# PHARMACOTHERAPY

# Pharmacotherapy

- Pharmacotherapy is **therapy** using **pharmaceutical drugs**
- Also called as **Drug therapy**
- Is a general term for using medication to treat disease.
- Other modes: surgery (surgical therapy), radiation (radiation therapy), movement (physical therapy)
- Among physicians, sometimes the term ***medical therapy*** refers specifically to **pharmacotherapy**
- For example, in oncology, medical oncology is thus distinguished from surgical oncology

- Pharmacology is the science that aims to continually improve pharmacotherapy.
- A pharmacotherapy specialist is an individual who is specialized in administering and prescribing medication, and requires extensive academic knowledge in pharmacotherapy.

•Drugs interact with receptors or enzymes in cells to promote healthy functioning and reduce or cure illness.

•It is employed to treat a range of psychological disorders, as well as attention hyperactivity disorder, major depression, schizophrenic psychosis, anxiety disorders, autism, panic attacks and neurotic disorder among several others.

•Drugs are selected based on

–characteristics of the drug (eg, efficacy, safety profile, route of administration, route of elimination, dosing frequency, cost)

–characteristics of the patient (eg, age, sex, other medical problems, likelihood of pregnancy, ethnicity, other genetic determinants).

•Risks and benefits of the drug are also assessed; every drug poses some risk.

•Response to a drug depends

–partly on the patient's characteristics and behaviors (eg, consumption of foods or supplements; adherence to a dosing regimen; differences in metabolism due to age  sex, race, genetic polymorphisms, or hepatic or renal insufficiency)

–coexistence of other disorders, and

–use of other drugs.

–Drug errors (eg, prescribing an inappropriate drug, misreading a prescription, administering a drug incorrectly)

## Classification of drugs based on therapeutic actions

**Drug:**

- By definition, drugs are chemical substances that affect or alter the physiology when taken into a living system.
- They can either be natural or synthetic.
- When a drug is therapeutically active and is used for the diagnosis, treatment or prevention of a disease, it is called medicine (legal drugs).

**Therapeutic class:**

Drug classes that are defined by their therapeutic use (the pathology they are intended to treat) include:

- Analgesics
- Antibiotic
- Anticoagulant
- Antidepressant
- Anticancer
- Antiepileptic
- Antipsychotic
- Antiviral
- Sedative
- Antidiabetic
- Cardiovascular

**Analgesic:**

- **Painkiller-** group of drugs used to achieve analgesia, relief from pain.
- They are distinct from anesthetics, which temporarily affect
- Analgesics are typically classified based on their mechanism of action

**1. Paracetamol (acetaminophen)**

- Paracetamol, also known as acetaminophen or APAP, is a medication used to treat pain and fever.
- It is typically used for mild to moderate pain.
- In combination with opioid pain medication, paracetamol is now used for more severe pain such as cancer pain and after surgery.
- It is typically used either by mouth or rectally but is also available intravenously.
- Effects last between two and four hours.
- It is classified as a mild analgesic and safe at recommended doses

2. **NSAIDs:** Nonsteroidal anti-inflammatory drug

- They are a drug class that groups together drugs that decrease pain and lower fever, and, in higher doses, decrease inflammation.
- The most prominent members of this group of drugs, aspirin, ibuprofen and naproxen, are all available over the counter in most countries.

3. **Opioids**

- Medically they are primarily used for pain relief, including anesthesia.
- Other medical uses include suppression of diarrhea, replacement therapy for opioid use disorder, reversing opioid overdose, and suppressing cough.
- Side effects of opioids may include itchiness, sedation, nausea, respiratory depression, constipation, and euphoria.
- Opioids act by binding to opioid receptors found principally in the central and peripheral nervous system and the gastrointestinal tract.
- These receptors mediate both the psychoactive and the somatic effects of opioids
- **Example**; Morphine, codeine, oxycodone, hydrocodone, dihydromorphine, pethidine)

**Morphine** is a pain medication It acts directly on the central nervous system (CNS) to increase feelings of pleasure and warm relaxation and reduce pain.

It can be taken for both acute pain and chronic pain and is frequently used for pain from myocardial infarction, kidney stones, and during labor.

## Antibiotic：

- An **antibiotic** is a type of antimicrobial substance active against bacteria.
- They may either kill or inhibit the growth of bacteria.
- Antibiotics are not effective against viruses such as the common cold or influenza; drugs which inhibit viruses are termed antiviral drugs or antivirals
- Antibiotics are commonly classified based on their mechanism of action, chemical structure, or spectrum of activity.
    - Most target bacterial functions or growth processes.
        - Those that target the bacterial cell wall (penicillins and cephalosporins) or the cell membrane (polymyxins), or interfere with essential bacterial enzymes (rifamycins, lipiarmycins, quinolones, and sulfonamides) have **bactericidal activities.**
        - Protein synthesis inhibitors (macrolides, lincosamides, and tetracyclines) are usually **bacteriostatic**.
    - Further categorization is based on their target specificity. "Narrow-spectrum" antibiotics target specific types of bacteria, such as gram-negative or gram-positive, whereas broad-spectrum antibiotics affect a wide range of bacteria.

**Anticoagulant:**

- Commonly known as **blood thinners**, are chemical substances that prevent or reduce coagulation of blood, prolonging the clotting time.
- Anticoagulants are used in therapy for thrombotic disorders
- Oral anticoagulants (OACs) are taken in pill or tablet form, and various intravenous anticoagulant dosage forms are used in hospitals.
- Some anticoagulants are used in medical equipment, such as sample tubes, blood transfusion bags, heart-lung machines, and dialysis equipment.
- The **biggest risk** of anticoagulation therapy is the increased risk of bleeding.
- Generally, the **benefit** of anticoagulation is prevention of or reduction of progression of a thromboembolic disease.
- A number of anticoagulants are available. The traditional ones (warfarin, other coumarins and heparins) are in widespread use.
- Warfarin is the dominant anticoagulant prescribed in a large multispecialty practice. It takes at least 48 to 72 hours for the anticoagulant effect to develop.
- Where an immediate effect is required, heparin must be given.
- **Other examples** are acenocoumarol, phenprocoumon, atromentin, and phenindione.

**Antidepressants**

- Medications used to treat major depressive disorder, some anxiety disorders, some chronic pain conditions, and to help manage some addictions.
- **Common side-effects** of antidepressants include dry mouth, weight gain, dizziness, headaches, sexual dysfunction,and emotional blunting.
- A discontinuation syndrome can occur after stopping any antidepressant
- Widely accepted scientific theory of antidepressant action is the **monoamine hypothesis** states that depression is due to an imbalance (most often a deficiency) of the monoamine neurotransmitters (namely serotonin, norepinephrine and dopamine)
- All currently marketed antidepressants have the monoamine hypothesis as their theoretical basis
- Number of limitations: one, all monoaminergic antidepressants have a delayed onset of action of at least a week; and secondly, there are a sizeable portion (>40%) of depressed patients that do not adequately respond to monoaminergic antidepressants.
- **EXAMPLE:** Citalopram, Escitalopram, Fluvoxamine, Fluoxetine, Paroxetine

**Anticarcinogen**

- **Carcinopreventive** agent is a substance that counteracts the effects of a carcinogen or inhibits the development of cancer.
- Anticarcinogens are different from anticarcinoma agents (anticancer or anti-neoplastic agents)
- Anticarcinoma agents are used to selectively destroy or inhibit cancer cells *after* cancer has developed.
- Anticarcinogens is motivated primarily by the **principle** that it is preferable to prevent disease (preventive medicine) than to have to treat it (rescue medicine).

- In theory, anticarcinogens may act via different mechanisms including enhancement of natural defences against cancer, deactivation of carcinogens, and blocking the mechanisms by which carcinogens act (such as free radical damage to DNA).
- Confirmation that a substance possesses anticarcinogenic activity requires extensive *in vitro*, *in vivo*, and clinical investigation.
- Health claims for anticarcinogens are regulated by various national and international organizations like the US Food and Drug Administration (FDA) and European Food Safety Authority (EFSA).

**Anticonvulsant**

- Commonly known as **antiepileptic drugs** or as **antiseizure drugs** used in the treatment of epileptic seizures.
- Anticonvulsants suppress the excessive rapid firing of neurons during seizures and also prevent the spread of the seizure within the brain.
- Used in the treatment of bipolar disorder and borderline personality disorder since many seem to act as mood stabilizers
- Conventional antiepileptic drugs may block sodium channels or enhance γ-aminobutyric acid (GABA) function.
- Their **targets** include voltage-gated sodium channels, components of the GABA system ($GABA_A$ receptors, the GAT-1 GABA transporter, and GABA transaminase) and voltage-gated calcium channels
- By blocking sodium or calcium channels, antiepileptic drugs reduce the release of excitatory glutamate, whose release is considered to be elevated in epilepsy,
- Antiseizure drugs provide symptomatic treatment only and have not been demonstrated to alter the course of epilepsy.

**Antipsychotic**

- Also known as **neuroleptics**
- Are a class of medication primarily used to manage psychosis (including delusions, hallucinations, paranoia or disordered thought), principally in schizophrenia but also in a range of other psychotic disorders.
- They are also the mainstay together with mood stabilizers in the treatment of bipolar disorder
- The use of antipsychotics may result in many unwanted side effects
- They block receptors in the brain for dopamine
- **Example:** Haloperidol, Chlorpromazine, Loxapine

**Antiviral**

- Class of medication used for treating viral infections.
- Antiviral drugs are one class of antimicrobials
- Most antivirals target specific viruses, while a broad-spectrum antiviral is effective against a wide range of viruses.
- Most of the antiviral drugs now available are designed to help deal with HIV, herpes viruses, COVID-19, the hepatitis B and C viruses, and influenza A and B viruses
- While most antivirals treat viral infection, vaccines are a preemptive first line of defense against pathogens.
- Vaccination involves the introduction (i.e. via injection) of a small amount of typically inactivated or attenuated antigenic material to stimulate an individual's immune system.
- The immune system responds by developing white blood cells to specifically combat the introduced pathogen, resulting in adaptive immunity.
- Vaccination in a population results in herd immunity

**Sedative**

- A **sedative** or **tranquilliser** is a substance that induces sedation by reducing irritability or excitement.
- They are CNS depressants and interact with brain activity causing its deceleration.
- They are often referred to collectively as **sedative-hypnotic** drugs because the sedative and hypnotic functions frequently overlap
- The term ***sedative*** describes drugs that serve to calm or relieve anxiety, whereas the term ***hypnotic*** describes drugs whose main purpose is to initiate, sustain, or lengthen sleep.
- In the event of an overdose or if combined with another sedative, many of these drugs can cause deep unconsciousness and even death.

**Antidiabetic**

- **Drugs used in diabetes** treat diabetes mellitus by altering the glucose level in the blood.
- Diabetes mellitus type 1 is a disease caused by the lack of insulin. Insulin must be used in type 1, which must be injected.
- Diabetes mellitus type 2 is a disease of insulin resistance by cells.
- Type 2 diabetes mellitus is the most common type of diabetes. Treatments include agents that (1) increase the amount of insulin secreted by the pancreas, (2) increase the sensitivity of target organs to insulin, (3) decrease the rate at which glucose is absorbed from the gastrointestinal tract, and (4) increase loss of glucose through urination.
- Insulin is usually given subcutaneously, either by injections or by an insulin pump.
- Insulin sensitizers address the core problem in type 2 diabetes – insulin resistance.
- Secretagogues are drugs that increase output from a gland, in the case of insulin from the pancreas.

# VITAMINS

- Vitamins are organic compounds that people need in small quantities. Most vitamins need to come from food because the body either does not produce them or produces very little.
- Each organism has different vitamin requirements. For example, humans need to get vitamin C from their diets — while dogs can produce all the vitamin C that they need.
- For humans, vitamin D is not available in large enough quantities in food. The human body synthesizes the vitamin when exposed to sunlight, and this is the best source of vitamin D.
- Different vitamins play different roles in the body, and a person requires a different amount of each vitamin to stay healthy.
- **Vitamins are either soluble in fat or water.**

**Fat-soluble vitamins**

- Vitamins A, D, E, and K are fat-soluble.
- The body stores fat-soluble vitamins in fatty tissue and the liver, and reserves of these vitamins can stay in the body for days and sometimes months.
- Dietary fats help the body absorb fat-soluble vitamins through the intestinal tract.

**Water-soluble vitamins**

- Water-soluble vitamins do not stay in the body for long and cannot be stored.
- They leave the body via the urine. Because of this, people need a more regular supply of water-soluble vitamins than fat-soluble ones.
- Vitamin C and all the B vitamins are water-soluble

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- The importance of vitamins as drugs is primarily in the prevention and treatment of deficiency diseases.
- Some vitamins do have other empirical uses in pharmacological doses.
- Vitamin deficiencies occur due to inadequate intake, mal-absorption, increased tissue needs, increased excretion, certain genetic abnormalities and drug vitamin interactions.
- Vitamins are not drugs or miracle cures.
- Taking large doses of vitamins can be harmful because your body only needs vitamins in very tiny amounts.
- Eating plenty of fruits, vegetables, whole grains and cereals will give your body the vitamins it needs, at the right level and in the right balance.
- Vitamin supplements can't replace a healthy diet, but a general multivitamin may help if your diet is inadequate.
- People who may need vitamin supplements include pregnant and breastfeeding women, people who consume alcohol in amounts over the recommended level, drug users and the elderly.

- Vitamin supplements are frequently misused and taken without professional advice. They are often used as a form of medicine to treat ailments such as colds, or to counteract lifestyle issues such as stress.
- When vitamins are taken as supplements, they are introduced into the body at levels that could never be achieved by eating even the healthiest of diets.
- Supplementation can also result in large doses of a single vitamin being eaten ‘alone.’
- The vitamins A, D, E and K are fat soluble, which means they can be stored in the body. Taking high doses of these vitamins, especially vitamin A, over a long period of time can result in harmful levels in the body unless you have a medically diagnosed deficiency.
- Some of the water soluble vitamins can also cause side effects in high doses. For instance, vitamin B6 has been linked with nerve damage when taken in large doses.
- For a healthy adult, if supplements are used, they should generally be taken at levels close to the recommended dietary intake (RDI). Information on how much a supplement provides can be found on the packaging.

# Cold remedies

- The common cold is caused by a viral infection in the upper airways, sinuses, throat, and nose.
- Cold is a self-limiting infection; this means it gets better on its own without requiring any special treatment.
- Most people get better within 1 week although, in some cases, it may last longer.
- There is no cure for the common cold, so, whatever remedies are taken only help treat the symptoms.
- Colds are caused by viruses and do not respond to antibiotics
- Treatment is directed at relieving signs and symptoms.

**Commonly used cold remedies include:**

- **Decongestant nasal sprays.** Adults can use decongestant drops or sprays for up to five days. Prolonged use can cause rebound symptoms. Children younger than 6 shouldn't use decongestant drops or sprays.
- **Cough syrups.** The Food and Drug Administration (FDA) and the American Academy of Pediatrics strongly recommends against giving OTC cough and cold medicines to children younger than age 4 as they may be harmful.

# Lifestyle and home remedies

To make yourself as comfortable as possible when you have a cold, try:

- **Drinking plenty of fluids.** Water, juice, clear broth or warm lemon water are good choices. Avoid caffeine and alcohol, which can dehydrate you.
- **Eating chicken soup.** Chicken soup and other warm fluids can be soothing and can loosen congestion.
- **Resting.** If possible, stay home from work or school if you have a fever or a bad cough or are drowsy after taking medications. This will give you a chance to rest as well as reduce the chances that you'll infect others.
- **Adjusting your room's temperature and humidity.** Keep your room warm, but not overheated. If the air is dry, a cool-mist humidifier or vaporizer can moisten the air and help ease congestion and coughing. Keep the humidifier clean to prevent the growth of bacteria and molds.
- **Soothing your throat.** A saltwater gargle — 1/4 to 1/2 teaspoon salt dissolved in a 4-ounce to 8-ounce glass of warm water — can temporarily relieve a sore or scratchy throat.
- **Using saline nasal drops.** To help relieve nasal congestion, try saline nasal drops. You can buy these drops over-the-counter, and they can help relieve symptoms, even in children.

# Laxatives

- **Laxatives**, **purgatives**, or **aperients** are substances that loosen stools and increase bowel movements.
- They are used to treat and prevent constipation.
- Laxatives may be administered orally or rectally.

**Types**

1. **Bulk-forming agents**

- Also known as roughage, are substances, such as fiber in food and hydrophilic agents in over-the-counter drugs, that add bulk and water to stools so that they can pass more easily through the intestines
- Site of action: small and large intestines
- Onset of action: 12–72 hours
- Examples: dietary fiber, Metamucil, Citrucel, FiberCon

Ideal for long-term maintenance of regular bowel movements.

**2. Emollient agents (stool softeners)**

- Known as stool softeners, are anionic surfactants that enable additional water and fats to be incorporated in the stool, making it easier for them to move through the gastrointestinal tract.

**Properties**

- Site of action: small and large intestines
- Onset of action: 12–72 hours
- Examples: Docusate (Colace, Diocto), Gibs-Eze

Emollient agents prevent constipation rather than treating long-term constipation

**3. Lubricant agents**

- Lubricant laxatives are substances that coat the stool with slippery lipids and decrease colonic absorption of water so that the stool slides through the colon more easily.

**Properties**

- Site of action: colon
- Onset of action: 6–8 hours
- Example: mineral oil

## 4. Hyperosmotic agents

- Hyperosmotic laxatives are substances that cause the intestines to hold more water within and create an osmotic effect that stimulates a bowel movement.

**Properties**

- Site of action: colon
- Onset of action: 12–72 hours (oral) 0.25–1 hour (rectal)
- Examples: glycerin suppositories (Hallens), sorbitol, lactulose, and PEG (Colyte, MiraLax)

## 5. Saline laxative agents

- Saline laxatives are non-absorbable osmotically active substances that attract and retain water in the intestinal lumen, increasing intraluminal pressure that mechanically stimulates evacuation of the bowel.

**Properties**

- Site of action: small and large intestines
- Onset of action: 0.5–3 hours (oral), 2–15 minutes (rectal)
- Examples: sodium phosphate (and variants), magnesium citrate, magnesium hydroxide (milk of magnesia), and magnesium sulfate (Epsom salt)

**6. Stimulant agents**

- Stimulant laxatives are substances that act on the intestinal mucosa or nerve plexus, altering water and electrolyte secretion.

**Properties**

- Site of action: colon
- Onset of action: 6–10 hours
- Examples: senna, bisacody

7. **Miscellaneous**

- Castor oil is a glyceride that is hydrolyzed by pancreatic lipase to ricinoleic acid, which produces laxative action by an unknown mechanism.

**Properties**

- Site of action: colon,small intestine
- Onset of action: 2–6 hours
- Examples: castor oil

Long-term use of castor oil may result in loss of fluid, electrolytes, and nutrients

# ANALGESICS

- The term analgesic refers to a medication that provides relief from pain without putting you to sleep or making you lose consciousness.
- Over-the-counter (OTC) (non-prescribed) analgesics that are generally used by the public are paracetamol, weak opioids such as codeine, and non-steroidal anti-inflammatory drugs (NSAIDs) such as ibuprofen and aspirin

## 1. Paracetamol (acetaminophen)

- Paracetamol, also known as acetaminophen or APAP, is a medication used to treat pain and fever (anti-pyretic drug).
- It is typically used for mild to moderate pain.
- In combination with opioid pain medication, paracetamol is now used for more severe pain such as cancer pain and after surgery.
- It is typically used either by mouth or rectally but is also available intravenously.
- Effects last between two and four hours.
- It is classified as a mild analgesic and safe at recommended doses
- Paracetamol acts as a selective inhibitor of the cyclooxygenase enzyme isoform, COX-3, found in the brain and spinal cord. Unlike NSAIDs, it has no anti-inflammatory action

2. **NSAIDs:** Nonsteroidal anti-inflammatory drug

- They are a drug class that groups together drugs that decrease pain and lower fever, and, in higher doses, decrease inflammation.
- NSAIDs produce analgesic effects, reduce inflammation and are anti-pyretic
- NSAIDs inhibit COX (cyclooxygenase). The inhibition of COX-1 and COX-2 by NSAIDs causes inhibition of the biosynthesis of prostaglandins.
- Prostaglandins are responsible for increasing the body's core temperature set point during fever. NSAIDs reverse this effect by causing inhibition of prostaglandin production.
- The most prominent members of this group of drugs, aspirin, ibuprofen and naproxen, are all available over the counter in most countries.

**ASPIRIN:**

- Acetylsalicylic acid, or aspirin, which is derived from salicylic acid, is the most widely used mild analgesic.
- Aspirin is a commonly used NSAID, mainly used for dental pain
- It has been advised that children under the age of 16 should not be given aspirin-containing products.
- The use of aspirin during fever or viral infection in children younger than 16 years is linked to an increase in the risk of **Reye's syndrome** which is characterized by an acute non-inflammatory encephalopathy and hepatic failure (liver and brain damage)

**Ibuprofen**

- Ibuprofen's anti-inflammatory effect is slightly weaker than aspirin and it has fewer side effects.
- It is taken for mild-to-moderate pain such as headaches and muscular/joint pains.
- ibuprofen can have a negative impact on the gastrointestinal tract and the kidneys.
- In addition, ibuprofen has been associated with an increased risk of heart disease and stroke

**3. Opioids**

- Medically they are primarily used for pain relief, including anesthesia.
- Other medical uses include suppression of diarrhea, replacement therapy for opioid use disorder, reversing opioid overdose, and suppressing cough.
- Side effects of opioids may include itchiness, sedation, nausea, respiratory depression, constipation, and euphoria.
- Opioids act by binding to opioid receptors found principally in the central and peripheral nervous system and the gastrointestinal tract.
- These receptors mediate both the psychoactive and the somatic effects of opioids
- **Example**; Morphine, codeine, oxycodone, hydrocodone, dihydromorphine, pethidine)

**Morphine**

- It is a pain medication It acts directly on the central nervous system (CNS) to increase feelings of pleasure and warm relaxation and reduce pain.
- It can be taken for both acute pain and chronic pain and is frequently used for pain from myocardial infarction, kidney stones, and during labor.

**Codeine**

- Has structural similarities to morphine, which in turn causes similar effects to reduce pain.
- It is defined as a weak opioid as its effects are less than those of morphine.
- Codeine should be used for mild-to-moderate pain.
- It is not recommended for children and is not generally given to asthmatics.
- Codeine can cause dependence.
- The side effect commonly associated with codeine is constipation

## External Antiseptics

- Are antimicrobial substances that are applied to living tissue/skin to reduce the possibility of infection, sepsis, or putrefaction.
- Antiseptics are generally distinguished from *antibiotics* by the latter's ability to safely destroy bacteria within the body, and from *disinfectants*, which destroy microorganisms found on non-living objects
- Antiseptics can be subdivided into about eight classes of materials.
- These classes can be subdivided according to their mechanism of action:
    - small molecules that indescrimantly react with organic compounds and kill microorganisms (peroxides, iodine, phenols)
    - more complex molecules that disrupt the cell walls of the bacteria.

1. Phenols such as phenol itself (as introduced by Lister) and triclosan, hexachlorophene, chlorocresol, and chloroxylenol. The latter is used for skin disinfection and cleaning surgical instruments. It is also used within a number of household disinfectants and wound cleaners.
2. Diguanides including chlorhexidine gluconate, a bacteriocidal antiseptic which (with an alcoholic solvent) is the most effective at reducing the risk of infection after surgery. It is also used in mouthwashes to treat inflammation of the gums (gingivitis).
3. Quinolines such as hydroxyquinolone, dequalium chloride, or chlorquinaldol.
4. Alcohols, including ethanol and 2-propanol/isopropanol are sometimes referred to as *surgical spirit*. They are used to disinfect the skin before injections, among other uses.
5. Peroxides, such as hydrogen peroxide and benzoyl peroxide. Commonly, 3% solutions of hydrogen peroxide have been used in household first aid for scrapes, etc
6. Iodine, especially in the form of povidone-iodine, is widely used. The traditional iodine antiseptic is an alcohol solution (called tincture of iodine). Iodine will kill all principal pathogens and, given enough time, even spores, which are considered to be the most difficult form of microorganisms to be inactivated by disinfectants and antiseptics.
7. Octenidine dihydrochloride, currently increasingly used in continental Europe, often as a chlorhexidine substitute.
8. Quat salts such as benzalkonium chloride, cetylpyridinium chloride, or cetrimide. These surfactants disrupt cell walls.

# ANTACIDS

- Antacids are over-the-counter (OTC) medications that help neutralize stomach acid.
- Antacids can be used to treat symptoms of excess stomach acid, such as:
  - Acid reflux, which can include regurgitation, bitter taste, persistent dry cough, pain when lying down, and trouble swallowing
  - Heartburn, which is a burning sensation in your chest or throat caused by acid reflux
  - Indigestion, which is pain in your upper gut that can feel like gas or bloating

## Mechanism of action

- When an excess amount of acid is produced in the stomach, the natural mucous barrier that protects the lining of the stomach can degrade, leading to pain and irritation.
- There is also potential for the development of acid reflux, which can cause pain and damage to the esophagus.
- Antacids contain alkaline ions that chemically neutralize stomach gastric acid, reducing damage to the stomach lining and esophagus, and relieving pain.
- Some antacids also inhibit pepsin, an enzyme that can damage the esophagus in acid reflux.
- Antacids do not directly inhibit acid secretion, and thus are distinct from acid-reducing drugs like $H_2$-receptor antagonists or proton pump inhibitors.
- Antacids do not kill the bacteria *Helicobacter pylori*, which causes most ulcers.

Antacids usually come in the following drug forms:

- liquid
- chewable gummy or tablet
- tablet that you dissolve in water to drink (Effervescent tablets )

**Precautions:**

Antacids are typically safe for most people. However, people with certain medical conditions should talk with their doctors before taking certain antacids that contain aluminum hydroxide and magnesium carbonate.

- People with heart failure may have sodium restrictions to help decrease fluid buildup. However, antacids often contain a lot of sodium. These people should ask their doctor before using antacids.
- People with kidney failure may develop a buildup of aluminum after using antacids. This can lead to aluminum toxicity.
- People with kidney failure also tend to have problems with electrolyte balance. All antacids contain electrolytes, which could make electrolyte balance problems worse.

**Side effects:**

- Side effects from antacids are rare. However, they can occur, even when you use them according to the directions.
- Antacids can either cause constipation or have a laxative effect. Some people have had allergic reactions. Antacids might also increase the risk of developing sensitivities to certain foods.
- Many of the side effects of antacids come from not taking them as directed.
- Many antacids contain calcium. If you take too much or take them for longer than directed, you could get an overdose of calcium.
- Too much calcium can cause:
    - nausea
    - vomiting
    - mental status changes
    - kidney stones
    - alkalosis. In this condition, your body doesn't make enough acid to function properly.

**Interactions:**

- Antacids can interfere with the function of other drugs.
- If you take another medication that increases your risk of bleeding, such as an anticoagulant or antiplatelet drug, you shouldn't take these antacids.

Be sure to talk to your doctor before taking aspirin-containing antacids if you:

- have a history of stomach ulcers or bleeding disorders
- are older than 60 years old
- drink three or more alcoholic drinks per day

# ANTIBIOTICS

Antibiotics are medicines that fight bacterial infections in people and animals. They work by killing the bacteria or by making it hard for the bacteria to grow and multiply.

Antibiotics can be taken in different ways:

- Orally (by mouth). This could be pills, capsules, or liquids.
- Topically. This might be a cream, spray, or ointment that you put on your skin. It could also be eye or ear drops.
- Through an injection or intravenously (I.V). This is usually for more serious infections.

**What do antibiotics treat?**

Antibiotics only treat certain bacterial infections, such as strep throat, urinary tract infections, and E. coli.

> You may not need to take antibiotics for some bacterial infections. For example, you might not need them for many sinus infections or some ear infections. Taking antibiotics when they're not needed won't help you, and they can have side effects.

Antibiotics **do not** work on viral infections. For example, you shouldn't take antibiotics for

- Colds and runny noses, even if the mucus is thick, yellow, or green
- Most sore throats (except strep throat)
- Flu
- Most cases of bronchitis

**Side effects:**

The side effects of antibiotics range from minor to very severe. Some of the common side effects include

- Rash
- Nausea
- Diarrhea
- Yeast infections

More serious side effects can include

- C. diff infections, which cause diarrhea that can lead to severe colon damage and sometimes even death
- Severe and life-threatening allergic reactions

You should only take antibiotics when they are needed because they can cause side effects and can contribute to antibiotic resistance. Antibiotic resistance happens when the bacteria change and become able to resist the effects of an antibiotic. This means that the bacteria are not killed and continue to grow.

When you take antibiotics, it is important that you take them responsibly:

- Always follow the directions carefully. Finish your medicine even if you feel better. If you stop taking them too soon, some bacteria may survive and re-infect you.
- Don't save your antibiotics for later
- Don't share your antibiotic with others
- Don't take antibiotics prescribed for someone else. This may delay the best treatment for you, make you even sicker, or cause side effects.

**7 Types of Antibiotics**

1. **Penicillins** such as penicillin and amoxicillin
2. **Cephalosporins** such as cephalexin (Keflex)
3. **Macrolides** such as erythromycin (E-Mycin), clarithromycin (Biaxin), and azithromycin (Zithromax)
4. **Fluoroquinolones** such as ciprofolxacin (Cipro), levofloxacin (Levaquin), and ofloxacin (Floxin)
5. **Sulfonamides** such as co-trimoxazole (Bactrim) and trimethoprim (Proloprim)
6. **Tetracyclines** such as tetracycline (Sumycin, Panmycin) and doxycycline (Vibramycin)
7. **Aminoglycosides** such as gentamicin (Garamycin) and tobramycin (Tobrex)

# BIOLOGICALS

- **Biological therapeutics, also referred to as Biologicals**, are those class of medicines which are grown and then purified from large-scale cell cultures of bacteria or yeast, or plant or animal cells.
- Biologicals are a diverse group of medicines which includes vaccines, growth factors, immune modulators, monoclonal antibodies, as well as products derived from human blood and plasma.
- What distinguishes biologicals from other medicines is that these are generally proteins purified from living culture systems or from blood, whereas other medicines are considered as 'small molecules' and are either made synthetically or purified from plants.
- Due to the differences in their nature and how they are produced, biological therapeutics are regulated, tested, and controlled differently than other medicines.
- To help ensure their quality, safety, and efficacy, each batch of a biological therapeutic product must be tested extensively at each stage of production in order to ensure consistency with prior batches

Also known as **biopharmaceutical**, **biologic(al) medical product**,or **biologic**

Some of the oldest forms of biologics are extracted from the bodies of animals, and other humans especially. Important biologics include:

- Whole blood and other blood components
- Organ transplantation and tissue transplants
- Stem-cell therapy
- Antibodies for passive immunity (e.g., to treat a virus infection)
- Human reproductive cells
- Human breast milk
- Fecal microbiota

Some biologics that were previously extracted from animals, such as insulin, are now more commonly produced by recombinant DNA.

Major kinds of biopharmaceuticals include:

- Blood factors (Factor VIII and Factor IX)
- Thrombolytic agents (tissue plasminogen activator)
- Hormones (insulin, glucagon, growth hormone, gonadotrophins)
- Haematopoietic growth factors (Erythropoietin, colony-stimulating factors)
- Interferons (Interferons-α, -β, -γ)
- Interleukin-based products (Interleukin-2)
- Vaccines (Hepatitis B surface antigen)
- Monoclonal antibodies (Various)
- Additional products (tumour necrosis factor, therapeutic enzymes)

## Non-steroidal contraceptives

- Contraception (birth control) prevents pregnancy by interfering with the normal process of ovulation, fertilization, and implantation.
- There are different kinds of birth control that act at different points in the process.
- Each method has its own side effects and risks.

- Hormonal methods: These use medications (hormones) to prevent ovulation. Eg: birth control pills (oral contraceptives)
- Barrier methods: These methods work by preventing the sperm from getting to and fertilizing the egg. Eg: condom
- Intrauterine devices (IUDs): These devices are inserted into the uterus, where they stay from one to ten years. It prevents the fertilized egg from implanting in the lining of the uterus and may have other effects as well.
- Tubal ligation: This medical procedure is a permanent form of contraception for women. Each fallopian tube is either tied or burned closed. The sperm cannot reach the egg, and the egg cannot travel to the uterus.
- Vasectomy: This medical procedure is a the male form of sterilization and should be considered permanent. In vasectomy, the vas defrens, the tiny tubes that carry the sperm into the semen, are cut and tied off.

**Hormonal contraception** refers to birth control methods that act on the endocrine system. Almost all methods are composed of steroid hormones, although in India one selective estrogen receptor modulator is marketed as a contraceptive.

**Ormeloxifene : nonsteroidal contraceptive**

- Ormeloxifene is a selective estrogen receptor modulator (SERM). Marketed as Centchroman, Centron, or Saheli, it is pill that is taken once per week.
- Ormeloxifene is legally available only in India.
- It is best known as a nonsteroidal oral contraceptive which is taken once per week.
- In India, ormeloxifene has been available as birth control since the early 1990s, and it was marketed there under the trade name **Saheli**,
- currently available free-of-cost for the women in India as **Chhaya (Centchroman)**.
- Ormeloxifene has also been licensed under the trade names **Novex-DS**, **Centron**, and **Sevista**
- It was **developed by Central Drug Research Institute (CDRI) Lucknow**
- Ormeloxifene is primarily used as a contraceptive but may also be effective for dysfunctional uterine bleeding and advanced breast cancer.

**Mechanism of action:**

- Ormeloxifene is a selective estrogen receptor modulator (SERM).
- In some parts of the body, its action is estrogenic (e.g., bones), in other parts of the body, its action is antiestrogenic (e.g., uterus, breasts).
- It causes an asynchrony in the menstrual cycle between ovulation and the development of the uterine lining, although its exact mode of action is not well defined.
- In clinical trials, it caused ovulation to occur later than it normally would in some women,but did not affect ovulation in the majority of women, while causing the lining of the uterus to build more slowly.
- It speeds the transport of any fertilized egg through the fallopian tubes more quickly than is normal.
- Presumably, this combination of effects creates an environment such that if fertilization occurs, implantation will not be possible.

## Herbal products

- Herbal products are medicines derived from plants.
- **Also known as phyto-pharmaceuticals. They exclusively contain one or more herbal substances or herbal preparations as active ingredients or combinations of them**
- They are used as supplements to improve health and well being, and may be used for other therapeutic purposes. Herbal products are available as tablets, capsules, powders, extracts, teas and so on.
- Herbal medicines are thought to be safe as it is natural, but in fact it can cause serious adverse effects and interaction with other drugs and supplements.
- In contrast to synthetic drugs containing chemically active substances, they consist of a plethora of natural compounds that activate or modulate various target systems in an organism.
- In general, herbal medicinal products are better tolerated and provide a superior benefit-risk ratio to synthetic drugs.
- **Phyto-pharmacon / Phyto-pharmaceutical:** basically, are herbal remedies which are prepared from herbal substances like dried plant parts such as leaves, blossom, herb, bark, or the roots traditionally already known to cure undesired conditions or illnesses.
- Phyto-pharmaceuticals have to follow comparable regulatory guidelines as conventional drugs.

- Unlike synthetic drugs, which are single active chemical substances, phyto-pharmaceuticals contain complex mixtures of hundreds of natural components.
- The efficacy of herbal medicinal products results from complex interactions the active components with molecular target structures, such as receptors, enzymes, and transport systems.

**The extract as active principle**

- Phyto-pharmaceuticals are natural products and like other natural products, such as coffee, wine or cocoa, their quality depends on many factors starting from the raw material.
- For example the plant variety, cultivation, climate, harvest time, drying process and further processing steps can all affect the quality of the final preparation.
- No coffee tastes the same as another, although they are all prepared from coffee beans. For this reason, increasing numbers of extracts are being manufactured, which are standardised or quantified with regard to important components.
- Such extracts therefore always contain defined amounts of the active ingredients. Likewise undesired substances; those that cause side-effects, can be removed.
- Various different dosage forms, such as film-coated tablets, drops, or ointments, can be manufactured from the extracts.

**Clinically proven phytotherapy**

- The highest demands are made on clinically proven phyto-pharmaceuticals. They are developed and scientifically evaluated in the same way as conventional medicinal products. This is very different to traditional phyto-pharmaceuticals, where the use is primarily based on experience,

Typical examples of clinically proven phyto-pharmaceuticals are:

- John’s wort for the treatment of depressive moods
- Butterbur for the treatment of hay fever
- Gingko for the treatment of declining mental performance
- Black cohosh for the treatment of menopausal symptoms
- Hawthorn for the treatment of cardiac symptoms
- Valerian and hops for the treatment of sleep disorders

Phyto-pharmaceuticals have a broad therapeutic margin and thus work well for simple and chronic symptoms.

Due to their high tolerability and rather low interaction potential, they are well suited for elder patients with multiple medications.

**MOST POPULAR HERBAL MEDICINES:**

- **Turmeric** is renowned for its anti-inflammatory benefits and may be especially effective for treating pain associated with arthritis. Curcumin is the major active compound in turmeric. It may treat a host of conditions, including chronic inflammation, pain, metabolic syndrome, and anxiety
- Both turmeric and curcumin supplements are widely considered safe, but very high doses may lead to diarrhea, headache, or skin irritation.
- Much like turmeric, **ginger** is a rhizome, or stem that grows underground. It contains a variety of beneficial compounds and has long been used in traditional and folk practices to treat colds, nausea, migraines, and high blood pressure Its best-established modern use is for relieving nausea associated with pregnancy, chemotherapy, and medical operations
- Ginger is very well tolerated. Negative side effects are rare, but large doses may cause a mild case of heartburn or diarrhea
- **Ginseng** is a medicinal plant whose roots are usually steeped to make a tea or dried to make a powder. It's frequently utilized in traditional Chinese medicine to reduce inflammation and boost immunity, brain function, and energy levels.
- **Ginkgo biloba,** also known simply as ginkgo, used in traditional Chinese medicine contains a variety of potent antioxidants. It is said to treat a wide range of ailments, including heart disease, dementia, mental difficulties, and sexual dysfunction

**Module 3:**

**PHARMACOTHERAPY**

**Classification of drugs based on therapeutic actions using suitable examples Special emphasis on Vitamins, cold remedies, laxatives, analgesics, non-steroidal contraceptives, external antiseptics, antacids, antibiotics, biologicals, herbal products. Pharmacotherapy of migraine, cancer, TB, diabetes and male sexual dysfuntion. Hormone replacement therapy**

# Pharmacotherapy of migraine

- Migraine is best described as a neuronal event that may be caused by a hereditary susceptibility of the brain and various environmental triggers. It may occur in patients who have a genetically sensitive nervous system. The pathophysiology of migraine continues to be studied, and numerous theories have been proposed.
- The clinical presentation of migraine may vary from patient to patient, and even within the same individual, it may vary from one attack to another. The proper diagnosis may require the assistance of physicians who have experience in headache management.
- Migraine may remain undiagnosed in many patients often resulting in an improper diagnosis of sinus or tension headache. Such misdiagnoses may lead to inadequate or improper treatment.
- **The Headache Classification Subcommittee of the International Headache Society (IHS)** has developed a comprehensive system for classifying migraine that can be useful along with other tools to assist in the diagnostic process

Migraine may occur in three clinical phases:

- The ***pre-headache phase*** includes the premonitory phase and the migraine aura. This phase may precede the headache by hours to days, affecting up to 20% to 60% of patients.
- During the ***headache phase***, the migraine itself usually presents with throbbing, pulsatile pain in the frontotemporal region, usually lasting from 4 to 72 hours. The pain may vary in severity from mild to severe and may escalate over the course of the headache. Other clinical features that may be present during this phase include nausea, vomiting, autonomic symptoms, nasal congestion, and lacrimation.
- The ***resolution (postdromal) phase*** consists of fatigue and irritability, lasting a day or two; this is sometimes referred to as the "migraine hangover."

Migraine is associated with a wide range of comorbidities, including depression, bipolar disease, fibromyalgia, irritable bowel syndrome, overactive bladder, sleep disorders, obsessive–compulsive disorders, and anxiety, which may have a significant impact on the care of the patient.

- The therapeutic approach to migraine should always include an evaluation of potential **triggers** or precipitating factors.
- some patients report benefits when they avoid certain foods and their chemical content.

**Pharmacotherapy**

- Involves medications used in acute (abortive) management and preventative (prophylactic) management.
- Medications that interact with various vasoactive neurotransmitters—including serotonin, tyramine, norepinephrine, gamma-aminobutyric acid (GABA), *N*-methyl-d-aspartate (NMDA), dopamine are utilized
- **Pain-relieving medications.** Also known as **acute or abortive treatment,** these types of drugs are taken during migraine attacks and are designed to stop symptoms.
- **Preventive medications.** These types of drugs are taken regularly, often daily, to reduce the severity or frequency of migraines.

# Acute (Abortive) Migraine Treatment

Medications Used in the Abortive Management of Migraine

ASA, numerous generics 650–1,000 mg q 4–6 hours (maximum 4,000 mg daily)
APAP (e.g., Tylenol) 325–1,000 mg q 4–6 hours (maximum 4,000 mg daily)

***Some combination OTC products***

- Anacin (ASA) 400 mg, caffeine 32 mg)
- Bayer Extra Strength (APAP 500 mg, caffeine 32.5 mg)
- Excedrin Extra Strength and Excedrin Migraine* (APAP 250 mg, ASA 250 mg, caffeine 65 mg)
- Vanquish (APAP 194 mg, ASA 227 mg, caffeine 33 mg)

***Barbiturate combinations****

- Butalbital and ASA/caffeine (Fiorinal) 1–2 tablets q 4–6 hours (also available with codeine)
- Butalbital and APAP/caffeine (Fioricet) 1–2 tablets q 4–6 hours (also available with codeine)

Restrict use to avoid rebound; 4 tablets daily; not more than 2 days per week

***Serotonin receptor agonists (triptans)***

- Sumatriptan (Imitrex) Intranasal, Oral, SQ
- Rizatriptan (Maxalt) Oral, MLT (dissolving product)
- Zolmitriptan (Zomig) Oral, ZMT (dissolving product), Nasal
- Naratriptan (Amerge) Oral
- Almotriptan (Axert) Oral

***Opiate combinations****

- Propoxyphene with APAP (Darvocet)
- Codeine with APAP (Tylenol #3)
- Oxycodone with APAP or ASA (Percocet, Percodan)
- Butorphanol nasal spray (Stadol) one spray in one nostril (1 mg); may repeat in 1 hour; maximum four sprays daily

***Ergot alkaloids***

- Dihydroergotamine mesylate (DHE) injection/1 mg/mL Nasal Spray (Migranol)
- Ergotamine tartrate (numerous brands with various contents, including belladonna alkaloids, caffeine, and phenobarbital)

***NSAIDs***

- Ibuprofen 200–400 mg q 4–6 hours (maximum 1,200 mg daily OTC)
  - Advil Migraine Liqui-Gels
  - Advil Migraine
- Naproxen sodium 220 mg q 6–8 hours (maximum 660 mg daily), OTC Aleve
- Numerous other products: diclofenac potassium (Cataflam), ketorolac (Toradol)

***Sympathomimetics****

- Isometheptene 65 mg, dichloralphenazone 100 mg, APAP 325 mg (Midrin)

***Phenothiazines:*** prochlorperazine (Compazine), chlorpromazine (Thorazine), metoclopramide (Reglan)

***Anticonvulsants:*** IV valproate (Depacon)

APAP = acetaminophen; ASA = aspirin; IV = intravenous; NSAID = nonsteroidal anti-inflammatory drug; OTC = over the counter; SQ = subcutaneous.

**Medications for relief: Acute (Abortive) Migraine Treatment**

Medications used to relieve migraine pain work best when taken at the first sign of an oncoming migraine — as soon as signs and symptoms of a migraine begin. Medications that can be used to treat it include:

- **Pain relievers.** These over-the-counter or prescription pain relievers include aspirin or ibuprofen (Advil, Motrin IB, others). When taken too long, these might cause medication-overuse headaches, and possibly ulcers and bleeding in the gastrointestinal tract.

- **Triptans.** These are prescription drugs such as sumatriptan (Imitrex, Tosymra) and rizatriptan (Maxalt) used for migraine because they block pain pathways in the brain. Taken as pills, shots or nasal sprays, they can relieve many symptoms of migraine. They might not be safe for those at risk of a stroke or heart attack.

- **Dihydroergotamines (D.H.E. 45, Migranal).** Available as a nasal spray or injection, these are most effective when taken shortly after the start of migraine symptoms for migraines that tend to last longer than 24 hours. Side effects can include worsening of migraine-related vomiting and nausea.

  People with coronary artery disease, high blood pressure, or kidney or liver disease should avoid dihydrogergotamines.

- **Lasmiditan (Reyvow).** This new oral tablet is approved for the treatment of migraine with or without aura. Lasmiditan can have a sedative effect and cause dizziness, so people taking it are advised not to drive or operate machinery for at least eight hours. Lasmiditan also shouldn't be taken with alcohol or other drugs that depress the central nervous system.

- **Ubrogepant (Ubrelvy).** This oral calcitonin gene-related peptide receptor antagonist is approved for the treatment of acute migraine with or without aura in adults. It's the first drug of this type approved for migraine treatment. It relieves pain and other migraine symptoms such as nausea and sensitivity to light and sound two hours after taking it. Common side effects include dry mouth, nausea and excessive sleepiness.

- **Opioid medications.** People who have migraines who can't take other migraine medications, narcotic opioid medications, especially those that contain codeine, might help. Because they can be highly addictive, these are usually used only if no other treatments are effective.

- **Anti-nausea drugs.** These can help if your migraine with aura is accompanied by nausea and vomiting. Anti-nausea drugs include chlorpromazine, metoclopramide (Reglan) or prochlorperazine (Compro). These are usually taken with pain medications.

**Preventive medications**

Medications can help prevent frequent migraines. Preventive medication is aimed at reducing how often you get a migraine how severe the attacks are and how long they last.

- **Blood pressure-lowering medications.** These include beta blockers such as propranolol (Inderal, Innopran XL, others) and metoprolol tartrate (Lopressor). Calcium channel blockers such as verapamil (Tarka, Verelan) can be helpful in preventing migraines with aura.
- **Antidepressants.** A tricyclic antidepressant (amitriptyline) can prevent migraines. Because of the side effects of amitriptyline, such as sleepiness and weight gain, other antidepressants might be prescribed instead.
- **Anti-seizure drugs.** Valproate and topiramate (Topamax) might help you have less frequent migraines, but can cause side effects such as dizziness, weight changes, nausea and more.
- **Botox injections.** Injections of onabotulinumtoxinA (Botox) about every 12 weeks help prevent migraines in some adults.
- **Calcitonin gene-related peptide (CGRP) monoclonal antibodies.** Erenumab-aooe (Aimovig), fremanezumab-vfrm (Ajovy) and galcanezumab-gnlm (Emgality) are newer drugs approved by the Food and Drug Administration to treat migraines. They're given monthly by injection. The most common side effect is a reaction at the injection site.

# Pharmacotherapy of cancer

- Cancer medication has an impact on the whole body, i.e. it is systemic pharmacotherapy.
- cancer pharmacotherapy need to be done individually with the patient according to the cancer type and spread, keeping in mind the overall condition of the patient.

The objective of cancer pharmacotherapy is to

- cure cancer using cancer pharmacotherapy, for example in the case of testicular cancer and lymphomas
- prevent the recurrence of cancer as a post-operative treatment, i.e. as adjuvant therapy, for example after breast cancer or intestinal cancer surgery
- relieve symptoms caused by cancer and extend life expectancy in the treatment of advanced cancer.

Cancer pharmacotherapy can be divided into four different groups according to the medication impact mechanism:

1. Cytostatics
2. Hormonal Therapies
3. Targeted Drugs
4. Immunologic Drugs.

## 1. Chemotherapy/ cytostatics

- Chemotherapy, i.e. cytostatics, have an effect by **preventing the division of all cells**, which often leads to the death of cancer cells. Cancer cells are particularly sensitive to cytostatics, because they divide faster than normal cells.
- The sensitivity of tumours to chemotherapy varies according to the cancer origin tissue and cell type
- Cancer treatment makes use of several cytostatics with different effects, either alone or as a combination of several different cytostatic drugs.
- Chemotherapy is usually administered intravenously or orally as tablets.
- In some cases, they can be administered locally, for example, into the spinal canal or urinary bladder.
- The implementation of all chemotherapies requires careful and regular monitoring of the patient's condition and blood count.
- Because the impact of chemotherapy targets all dividing cells of the body, side effects for healthy tissue are usually unavoidable. However, the healthy cells of the body recover faster.
- The most common side effects include nausea, hair loss, fatigue, problems with bowel movement, interferences in the sense of taste and a decline in overall Immunity.

## 2. Hormonal therapies

- The hormonal therapy of cancer aims to **prevent the production of the hormone vital to the cancer** in question and its effects on the body.
- Hormonal therapy is used, among other things, in the treatment of breast cancer, prostate cancer, thyroid cancer and uterine cancer.
- When compared with cytostatic therapies, hormonal therapies are clearly better tolerated.
- Possible side effects of hormonal therapies are very different in different people. For example, medication that prevents the impact of oestrogen, i.e. female hormone, among women cause menopausal symptoms due to the shortage of the female hormone.
- Hormonal therapy can be implemented either as tablets or injections.
- The therapy is usually long-term, lasting several years.
- In the treatment of advanced prostate cancer and breast cancer, it can continue for the rest of the patient's life.

## 3. Targeted drugs

- Targeted drugs are targeted treatments that **disturb the functioning of the communication chains** vital for the growth of cancer.
- Targeted drugs are used, among other things, in the treatment of certain blood cancer, lung cancer, breast cancer, lymphatic tissue cancer, renal cancer, liver cancer and intestinal cancer types.
- Targeted pharmacotherapy is given to patients whose tumour samples feature the **specific gene mutation** and who are therefore expected to benefit from the treatment.
- The side effects of targeted drugs are usually fairly minor in comparison to cytostatic therapies.
- Often, the antibodies of targeted drugs are combined with cytostatic therapies. In such cases, the treatment causes side effects brought about by the cytostatics.

## 4. Immunologic drugs

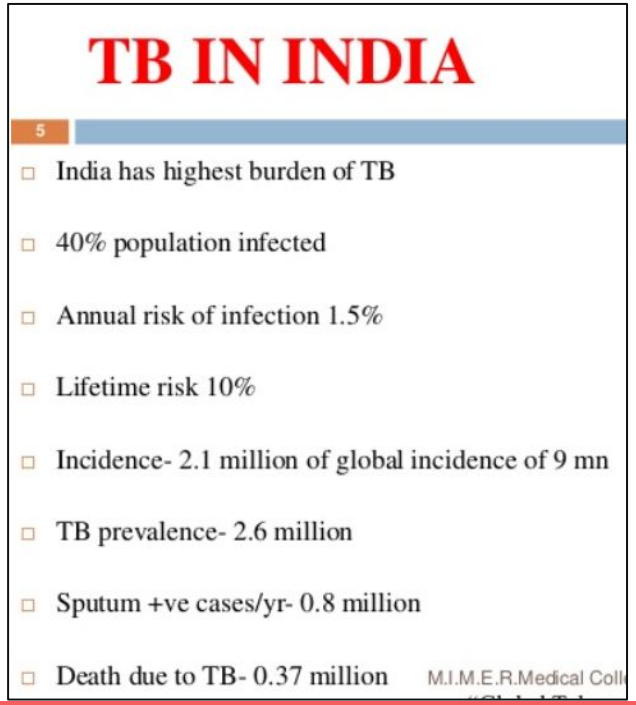
- Immunologic drugs aim to **boost the immune system of the body** and so cause the body's **own immune defence system to attack the cancer cells.**
- The treatment of melanoma was the first to benefit from the immunological treatments.
- The disadvantage of treatments based on immune defence is that, once you interfere with the body's defence mechanisms, the body may also attack its own tissue and cause **autoimmune diseases and severe inflammation.**
- In immunological treatments, it is important to monitor the possible side effects and to begin their treatment quickly.
- Otherwise, the disadvantages of the immunological treatments are clearly more minor than those of cytostatic therapies.

# Pharmacotherapy of TB

- **Tuberculosis** (**TB**) is an infectious disease usually caused by *Mycobacterium tuberculosis* (MTB) bacteria.
- Tuberculosis generally affects the lungs, causing **pulmonary TB** but can also affect other parts of the body causing **extra pulmonary TB**
- Spread through cough, sneeze, or respiratory fluids

## SIGNS AND SYMPTOMS:

- When the disease becomes active, 75% of the cases are pulmonary TB, that is, TB in the lungs.
- Symptoms include chest pain, coughing up blood, and a productive, prolonged cough for more than three weeks.
- Systemic symptoms include fever, chills, night sweats, appetite loss, weight loss, pallor, and often a tendency to fatigue very easily.



## TRANSMISSION OF THE DISEASE

- Pulmonary tuberculosis is a disease of respiratory transmission, Patients with the active disease (bacilli) expel them into the air by:
  - coughing,
  - sneezing,
  - shouting,
  - or any other way that will expel bacilli into the air
- **Transmission is dependent on closeness and time of contact**
- Once inhaled by a tuberculin free person, the bacilli multiply 4 -6 weeks and spreads throughout the body. The bacilli implant in areas of high partial pressure of oxygen:
- lung
- renal cortex
- reticuloendothelial system

# RISK FACTORS OF TUBERCULOSIS

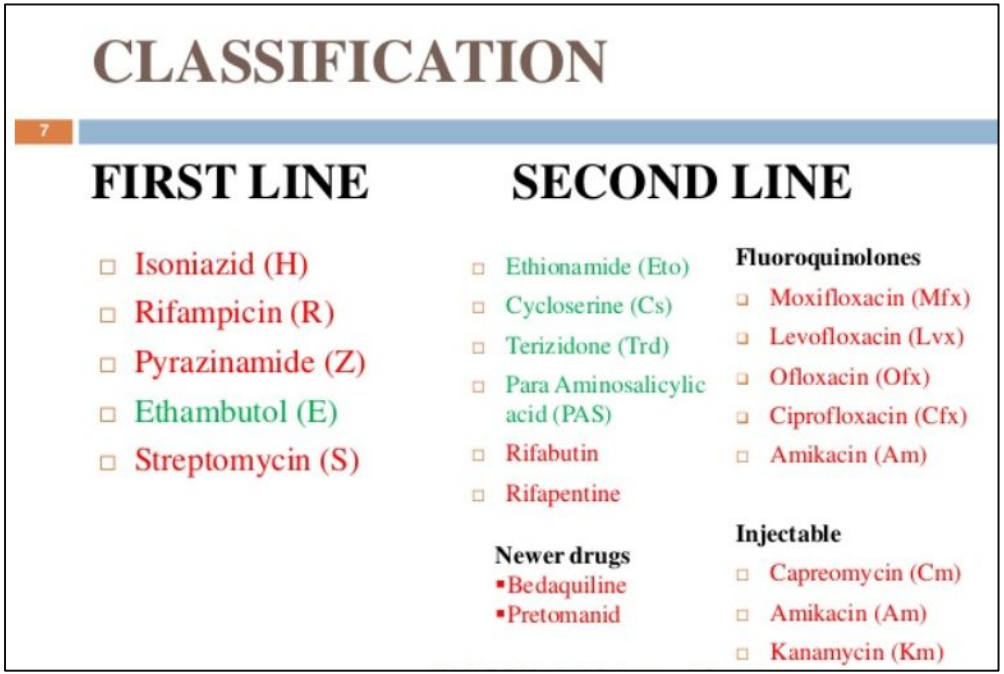
- Low socioeconomic status
- Crowded living conditions
- Diseases that weakens immune system like HIV
- Person on immunosuppresants like steroid
- Health care workers
- Migration from a country with a high number of cases
- Alcoholism
- Recent Tubercular infection(within last 2 year)
- HIV infection
- Children exposed to high risk adults
- Close contacts of persons known or suspected to have active disease
- Silicosis
- Prolonged corticosteroid therapy
- Other immunosuppressive therapy
- Low body weight (10% or more below the ideal)
- Diabetes mellitus
- Residents and employees of high-risk congregate settings
- Patients with CRF

**Pharmacotherapy:**

- Treatment of TB uses antibiotics to kill the bacteria.
- Effective TB treatment is difficult, due to the unusual structure and chemical composition of the mycobacterial cell wall, which hinders the entry of drugs and makes many antibiotics ineffective
- Active TB is best treated with combinations of several antibiotics to reduce the risk of the bacteria developing antibiotic resistance.

- *M. tuberculosis* is a slow-growing organism. Its metabolic activity varies over time and across environments.
- *M. tuberculosis* is generally classified into two subpopulations: those that are metabolically active and replicating, and those that are not.
- Typically, successful treatment regimens contain agents that act on both subpopulations.
- Persisting organisms are metabolically dormant and do not actively replicate; consequently, their elimination requires prolonged treatment duration.
- Without continued treatment, some patients may relapse with active TB disease.

- More than twenty drugs have been developed for the treatment of TB
- The **first line drugs,** are only used for the treatment of new patients who are very unlikely to have resistance to any of the TB drugs.
- The **second line drugs**, that are only used for the treatment of drug resistant TB



# GROUPING OF ANTI-TB DRUGS

8

Group 1:First-line oral agents

- Isoniazid (H)
- Pyrazinamide (Z)
- Ethambutol (E)
- Rifampin (R)

Group 2:Injectable agents

- Streptomycin (S)
- Kanamycin (Km)
- Amikacin (Am)
- Capreomycin (cm)

Group 3:Fluoroquinolones

- Levofloxacin (lfx)
- Moxifloxacin (mfx)
- Ofloxacin (ofx)

Group 4:Oral bacteriostatic second-line agents

- Para-aminosalicylic acid (pAS)
- Cycloserine (cs)
- Terizidone (Trd)
- Ethionamide (eto)
- Protionamide (pto)



Group 5: Agents with unclear role in treatment of drug resistant-TB

- Clofazimine (cfz)
- Linezolid (lzd)
- Amoxicillin/clavulanate (Amx/clv)
- Thioacetazone (Thz)
- Imipenem/ Cilastatin (ipm/cln)
- Clarithromycin (clr)

**First line drugs:**

**1. Isoniazid**

## ISONIAZID

11

- Active only against M.tuberculi
- Cheapest drug
- Inhibits resting microbes (bacteriostatic), kills multiplying (bactericidal)
- Effective against extracellular & intracellular organisms

## MOA Mechanism of action:

12

Prodrug

↓

Mycobacterial catalase-peroxidase(KatG) (activated)

↓

Covalent complex with acyl carrier protein (AcpM) & KasA

↓

Blocks mycolic acid synthesis & kills bacteria

## ADR Adverse Drug Reaction

- Peripheral neuropathy
- Structurally analogue to pyridoxine & form hydrazone (highly water soluble) with pyridoxal & rapidly excreted in urine
- Rx- Pyridoxine 10 mg/day prophylaxis &100mg/day-for toxicity
- Hepatitis (elderly & liver disease)
- Because of CYP2E1 induced hepatotoxic metabolite generation

## 2. Rifampicin:

- Semi synthetic derivatives of Rifamycin B (Streptomyces mediterranei)
- Most active agent
- Active against gram +ve & -ve cocci, some enteric bacteria, mycobacteria & chlamydia
- Extra & intra- cellular organisms
- Slow dividing (main)


- **MOA:**
  Binds to subunit of bacterial DNA-dependent RNA polymerase & inhibits RNA synthesis.
- **Resistance**
  Mutation to β subunit of bacterial RNA polymerase

### ADR

- Red discoloration of Body fluids (urine, tear & sputum )
- Fatal hepatitis (Existing liver disease)
- Flu like syndrome
- Nausea, Vomiting
- Dizziness & Confusion

## 3. Pyrazinamide:

### PYRAZINAMIDE

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- Synthetic, orally effective, bactericidal
- Used with INH & Rifampicin
- Prodrug, converted to pyrazinoic acid (pyrazinamindase of m. tuberculosis)
- Inactive at neutral pH
- Bactericidal to dividing organisms (Intracellular)
- **Sterilizing agent**

**Mechanism of action:**
Inhibits mycobacterial fatty acid synthase-1 enzyme & disrupts mycolic acid synthesis

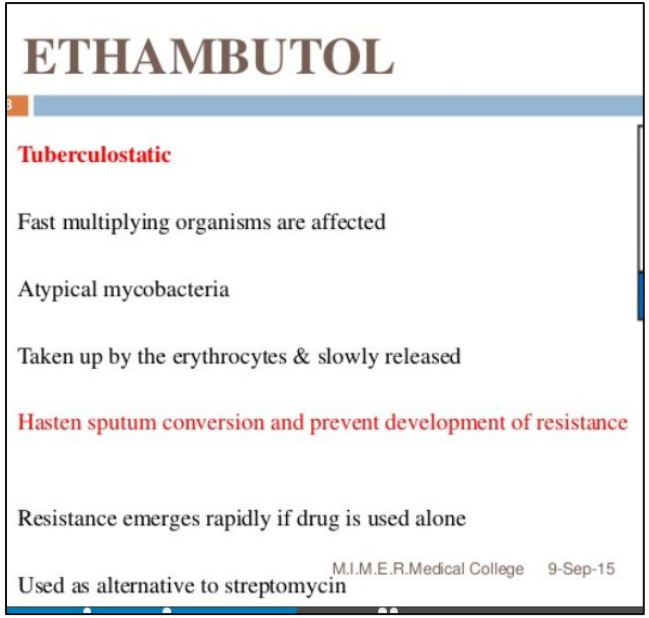
### Resistance

- Mutation of pncA gene
- Impaired uptake

### ADR

- Hepatotoxicity (C/I in liver ds)
- Hyperuricaemia, may precipitate gout
- Fever, Malaise, Urticaria, Skin rash
- Arthralgia
- GI upset – Anorexia, Nausea, Vomiting

## 4. Ethambutol:




- **MOA:**

  Inhibits mycobacterial arabinosyl transferase, involved in polymerization reaction of arabinoglycan, essential component of mycobacterial cell wall

- **Mechanism of resistance:** Mutation of emb gene

### ADR

- Optic neuritis: dose related, initially Red/ Green color blindness followed by a ↓ in visual acuity (disappear following withdrawal of drug)
- Hypersensitivity: skin rash, fever, itching
- Other adverse effects: Arthralgia, GI disturbance, Headache & mental disturbance

## 5. Streptomycin:

### STREPTOMYCIN

- First clinically useful antitubercular drug
- *Streptomyces griseus*
- Active mainly against extracellular bacilli
- Supplimental 1st line drug

### MOA

- Interference with initiation complex of peptide formation
- Misreading of mRNA→ Incorporation of incorrect AA into peptide→Nnonfunctional or toxic protein
- Breakup of polysomes into nonfunctional monosomes

### ADR

Dose related, & risk is ↑ in elderly

- Ototoxicity
- Nephrotoxicity
- Rash
- Fever

### Mechanism of resistance

1. Production of transferase enzyme, inactivates aminoglycosides by acetylation, adenylylation or phosphorylation (Major action)
2. Impaired entry of drug
3. Receptor protein on 30s ribosomal subunit deleted or altered (Mutation)

**Streptomycin can cause people to become deaf and it should be avoided if at all possible. It should only be used for the treatment of Drug Resistant TB when no other drug is available.**

For new patients with drug sensitive TB the World Health Organisation (WHO) recommends that they should have **six months of drug treatment.** This should consist of a **two month "intensive" treatment phase followed by a four month "continuation" phase.**

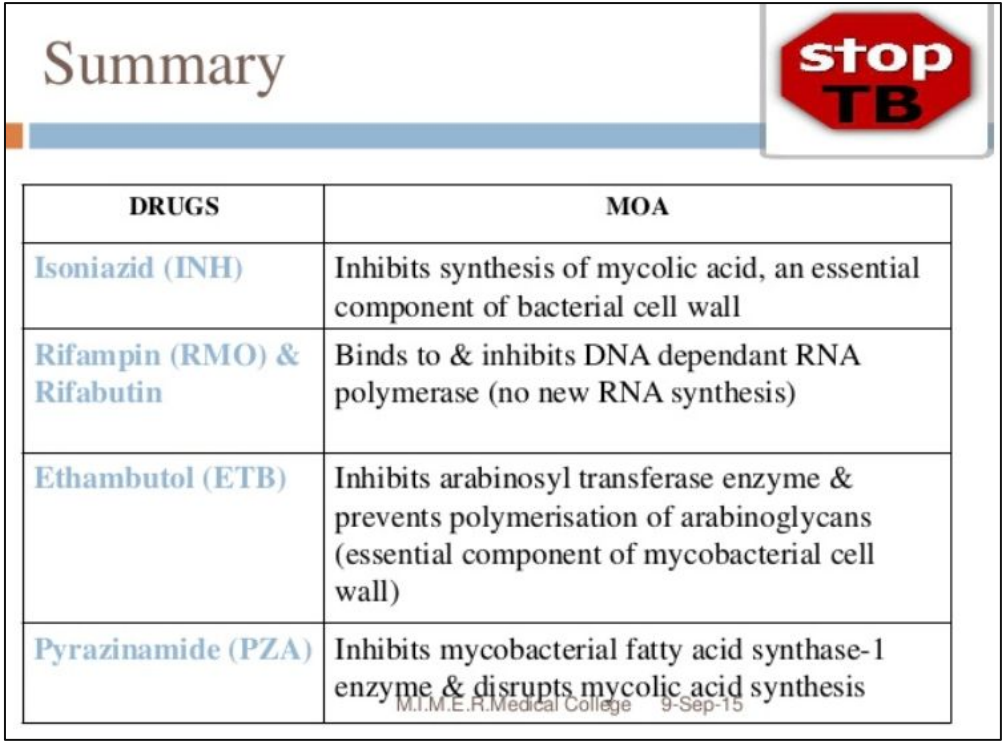
For the two month "intensive" drug treatment phase they should receive:

- Isoniazid (H/Inh)
- with rifampicin (R/Rif)
- and pyrazinamide (Z/Pza)
- and ethambutol (E/Emb)

followed by

- Isoniazid (H/Inh)
- with rifampicin (R/Rif)

for the "continuation" TB drug treatment phase



**Second line drugs:**

1. **ETHIONAMIDE:**

- Ethionamide blocks synthesis of mycolic acids in susceptible organisms.

2. **CAPREOMYCIN:** Obtained from *Streptomyces capreolus*

- Mechanism of action : Peptide protein synthesis inhibitor.
- Important agent for drug resistant tuberculosis
- Strains resistant to Amikacin, susceptible to Capreomycin

3. **CYCLOSERINE:** *Streptomyces orchidaceus*

- Structural analog of D- alanine
- Mechanism of action : Inhibits incorporation of D- alanine into peptidoglycan pentapeptide & inhibits mycobacterial cell wall synthesis

4. **AMINOSALICYLIC ACID (PAS) :**

- Folate synthesis antagonist,
- active exclusively against *Mycobacterium tuberculosis*
- Structurally similar to p-aminobenzoic acid(PABA) and the sulfonamides

5. **FLUOROQUINOLONES**

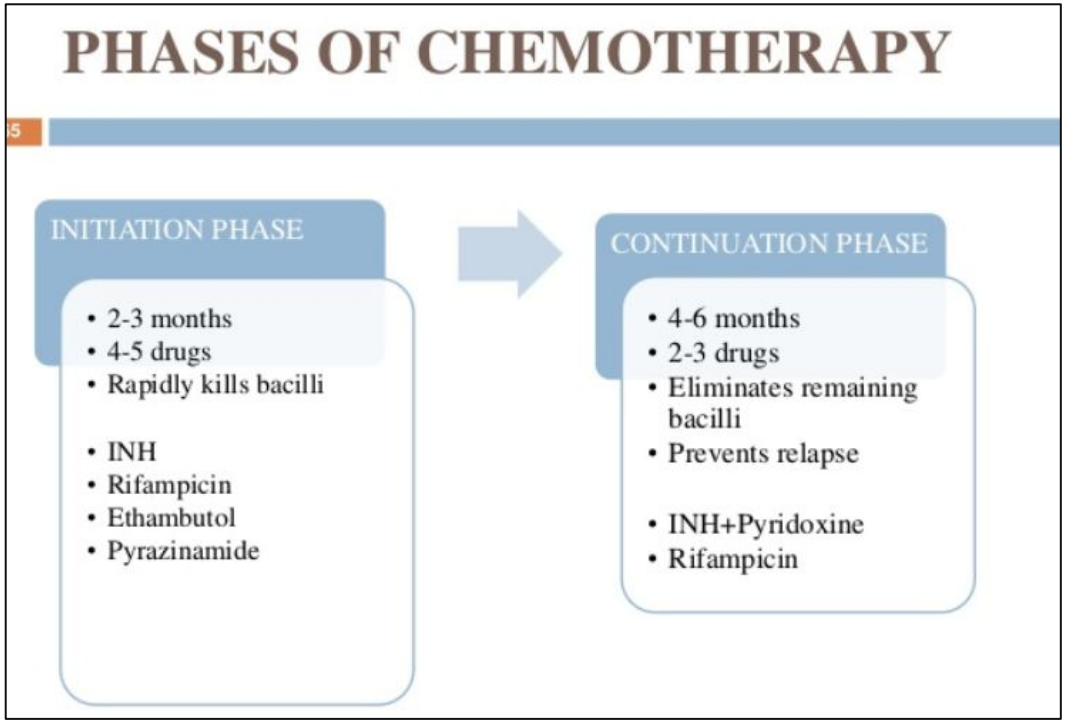
- Active against typical & atypical mycobacteria.
- **Ciprofloxacin, Levofloxacin, Moxifloxacin:** Important drugs, especially for strains resistant to first line agents.
- MOA: Inhibit bacterial DNA synthesis by inhibiting bacterial Topoisomerase II (DNA Gyrase) & topoisomerase IV

**6. RIFABUTIN/ RIFAPENTINE** :

- Derived from rifamycin & related to rifampin
- Significant activity against *M.tuberculosis , M avium & M.fortuitum.*
- Bacterial RNA polymerase inhibitor.
- Effective in prevention & treatment of atypical mycobacterial infection in AIDS

# PHASES OF CHEMOTHERAPY





# Pharmacotherapy of diabetes

- Diabetes mellitus (DM) is a **group of metabolic disorders characterized by hyperglycemia**; is associated with abnormalities in carbohydrate, fat and protein metabolism; and results in chronic complications including microvascular, macrovascular, and neuropathic disorders.
- DM is the **leading cause of blindness in adults aged 20 to 74 years**, and the leading contributor to development of **end-stage renal disease**.
- Finally, a **cardiovascular event** is responsible for 75% of deaths in individuals with type 2 DM.

## CLASSIFICATION OF DIABETES

- TYPE 1 DIABETES
- TYPE 2 DIABETES
- GESTATIONAL DIABETES MELLITUS
- Maturity onset diabetes of youth (MODY)

# TYPE 1 DIABETES

- This form of diabetes results from **autoimmune destruction** of the *β cells of the pancreas.*
- *Markers of immune destruction of the β cell are present at the time of diagnosis in 90% of individuals and include* **islet cell antibodies, antibodies to glutamic acid decarboxylase, and antibodies to insulin.**
- While this form of diabetes **usually occurs in children and adolescents**, it can occur at any age.

# GESTATIONAL DIABETES MELLITUS

- Gestational diabetes mellitus (GDM) is defined as **glucose intolerance** which is first recognized during pregnancy.
- Gestational diabetes complicates about **7% of all pregnancies**.
- Clinical detection is important, as therapy will reduce perinatal morbidity and mortality.

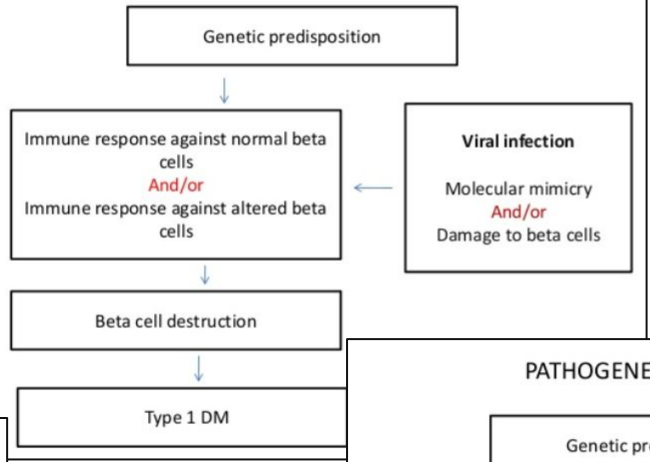
# TYPE 2 DIABETES

- This form of diabetes is **characterized by insulin resistance** and at least initially, **a relative lack of insulin secretion**.
- Most individuals with type 2 diabetes exhibit **abdominal obesity** which itself **causes insulin resistance**.
- In addition, **hypertension**, **dyslipidemia** (high triglyceride levels and low HDL-cholesterol levels), and **elevated inhibitor plasminogen activator-1 (PAI-1) levels** are often present in these individuals.
- This **clustering of abnormalities** is referred to as the "insulin resistance syndrome" or the "**metabolic syndrome**."

# Maturity onset diabetes of youth (MODY)

- Maturity onset diabetes of youth (MODY) is characterized by impaired insulin secretion with **minimal or no insulin resistance**.
- Patients typically exhibit **mild hyperglycemia at an early age**.
- The disease is inherited in an autosomal dominant pattern with at least three different loci identified to date.
- **Genetic inability to convert proinsulin to insulin** results in mild hyperglycemia and is inherited in an autosomal dominant pattern.

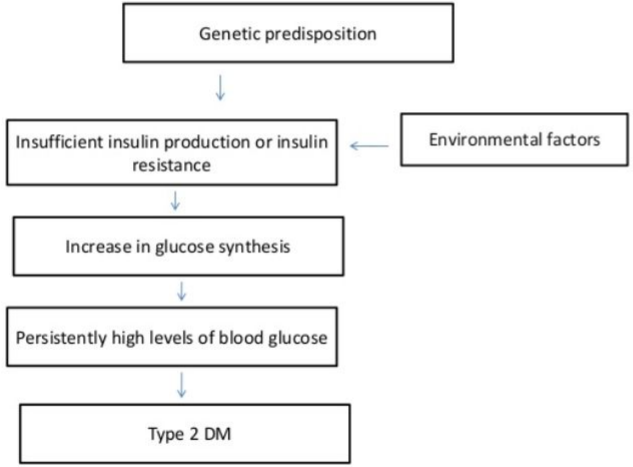
## PATHOGENESIS OF TYPE 1 DM




## ETIOLOGY

| GENETIC FACTORS | ENVIRONMENTAL FACTORS | FACTORS WITHIN INDIVIDUAL |
|---|---|---|
| •Genetic mutation of β-cells<br>•Mutation in mitochondrial DNA<br>•Genetic defects in insulin action | • Obesity<br>•Lifestyle changes<br>•Lack of physical activity | TYPE 1 DM<br>•Production of autoantibodies to destroy β- cells<br>•Deficiency in insulin secretion<br>TYPE 2 DM<br>•Insulin resistance |

## PATHOGENESIS OF TYPE 2 DM



## SIGNS AND SYMPTOMS

- Ketoacidosis
- Ketonuria

Ketones are by-products of muscle and fat breakdown when there is no enough insulin

- Glycosuria (presence of glucose in urine)
- Polydypsia (increased thirst)
- Polyuria (increased frequency of urination)
- Polyphagia (extreme hunger)
- Weight loss
- Fatigue and headache
- Blurred vision
- Frequent infections

## Management of DM

- The major components of the treatment of diabetes are:

| | |
|---|---|
| A | • **Diet and Exercise** |
| B | • **Oral hypoglycaemic therapy** |
| C | • **Insulin Therapy** |

Diabetes

## DIET

- Medical nutrition therapy is recommended for all persons with DM.
- For individuals with type 1 DM, the focus is on regulating **insulin administration** with a **balanced diet** to achieve and maintain a healthy body weight.
- Patients with type 2 DM often require **caloric restriction** to promote weight loss.

## Exercise

- In general, most patients with DM can benefit from **increased activity**.
- **Aerobic exercise** improves insulin resistance and glycemic control in the majority of individuals, and reduces cardiovascular risk factors, contributes to weight loss or maintenance, and improves wellbeing.
- **Start exercise slowly** in previously sedentary patients.

- Patients with type 1 diabetes mellitus are treated with insulin as well as diet and exercise.
- Patients with type 2 diabetes mellitus are often initially treated with diet and exercise. If those measures are not sufficient for glycemic control, patients may be prescribed oral antihyperglycemic drugs, injectable glucagon-like peptide-1 (GLP-1) receptor agonists, insulin, or a combination of these drugs.
- For some patients with diabetes, drugs often are given to prevent diabetes complications. Agents include renin-angiotensin-aldosterone system blockers (angiotensin-converting enzyme [ACE] inhibitors or angiotensin II receptor blockers [ARBs]), statins, and aspirin.

## Insulin

- Insulin is an **anabolic and anti catabolic hormone**.
- It plays major roles in protein, carbohydrate, and fat metabolism.
- Endogenously produced insulin is cleaved from the **larger proinsulin peptide** in the *β cell to the active* ***peptide of insulin*** **and C-peptide**, which can be used as a marker for endogenous insulin production.
- All **commercially** available insulin preparations contain only the active **insulin peptide**.

## TYPES OF INSULIN PREPARATIONS

- Ultra-short-acting
- Short-acting (Regular)
- Intermediate-acting
- Long-acting

| | Short-acting (regular) insulins<br>e.g. Humulin R, Novolin R | Ultra-Short acting insulins<br>e.g. Lispro, aspart, glulisine |
|---|---|---|
| Uses | Designed to control postprandial hyperglycemia & to treat emergency diabetic ketoacidosis | Similar to regular insulin but designed to overcome the limitations of regular insulin |
| Physical characteristics | Clear solution at neutral pH | Clear solution at neutral pH |
| Chemical structure | Hexameric analogue | Monomeric analogue |
| Route & time of administration | S.C. 30 – 45 min before meal<br>I.V. in emergency<br>(e.g. diabetic ketoacidosis) | S.C. 5 min (no more than 15 min) before meal<br>I.V. in emergency<br>(e.g. diabetic ketoacidosis) |
| Onset of action | 30 – 45 min ( S.C ) | 0 – 15 min ( S.C ) |
| Peak serum levels | 2 – 4 hr | 30 – 90 min |
| Duration of action | 6 – 8 hr | 3 – 4 hr |
| Usual administration | 2 – 3 times/day or more | 2 – 3 times / day or more |



## 3. Intermediate - acting insulin

**e.g. isophane (NPH)**

Turbid suspension

Injected S.C.(Only)

Onset of action 1 - 2 hr

Peak serum level 5 - 7 hr

Duration of action 13 - 18 hr

**Lente insulin**

Turbid suspension

Mixture of 30% semilente insulin

70% ultralente insulin

Injected S.C. (only)

Onset of action 1 - 3 hr

Peak serum level 4 - 8 hr

Duration of action 13 - 20 hr

**Lente and NPH insulins**

Are roughly equivalent in biological effects.

They are usually given once or twice a day.

N.B: They are not used during emergencies

(**e.g. diabetic ketoacidosis**).

## 4. Long acting insulin

**e.g.Insulin glargine**

Onset of action 2 hr

Absorbed less rapidly than NPH & Lente insulins.

Duration of action upto 24 hr

Designed to overcome the deficiencies of intermediate acting insulins

**Advantages** over intermediate-acting insulins:

- Constant circulating insulin over 24hr with no pronounced peak.
- More safe than NPH & Lente insulins due to reduced risk of hypoglycemia(esp.nocturnal hypoglycemia).
- Clear solution that does not require resuspention before administration.

## COMPLICATIONS OF INSULIN THERAPY

- Severe Hypoglycemia (< 50 mg/dl ) – Life threatening

  Overdose of insulin

  Excessive (unusual) physical exercise

  A meal is missed
- Weight gain
- Local or systemic allergic reactions (rare)
- Lipodystrophy at injection sites
- Insulin resistance
- Hypokalemia

**Oral hypoglycemic/Antihyperglycemic drugs:**

Oral antihyperglycemic drugs may

- Enhance pancreatic insulin secretion (secretagogues)
- Sensitize peripheral tissues to insulin (sensitizers)
- Impair gastrointestinal absorption of glucose
- Increase glycosuria

**1. Sulfonylureas: insulin secretagogues**

- The primary mechanism of action of lower plasma glucose by stimulating pancreatic beta-cell insulin secretion.
- Sulfonylureas bind to a specific sulfonylurea receptor (SUR) on pancreatic β cells and Elevates secretion of insulin from the pancreas.
- They and may secondarily improve peripheral and hepatic insulin sensitivity by reducing glucose toxicity.

**2. Biguanides**

- lower plasma glucose by decreasing hepatic glucose production (gluconeogenesis and glycogenolysis).
- **Metformin** is the only biguanide available, been used clinically for 45 years.
- Metformin enhances insulin sensitivity of both hepatic and peripheral (muscle) tissues. This allows for an increased uptake of glucose into these insulin- sensitive tissues. Metformin has no direct effect on the β cells

**3. Alpha-glucosidase inhibitors**

- **Acarbose, Miglitol**: competitively inhibit intestinal enzymes that hydrolyze dietary carbohydrates
- carbohydrates are digested and absorbed more slowly, thereby lowering postprandial plasma glucose.
- Alpha-glucosidase inhibitors are less effective than other oral drugs in reducing plasma glucose, and patients often stop the drugs because they may cause dyspepsia, flatulence, and diarrhea.
- But the drugs are otherwise safe and can be used in combination with all other oral drugs and with insulin.

**4. Short-acting insulin secretagogues**

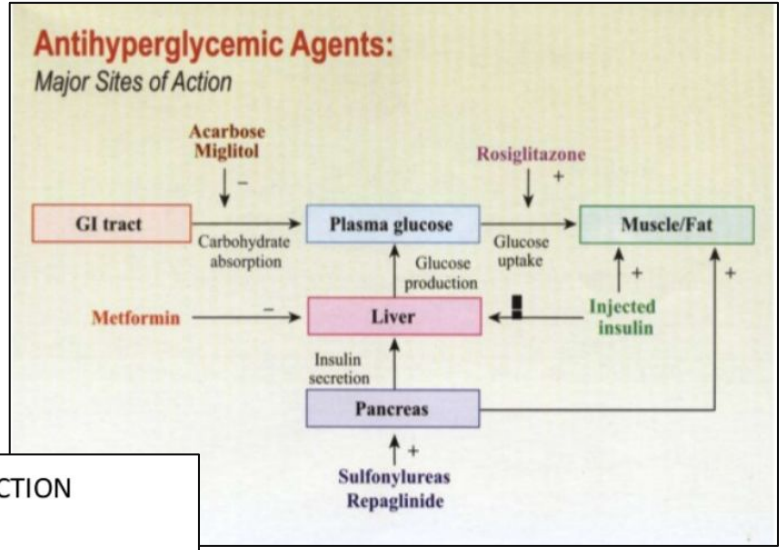
- **repaglinide, nateglinide:** stimulate insulin secretion in a manner similar to sulfonylureas.
- stimulate insulin secretion more during meals than at other times
- Patients who have not responded to other oral drugs (eg, sulfonylureas, metformin) are not likely to respond to these drugs.

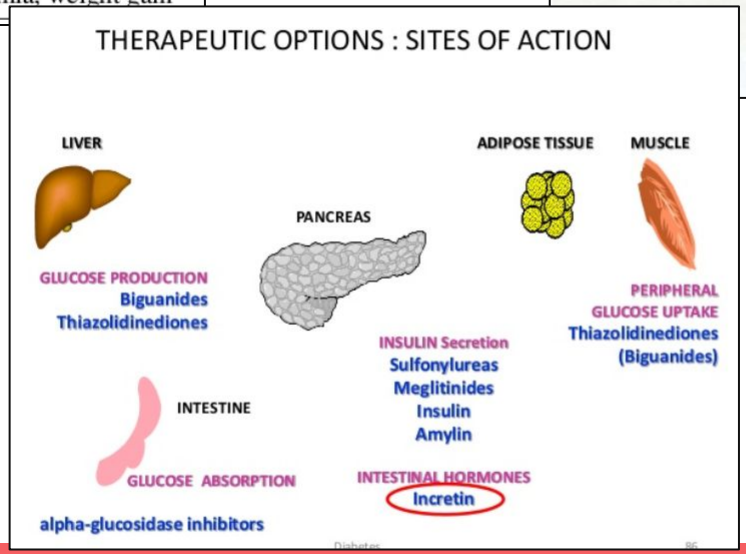
**5. Thiazolidinediones**

- **TZDs—pioglitazone, rosiglitazone:** decrease peripheral insulin resistance ( insulin sensitizers), but their specific mechanisms of action are not well understood.
- The drugs bind a nuclear receptor primarily present in fat cells that is involved in the transcription of genes that regulate glucose and lipid metabolism.

## Current Medications for Treatment of Diabetes

| Drug Class | Side Effects |
|---|---|
| Sulfonylureas | Hypoglycemia, weight gain |
| Meglitinides | Hypoglycemia, weight gain |
| Metformin | GI intolerance |
| Thiazolidinediones | Edema, weight gain |
| α-Glucosidase inhibitors | GI intolerance |
| Insulin | Hypoglycemia, weight gain |



## Hormone replacement therapy

- Hormone replacement therapy (HRT) is a treatment to relieve symptoms of the menopause. It replaces hormones that are at a lower level as you approach the menopause.
- Hormone replacement therapy (HRT) can help balance estrogen and progesterone levels during or near menopause.
- Also known as menopausal hormone therapy, HRT can help relieve sweating, hot flashes, and other symptoms of menopause. It can also reduce the risk of osteoporosis.
- Some types of HRT contain both progesterone and estrogen, while others contain only estrogen. Sometimes they contain testosterone.
- Hormone therapy has also been proved to prevent bone loss and reduce fracture in postmenopausal women
- However, there are risks associated with using hormone therapy. These risks depend on the type of hormone therapy, the dose, how long the medication is taken and your individual health risks

Around menopause, many people experience:

- hot flashes and night sweats
- vaginal dryness
- bone thinning, or osteoporosis
- urinary problems
- thinning hair
- sleep problems
- mood changes
- irregular periods
- difficulties with concentration and memory

**Basic types of hormone therapy**

Hormone replacement therapy primarily focuses on replacing the estrogen that your body no longer makes after menopause.

There are two main types of estrogen therapy:

- **Systemic hormone therapy.** Systemic estrogen — which comes in pill, skin patch, ring, gel, cream or spray form — typically contains a higher dose of estrogen that is absorbed throughout the body. It can be used to treat any of the common symptoms of menopause.
- **Low-dose vaginal products.** Low-dose vaginal preparations of estrogen — which come in cream, tablet or ring form — minimize the amount of estrogen absorbed by the body. Because of this, low-dose vaginal preparations are usually only used to treat the vaginal and urinary symptoms of menopause.

If hysterectomy (removal of uterus) is not done doctor will typically prescribe estrogen along with progesterone or progestin (progesterone-like medication). This is because estrogen alone, when not balanced by progesterone, can stimulate growth of the lining of the uterus, increasing the risk of endometrial cancer.

**Risks of hormone therapy**

hormone replacement therapy that consisted of an estrogen-progestin pill (Prempro) increased the risk of certain serious conditions, including:

- Heart disease
- Stroke
- Blood clots
- Breast cancer

**Who can take HRT**

Most women can have HRT if they're having symptoms associated with the menopause.

But HRT may not be suitable if you:

- have a history of breast cancer, ovarian cancer or womb cancer
- have a history of blood clots
- have untreated high blood pressure – your blood pressure will need to be controlled before you can start HRT
- have liver disease
- are pregnant – it's still possible to get pregnant while taking HRT, so you should use contraception until 2 years after your last period if you're under 50, or for 1 year after the age of 50

## Types of HRT

There are various ways of delivering hormone therapy, and the different types provide different combinations and amounts of hormones.

Common types include:

**Estrogen-only HRT**: A doctor may recommend this if a person has had their uterus and ovaries removed, in which case progesterone is not necessary.

**Cyclical, or sequential, HRT:** This may be a good option if symptoms occur before menopause; the dosage can align with the menstrual cycle.

**Continuous HRT**: After menopause, a doctor may prescribe a continuous combination of estrogen and progesterone.

**Local estrogen**: Vaginal tablets, creams, or rings can help with urogenital symptoms, including vaginal dryness and irritation.

Menopause is not an illness. It is a natural transition from the years in which a female can reproduce to the next phase of life.

Many people go through menopause without requiring any treatment. However, if the transition causes troubling or distracting symptoms, a variety of treatment approaches are available.

HRT can help manage some of the symptoms of menopause.