisone - IM or IV | Reverse hypotension & bronchoconstriction by decrease release of inflammatory mediators. Also decrease mucosal swelling and skin reaction.  May help to limit biphasic reactions by decreasing allergic mediators. |
| H1 Blockers (can’t be used alone, not lifesaving) | |
| Chlorophenamine - IM or IV | Can help to counter act histamine-mediated vasodilation & bronchoconstriction.  May help to limit biphasic reactions by 🠋 more histamine release. |
| Phenaramine - IM or IV |
| Adjuvant to 2nd line | |
| Bronchodilators | |
| Salbutamol - nebulizer | 2-AD agonist, short acting, rapid relief.  May also inhibit airway microvascular leakage. |
| Ipratropium - nebulizer | Anticholinergic 🠊longer duration of action 🠊 🠋 secretion. Less rapid in action**.** |
| Aminophylline - IV | Treatment of anaphylaxis when inhaled Broncho-dilators are not effective & bronchospasm is persistent. **Given in hospital setting as levels of drug should be** Therapeutically Monitored **(**has narrow therapeutic index) |
| Glucagon | |
| Glucagon - 1 mg IV q 5 min | for severe anaphylaxis **in patients taking b-blockers** |
| H2 Blockers  (significance of them is not established , they are associated with serious adverse drug interactions) | |
| Ranitidine - 50 mg IV |  |
| cimetidine | **Contraindications**: elderly, renal/hepatic failure, or if on b-blockers. |

**Lecture 5 (adrenergic drugs)**

|  |  |  |  |
| --- | --- | --- | --- |
| Drug | | Receptor | Function |
| Direct / Catecholamine / Non-selective | | | |
| Adrenaline | | *≥ α* | **Uses: 1)** Status asthmatics (S.C./Inhalation). **2)** Allergic reactions (S.C.) **3)** Cardiac arrest (IV) **4)** local hemostatic. **5)** Local anesthetics.  **Administration:** parenteral & by inhalation. |
| Noradrenaline | | *α >* | Sever vasoconstriction (α1), Reflex bradycardia, 🠝 force of contraction but 🠋 H.R.  **Administration:** IV  **Uses: Hypertensive state**, **local hemostatic**. |
| Isoprenaline | | *β > α* | **Uses:** Mainly **cardiac arrest** (Parenteral)**, acute asthma** (Inhalation) |
| Dopamine | | *> >* | Has diuretic action /**Admin.:** parentally by infusion.  **Uses:** Treatment of shock. |
| Dobutamine | | *> >* | **Uses: 1)** Acute heart failure. **2)** Cardiac decompensation. / **Admin.:** IV |
| Direct / Non-ctecholamine / Selective | | | |
| Midodrine &  Phenylephrine | |  | **Admin.:** Orally / **ADRS:** Hypertension.  **Uses: 1)Hypotension**, tachycardia. **2)**Local Hemostatic. **3)**Mydriasis. **4)**Decongestant. |
| Clonidine | |  | Is an imidazoline. **Admin.:** Orally or as patch / **Uses: Hypotension** |
| Brimonidine | |  | Is an imidazoline. / **Uses:** Glaucoma |
| Salbutamol | |  | **Admin.:** Orally, by inhalation or parenteral **Uses:** Asthma and COPD. |
| Terbutaline | |  | **Uses:** Bronchodilator, **Tocolytic** |
| Ritodrine | |  | **Admin.:** Orally, or by injection. / **Uses: Tocolytic** for premature labor |
| Indirect / Non-ctecholamine / Non-selective | | | |
| Amphetamine | Abused in sports. / **Admin.:** Orally. / **ADRS:** Tachyphylaxis, euphoria, weight loss. **CNS slide effects.** | | |
| Dual / Non-ctecholamine / Non-selective | | | |
| Ephedrine | | Abused in sports. / **Admin.:** Orally. / **ADRS:** Tachyphylaxis, urine retention. | |
| Direct / Nasal & Ocular decongestant | | | |
| Phenylephrine | | **Uses:** treatment for nasal stuffiness / **ADRS:** Can cause nasal rebound. | |
| Methoxamine | |
| Nephazoline | |
| Oxymetazoline | |
|  | |
| Dual / Nasal & Ocular decongestant | | | |
| Pseudoephedrine | | CNS & pressor effects compared to ephedrine / works the same as “Nasal & Ocular Decongestants” & for **flu** | |

**Lecture 6 (respiratory tract infection)**

\*Root of administration: PO = orally

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Drug | Pharmacokinetics | | Uses | ADRS |
| Cell wall synthesis inhibitors (through inhibition of peptidoglycan layer of the cell wall.) | | | | |
| β-lactam antibiotics Penicillins (Bactericidal) | | | | |
| Amoxicillin | **Clavulanic acid** | Orally or parenterally / Not metabolized in human. /Excreted mostly unchanged in urine / Relatively polar. | **URTI’s**, **Acute otitis media** (especially produced by Group A gram + β-haemolytic streptococci).  **LRTI’s.** | Hypersensitivity.  Diarrhea / Nephritis  Superinfections.  Convulsions (after high IV dose or in renal failure). |
| Ampicillin | **Sulbactam** |
| Piperacillin | **Tazobactam** |
| β-lactam antibiotics Cephalosporins (Bactericidal) | | | | |
| Cephalexin-PO | 1st Generation / Manly against **gram + bacteria.** | | URTI’s | * Hypersensitivity reactions. * Thrombophlebitis. * Superinfections. * Diarrhea. |
| Cefuroxime axetil-PO | 2nd Generation / mainly against **Gram - bacteria.**  Active against β-lactamase –producing bacteria. | | * URTI’s * LRTI’s * Sinusitis * Otitis media |
| Cefaclor-PO |
| Ceftriaxone-IV | 3rd Generation / Manly against **Gram - bacilli.**  Penetration into CSF / Excreted mostly in urine  Long Half-life(4-7h) (Ceftriaxone) | | **Pneumonia** produced by β-lactamase bacteria. |
| Cefotaxime-IV |
| Cefixime-PO |
| Protein synthesis inhibitors (by binding to 50S subunit of the bacterial ribosomes) | | | | |
| Macrolides Cephalosporins (Bacteriostatic) (Bactericidal at high concentration) | | | | |
| Erythromycin | --- | | **Chlamydial** pneumonia  Legionella pneumonia | Hypersensitivity Reactions |
| Azithromycin | Mainly against **Gram – bacteria** / **Inactive** metabolite  **No effect** on cytochrome P450 system | |
| Clarithromycin | Manly against **gram + bacteria** / **Active** metabolite  **Inhibits** cytochrome P450 system. | |
| DNA synthesis inhibitors (Inhibit DNA Gyrase enzyme (an enzyme involved in DNA supercoiling) ) | | | | |
| Fluoroquinolones | | | | |
| Ciprofloxacin | Given **orally** or **parenterally**. / Excreted mainly in **kidney,**  Concentrates in many tissue (kidney, prostate, lung, bones)  Relatively ↓ T½ allows once daily (**moxifloxacin** & **Gatifloxacin**) & twice-daily (**Ciprofloxacin**).  **Antibacterial spectrum:**  **Ciprofloxacin** mainly effective **Gram - bacteria,**  **Moxifloxacin** & **Gatifloxacin** G – & G + & given once daily  ( highly active against Pseudomonas species )  **Contraindications:**  < 18 years, Pregnancy, Breast feeding. | | Acute exacerbation of **COPD**.  Community acquired pneumonia.  Legionella pneumonia. | Nausea, vomiting, diarrhea.  **CNS effects:**  (Confusion, insomnia, headache, anxiety).  Arthropathy.  **Phototoxicity.** |
| Moxifloxacin |
| Gatifloxacin |

**Lecture 7 (TB)**

|  |  |
| --- | --- |
| Drug | Function |
| 1) First-line treatment | |
| Isoniazid  Taken together with Rifampin for 9 months as treatment. | **Mech.:** 1) Bacteriostatic. 2) Bactericidal. / Inhibit synthesis of cell wall (**Mycolic acid**)  **Site:** Intracellular & extracellular bacilli. / **Use:** **TB**, latent TB, **Prophylaxis** against TB.  **ADRS:** Peripheral neuritis, optic neuritis & atrophy, hepatitis. / **Drug interaction:** *E. inhibition.* |
| Rifampin | **Mech.:** 1) Bactericidal. / Inhibit **RNA synthesis**. / **Use:** Treatment & **Prophylaxis** for **TB**.  **Site:** Intracellular & extracellular bacilli. / **Drug interaction:** *E. inducer.*  **ADRS:** 1) red-orange decolorized secretions. 2) Hepatitis. 3) Flu-like syndrome. 4) Hemolytic anemia. |
| Ethambutol  Taken with Pyrazinamide for the 1st 2 months to shorten the treatment from 9 to 6 months. | **Mech.:** 1) Bacteriostatic. / Inhibit mycobacterial **arabinosyl transferase** disrupting its assembly.  **Site:** Intracellular & extracellular bacilli. / **Use:** **Combined** with other drugs to treatment **TB**.  **ADRS:** 1) Optic neuritis. 2) Red-green color blindness. **Contraindication:** Children under 5 years. |
| Pyrazinamide | **Mech.:** 1) Bacteriostatic. / Unknown. / **ADRS:** 1) Hepatotoxicity. 2) Hyperuricemia. 3) Drug fever & Skin rash.  **Site:** Intracellular bacilli. / **Use:** In **MDR-TB**. & as **Prophylaxis** & to **shorten course** of treatment **TB**. |
| Streptomycin | **Mech.:** 1) Bactericidal. / **Inhibit of protein synthesis** by binding to 30S ribosomal subunits.  **Site:** Extracellular bacilli. / **Use:** **Sever life- threating** form of **TB** as **meningitis, disseminated** disease.  **ADRS:** 1) Ototoxicity. 2) Nephrotoxicity. 3) Neuromuscular black. |
| 2) Second-line treatment | |
| Ethionamide | **Mech.:** Inhibit synthesis of cell wall (**Mycolic acid**). / **ADRS:** 1) Teratogenic. 2) Poorly tolerated. |
| Rifabutin | **Mech.:** RNA inhibitor. Cross-resistance with Rifampin is completed. / **Drug interaction:** *E. inducer.*  **Site:** Intracellular & extracellular bacilli. / **Use:** Prevention & treatment of TB & **atypical** TB.  **ADRS:** 1) GIT intolerance. 2) Orange-red discoloration of body secretions. |
| Para-Aminosalicylic acid (PAS) | **Mech.:** 1) Bacteriostatic. / Inhibit folic acid synthesis.  **ADRS:** 1) GIT upset. 2) Crystalluria. |
| Fluoroquinolones (ciprofloxacin) | **Use:** effective against **MRTB (multidrug- resistant tuberculosis.)** |

**Lecture 8 (Antibiotic)**

|  |  |  |  |
| --- | --- | --- | --- |
| Drug | Info. | Contra. | ADRS |
| Inhibition of cell wall synthesis | | | |
| Penicillins | Bacterial β-lactamase inactivates it  (By cleaving the β-lactam ring of the drug). |  |  |
| penicillin G | Narrow spectrum |  |  |
| Ampicillin | Broad spectrum |  |  |
| Amoxicillin | Broad spectrum |  |  |
| Cephalosporin | Bacterial β-lactamase inactivates it. |  |  |
| Inhibition of protein synthesis | | | |
| Macrolides |  |  |  |
| Tetracyclines |  | Pregnancy and Lactation → | Bone deformity. |
| Chloramphenicol |  | G-6-PD deficiency → | Hemolysis.  **Grey baby Syndrome**  **Plastic anemia.** |
| Aminoglycosides |  | Pregnancy and Lactation → | Hearing loss.  **renal failure** |
| Erythromycin |  |  | **hepatic failure** |
| Inhibition of DNA synthesis | | | |
| Quinolones |  | Children & Pregnancy → | **tendon damage** |
| Inhibition of folate synthesis | | | |
| Sulphonamides |  | G-6-PD deficiency → | Hemolysis. |
| Trimethoprim |  |  |  |
| Inhibition of RNA synthesis (by binding to RNA polymerase) | | | |
| Rifampicin | **Use:** TB |  |  |

**Lecture 9 (rhinitis and cough)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Drugs for rhinitis | | | | | | | |
| Anti-histamines generations | **1st** | **e.g. Chlorpheniramine Diphenhydramine Promethazine (used for Nausea and vomiting)** | short duration, drug interactions, ADRs (sedation) | Clinical uses:  1. Allergic rhinitis: relieves rhinorrhea, sneezing, and itching of eyes and nasal mucosa  2. Common cold  3. Motion sickness.  4. Allergic dermatoses  H1 block actions:  Conjunctivitis, Urticaria, Flu (cough & sneezing)  Itching  Insomnia, Sleep aid, Vertigo, Anxiety, Cough  POOR CONTROL of Asthma, Otitis, Anaphylaxis, Sinusitis, Atopic dermatitis. | Metabolized in the liver  Excretion via kidney  except fexofenadine | ADRs:  Sedation, tinnitus, fatigue, dizziness, blurred vision, dry mouth, CNS effects at overdose | Drugs interaction:  Interact with CNS depressants & cholinesterase inhibitors |
| **2nd** | **Cetirizine**  **Loratadine** | short duration, no drug interaction, minimal ADRs, specific for H1 receptors |
| **3rd** | **Levocetirizine**  **Fexofenadine**  **Desoloratadine** |
| serotonin | appetite | |
| α-adrenergic | Hypotension  Dizziness  Reflex tachycardia | |
| cholinergic | Dry mouth  Urinary retention  Sinus tachycardia | |
|  | |  | **Clinical use** | | **ADRs** | | |
| ANTI-ALLERGICS | | **Mast cell stabilizers:**  **Cromolyn & Nedocromyl** | Used in children for prophylaxis of perennial allergic rhinitis.  \*Should be given on a daily basis and never stop abruptly. | | Induce cough, wheezes, headache, rash | | |
| **Leukotriene receptor Antagonists :**  **Zafirlukast, Montelukast, Pranlukast** | Prophylaxis of lower respiratory tract allergies | | Elevation of liver enzymes, headache, dyspepsia | | |
| topical Corticosteroids | | **beclomethasone, budesonide, & fluticasone** | Given in severe intermittent or moderate persistent symptoms | | Nasal irritation, fungal infection, hoarseness of voice | | |
| Decongestants (α-Adrenergic agonists) | | **Systemic: Pseudoephedrine** | For treatment of nasal stuffiness | | * Nervousness, insomnia, tremors, palpitations, hypertension. * Better avoided in hypertension, heart failure, angina pectoris, hyperthyroidism, Glaucoma. | | |
| **Topical: Phenylethylamines & Imidazoline** | Rebound nasal stuffiness  Due to repeated administration (10 days -2 weeks) | | |
| Anticholinergics | | **Ipratropium** | Nasal drops to control rhinorrhea.  -very effective in vasomotor rhinitis (watery hyper-secretion).  -bronchodilator in asthma. | | wheezing, bladder pain, cough producing mucous | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Drugs for cough | | | | | |
| For Reproductive cough | **Expectorants** | Reflex stimulation (**Guaifenesin)** | | **ADRs:**  Dry mouth, chapped lips, risk of kidney stones(🠉uric acid excretion). | Clinical use: Common cold, Bronchitis, Pharyngitis, Chronic paranasal sinusitis. |
| Direct stimulation ( e.g. Iodinated glycerol) | | ADRs:Unpleasant metallic taste, hypersensitivity, hypothyroidism, swollen salivary glands & flare of old TB. |
|  |  | | Mechanism | ADRs |
| Mucolytics | Hypertonic saline and NaHCO3 | | * Viscoelasticity by   🠉 water content | Use: Most mucolytics are used as adjuvant therapy when there is excessive &/or thick mucus |
| Steam inhalation | | 🠋 Adhesiveness |
| **N-acetylcysteine** | | Breakdown S-S bonds (used in acetaminophen over dose) | Bronchospasm, stomatitis, rhinorrhea, rash, nausea & vomiting |
| **Bromhexine** and its metabolite(ambroxol) | | Synthesize serous mucus & activate ciliary clearance | Rhinorrhea, lacrimation, gastric irritation, hypersensitivity |
| **Pulmozyme** (Dornase Alpha or rhDNAase) | | Cleavage of extracellular bacterial DNA (used in severe infections) | Voice changes, pharyngitis, laryngitis, rhinitis, chest pain, fever, rash |
|  | |  |  | **Drug** | **Target** |
| For dry cough: Antitussive agents | | Peripherally inhibitors | Inhibitors of  Airway stretch receptor | Demulcentm coated as Lozenges & gargles | Pharynx |
| Emollients, coated by Menthol & eucalyptus | Larynx |
| aerosols or inhalational of hot steam:  Eucalyptol & tincture benzoin compound | Tracheobronchial |
| Use local anesthetic aerosols: Lido*caine*, benzo*caine*& tetra*caine* | Bronchoscopy OR bronchography |
| Inhibitors of pulmonary stretch receptor in Alveoli:  **Benzonatate** | Mechanism:  ⭣ Sensitivity (numbing) of receptors by local anesthetic action. | ADRs: Drowsiness,  Dizziness,  Dysphagia allergic reaction  CNS effects when overdosed |
| Centrally | Opioids**: Codeine** &  phol**codine** |  |  |
| Non-opioids: Anti-Histamine & **Dextromethrophan** | 🠉 Threshold at cough center.  **It has benefits over opioids in being:**   **1. As potent as codeine**  **2- But no drowsiness**  **3- Less constipating**  **4- No respiratory depression.**  **5- No inhibition of mucociliary clearance**  **6- No addiction.** | ADRs:  In normal doses: Nausea  Vomiting  Dizziness  Rash  Pruritus  OVERDOSE:  Opoiat-like ADRs on RT &GIT + Hallucination |

**Probably Won’t be in the exam**