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## UNIT 2 ESSENTIAL DRUGS - 2

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## 2.0 INTRODUCTION

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According to the World Health Organization, “a drug is any substance or product that is used or intended to be used to modify or explore physiological systems or pathological states for the benefit of recipients”. In the previous unit you have learnt about the usage and pharmacology of some common drugs. In the present unit you will learn about the often used medicines used to treat some more common diseases. Drugs are not always used to treat any disease; these are also used to prevent some diseases, like consumption of iron tablets regularly will prevent the development of anaemia in an individual. A drug may be classified by the chemical type of the active ingredient or by the way it is used to treat a particular condition. There are many drugs available to treat one particular condition, but the time tested ones are preferred even by new physicians. A new drug has to wait for many years to be established as the common drug to treat a particular condition and to win the confidence of physicians’. The drugs in a particular section of this unit are used to treat a particular condition. The mechanism of

action, uses, indications, contraindications and the common side effects of these drugs are described. Be cautious that since all medicine has an active chemical ingredient and any person can develop any sort of reaction after taking a medicine (called idiosyncratic reaction), it is advisable that you do not prescribe these medicines without consulting a qualified physician.

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## 2.1 OBJECTIVES

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At the end of the unit, you will be able to:

- list the drugs used in gastrointestinal infections and disturbances;
- discuss the benefits of prenatal steroids with your clients;
- counsel about the usage of nutritional supplements to a person;
- understand the difference between various intravenous fluids used in hospitals;
- prescribe oral rehydration solutions to a diarrhoea patient;
- enumerate drugs used to treat raised blood pressure and epilepsy diabetes;
- discuss the harmful effects of regular usage of sedatives with your clients; and
- list the drugs used for relief of respiratory difficulty.

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## 2.2 DRUGS USED TO TREAT INTESTINAL INFESTATION

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Any pathogen, be it bacteria, virus, fungus or protozoa can enter our gastrointestinal tract (GIT) and cause GI symptoms. Most common amongst all the pathogens infecting our GIT are the helminthes. Tapeworms, roundworms and flukes are classified as helminthes. These helminthes are present in nearly 70% of Indians. They are more common in developing and less developed countries with poor personal and environmental hygiene. Sometimes different types of helminths infect same individual. In addition, they may be found in blood and tissues of human beings. They do harm to our body by depriving us of the nutrients which we consume by mouth, causing blood loss, injury to tissues and secreting toxins. Anthelmintics are effective in removing worms from the body but proper hygiene is necessary to prevent re-infection. Washing hands properly is of utmost importance.

### 2.2.1 Anthelmintic Drugs

Anthelmintics are a group of drugs that expel parasitic worms and other internal parasites from the body. They act by either paralysing or killing them. They are also known as vermifuges (those that paralyses the worms) or vermicides (those that kill the worms).

**Uses:** Anthelmintics are also used in mass deworming campaigns of school going children in India. The following table shows the common helminths available in India and first line of drugs used to treat them.

**Table 2.1: Common Worms Prevalent in India and the First Choice Drugs for Treatment**

Worm	First Choice Drugs
Round worm ( <i>Ascarislumbricoides</i> )	Mebendazole, Albendazole, Pyrantel
Hookworm <i>Ancylostomaduodenale</i> <i>Necatoramericanus</i>	Pyrantel, Mebendazole, Albendazole Mebendazole, Albendazole
Thread worm ( <i>Enterobiusvermicularis</i> )	Pyrantel, Mebendazole, Albendazole
<i>Stongyloidesstercoralis</i>	Ivermectin
Whip worm ( <i>Trichuristrichiura</i> )	Mebendazole
<i>Trichinella spiralis</i>	Albendazole
Fialria ( <i>Wuchereriabancrofti</i> , <i>Brugiamalayi</i> )	Diethyl carbamazine, Ivermectin
Tape worms <i>Taeniasaginata</i> <i>Taeniasolium</i> <i>Hymenolips nana</i> <i>Neurocysticersoris</i>	Praziquantel Praziquantel Praziquantel Albendazole
Hydatid disease ( <i>Echinococcusgranulosus</i> , <i>E. multoloucris</i> )	Albendazole

**Table 2.2: Common Anthelmintic**

Name of Drug	Use	Dose	Side Effects	Contraindications	Precautions
Mebendazole	Hookworm, roundworm, pinworm, whipworm	100 mg PO q12hr for 3 consecutive days	Angioedema, fever, dizziness, headache, haematuria, leukopenia, seizures, anaemia	Hypersensitivity	Neutropenia and agranulocytosis
Diethyl carbamazine	W. Bancrofti, B Malayi	Day 1: 50 mg PO PCDay 2: 50 mg TIDDay 3: 100 mg TIDDay 4-14: 6 mg/kg/day divided TID	Fever, GI disturbances	Pregnancy	Safe drug
Albendazole	Neurocysticercosis, Ancylostoma, Ascariasis, Hookworm	400 mg PO BID x 8-30 days 400 mg PO once	Headache, liver problem, abdominal pain, nausea, vomiting	Hypersensitivity to the drug	Potential for bone marrow suppression, advice blood count regularly

Name of Drug	Use	Dose	Side Effects	Contraindications	Precautions
Pyrantel	Hookworm, roundworm, pinworm	11 mg/kg PO x1 dose; not to exceed 1 g/dose	Dizziness, drowsiness, insomnia, headache, rash, anorexia, nausea, vomiting, abdominal cramps	Hypersensitivity, Intestinal obstruction, Hepatic disease	Anaemia, hepatic impairment, malnutrition
Ivermectin	Strongyloidiasis of the Intestinal Tract	12 mg PO once	Abdominal pain, Hypotension, Dizziness, Headache, Hyperthermia, Insomnia, Rash, Urticaria, Eosinophilia, Leukopenia, Hepatitis, Tremor, Blurred vision	Hypersensitivity to ivermectin	May cause cutaneous and/or systemic reactions, Take on empty stomach

### 2.2.2 Anti-Amoebic Drugs

Anti-amoebic drugs are used in infection caused by protozoa *Entamoeba histolytica*. Amoebiasis is endemic in most part of India. Poor environmental sanitation and low socio-economic status are important factors in spread of the disease. It spreads through fecal contamination of food and water. It causes dysentery and amoebic liver abscess. The common anti-amoebic drugs are metronidazole, tinidazole, secnidazole, ornidazole, satranidazole and diloxanidefuroate.

**Uses:** These drugs are used in the treatment of amoebiasis, giardiasis, trichomonas vaginitis, anaerobic bacterial infections, pseudomembranous enterocolitis (caused by *Clostridium difficile*).

**Adverse effects:** Side effects of metronidazole is frequent, but mostly non-serious. Nausea, anorexia, metallic taste and abdominal cramps are frequent. Less common side effects are headache, dryness of mouth, glossitis, dizziness and rashes.

**Interactions:** Person taking metronidazole should avoid alcohol as intolerance to alcohol may develop.

**Table 2.3: Common Anti-amoebic Drugs**

Name of Drug	Use	Dose	Side Effects	Contraindications	Precautions
Metronidazole	Acute intestinal amoebiasis, Hepatic amoebiasis	400 mg tablets TDS for 10 days 2g/ day in	Nausea, headache, dry mouth, metallic taste	Hypersensitivity	Disulfiram like reactions when combined with alcohol

Name of Drug	Use	Dose	Side Effects	Contraindications	Precautions
	Vaginal & urethral Trichomoniasis Giardiasis	OD dose 250 mg thrice daily for 10 days			
Tinidazole	Intestinal amoebiasis, amoebic liver abscess	2 g/day PO for 3 days dizziness,	Anorexia, constipation, trimester of dysgeusia, dyspepsia	Hypersensitivity 1st pregnancy	History of blood dyscrasias, hepatic impairment. Risk of convulsive seizures & peripheral neuropathy
Diloxanide furoate	Amoebiasis	500 mg TDS for 10 days	Nausea, loss of appetite, diarrhoea, abdominal cramps, flatulence	Hypersensitivity 1st trimester of pregnancy	Dizziness may occur, careful while driving
Ornidazole	Amoebiasis, Amoebic dysentery, Trichomoniasis, Giardiasis	0.5 g BID for 5-10 days 1.5 g OD for 3 days 1.5 g once 1.5 g OD for 1-2 days	Somnolence, headache, nausea, vomiting, dizziness, tremor, rigidity, poor coordination, seizures	Hypersensitivity	Renal and hepatic impairment

### Check Your Progress 1

1) List harmful effects caused by worms.

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2) Anthelmintic drugs – explain meaning.

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3) Name the drugs used for mass deworming campaign.

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4) List the indications for Mebandazole.  
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5) List common anti-amoebic drugs.  
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## 2.3 CORTICOSTEROIDS IN PREGNANCY

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Labor before 37 weeks of pregnancy is called preterm labour. The longer the baby stays inside the mother, the less likely s/he will have problems associated with preterm birth. A baby born prematurely can have problems of the lungs, heart, brain, and other body systems. Recent advances in the study of preterm labour have identified effective drugs that may delay delivery. Tocolytic medicines are given to prevent uterine contractions for preterm labour. Steroid treatment reduces the risk of lung problems in babies who are born early, especially for those born between 29 and 34 weeks of pregnancy. Studies has shown that the steroid treatment reduces the risk of lung disease to half and reduces a premature baby’s risk of dying by up to 40 per cent. Steroids may also help reduce other complications in the baby like fewer problems with their intestines and bleeding in the brain. The steroid injections are given two to four times over a two-day period, depending on which steroid is used. Corticosteroid regimens shown to be effective include: betamethasone 12 mg intramuscularly, 2 doses 24 hours apart; or dexamethasone 6 mg intramuscularly 4 doses 12 hourly.

### 2.3.1 Risks of Taking Steroids in Pregnancy

It is seen that administration of steroids to a pregnant female can affect the immune system, neurological development, and growth of her fetus. However, low dosage of steroids given in later half of pregnancy is safe.

#### Contraindications of corticosteroids

Corticosteroid should not be given if women have generalised infection like sepsis.

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## 2.4 NUTRITIONAL SUPPLEMENTS

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A variety of nutritional supplements are available in the market. It is tough to figure out what to choose from among the numerous boxes of dietary and nutritional supplements. There are supplements available to decrease weight, increase weight or even remove tiredness. These contains minerals and vitamins.

**Need of dietary supplements:** We should keep in mind that that dietary supplements are there to supplement the diet, not to replace a balanced diet. Supplements can enhance a diet where there are deficiencies, but a mixture of vitamin, mineral or other dietary supplements in a tablet, capsule or syrup can

never take the place of a balanced diet. Some people may require supplements because the vitamins or minerals they need are difficult to get in adequate amounts in the diet. These group of individuals needs dietary supplements: pregnant women, nursing mothers, strict vegetarians, people with food allergies or intolerances and senior citizens. Taking a once-daily multivitamin is not harmful, as long as it is selected based on one's age and sex. Let us learn about the common food supplements.

### 2.4.1 Calcium

We get enough calcium from dairy products, dark leafy greens, soybeans, beans and fish. Calcium supplementation is generally recommended for pregnant and nursing mothers. It's use in the prevention of fracture in peri-menopausal and elderly women is recently questioned by a study. Calcium supplement usually contain calcium citrate or lactate. Taking a daily or weekly vitamin D supplement or getting safe sun exposure to have adequate blood levels of vitamin D helps in the absorption of calcium.

### 2.4.2 Iron

Iron deficiency is the most common form of malnutrition in the world, affecting more than 2 billion people globally. Iron deficiency anaemia is highly prevalent in less-developed. Amongst all the causes of anaemia, iron deficiency is usually the most common cause. The prevalence of anaemia, defined by low haemoglobin is commonly used to assess the severity of iron deficiency in a population. It is most prevalent and severe in young children and women of reproductive age. It may also be found in older children, adolescents, adult men and the elderly. Iron deficiency anaemia occurs when iron stores are exhausted and the supply of iron to the tissues is less. It generally develops slowly and is not clinically apparent until anaemia is severe. Severe anaemia is defined clinically as a low haemoglobin concentration leading to cardiac decompensation. Here heart cannot maintain adequate circulation of the blood. Individual feels breathless at rest. In practical settings, severe anaemia may be defined by using a haemoglobin or haematocrit cutoff or by extreme pallor. If the haemoglobin or haematocrit can be determined, cutoffs of haemoglobin below 7.0 g/dL or haematocrit below 20% is used to define severe anaemia. Clinically pallor can be seen in the inferior conjunctiva of the eye, the nail beds, and the palm. If any of these sites is abnormally pale, the individual should be considered to be severely anemic.

Pregnant and postpartum women and children less than 6 years of age are the priority target groups for any iron supplementation programme. Where parasitic infections are common, giving anthelmintic along with iron supplements may increase the effectiveness of supplementation.

Infants are normally born with plenty of iron. However, beyond 6 months of age, iron content of milk is not sufficient to meet many infants' requirements and complementary foods are usually low in iron. Low-birth-weight infants (less than 2500 g) are born with fewer iron stores and are at high risk of deficiency after 2 months. Where iron-fortified complementary foods are not widely and regularly consumed by young children, infants should routinely receive iron supplements in the first year of life. Individuals diagnosed with severe anaemia and treated with oral iron therapy should be asked to return for evaluation 1 week and 4 weeks after iron supplementation is begun. The purpose of this follow-up is to

refer individuals who are in need of further medical attention. Specifically, individuals should be referred to a hospital if their condition has worsened at the 1-week follow-up visit or if their condition shows no improvement at the 4-week follow-up visit.

Iron is best absorbed on an empty stomach (usually if taken 1 hour before or 2 hours after meals). If stomach upset occurs, the iron tablet or syrup may be taken with food. Antacids, dairy products, tea, or coffee should be avoided within 2 hours before or after iron supplementation because they will decrease its effectiveness. Constipation, diarrhoea, stomach cramps, or upset stomach may occur following its use. These effects are usually temporary and may disappear. Iron may cause stools to turn black, an effect that is not harmful.

### 2.4.3 Folic Acid

Folate and folic acid are forms of a water-soluble B vitamin. Folate occurs naturally in food, and folic acid is the synthetic form of this vitamin. Foods that are naturally high in folate include leafy vegetables, fruits (bananas, melons, and lemons), beans, mushrooms, meat, orange juice, and tomato juice. Folic acid is mostly used to prevent and treat anaemia with iron. Folic acid is also used for other conditions commonly associated with folate deficiency, including ulcerative colitis, liver disease, alcoholism, and kidney dialysis. Some people use folic acid to prevent colon cancer or cervical cancer. It is also used to prevent heart disease and stroke, as well as to reduce blood levels of homocysteine which is a risk for heart disease. It is also used in Alzheimer's disease, age-related hearing loss, prevention of age-related macular degeneration, reducing signs of aging, nerve pain, muscle pain, and vitiligo. Folic acid is often used in combination with other B vitamins. All women of childbearing age should consume 0.4 mg (400 micrograms) of folic acid daily to prevent two common and serious birth defects, spina bifida and anencephaly.

The World Health Organization (WHO) recommends that daily oral iron and folic acid supplementation should be a part of the antenatal care to reduce the risk of low birth weight, maternal anaemia and iron deficiency.

**Side effects:** Folic acid is unsafe when taken in large doses for long-term. High doses of folic acid might cause abdominal cramps, diarrhoea, rash, sleep disorders, irritability, confusion, nausea, behaviour changes, seizures, excitability, and other side effects.

### 2.4.4 Zinc

Zinc is an 'essential trace element' because very small amounts of zinc are necessary for human health. Zinc deficiency is associated with an increased risk of gastrointestinal infections, adverse effects on the structure and function of the gastrointestinal tract, and impaired immune function. Dietary deficiency of zinc is especially common in low-income countries because of a low dietary intake of zinc-rich foods (mainly foods of animal origin) or inadequate absorption caused by its binding to dietary fiber and phytates often found in cereals, nuts and legumes.

**Uses:** Zinc is used for treatment and prevention of zinc deficiency and its consequences, including stunted growth and acute diarrhoea in children, and slow wound healing. Supplementary zinc benefits children with diarrhoea because it is a vital micronutrient essential for protein synthesis, cell growth and differentiation,



immune function, and intestinal transport of water and electrolytes. Zinc supplementation has been found to reduce the duration and severity of diarrheal episodes and likelihood of subsequent infections for 2 to 3 months. It is also used for boosting the immune system, treating the common cold and recurrent ear infections, and preventing lower respiratory infections. Some people use zinc for an eye disease called macular degeneration, for night blindness, and for cataracts. It is also used for asthma, diabetes, high blood pressure, acquired immunodeficiency syndrome (AIDS), and skin conditions such as psoriasis, eczema, and acne. Some people use zinc for benign prostatic hyperplasia (BPH), male infertility, erectile dysfunction (ED), weak bones, rheumatoid arthritis, and muscle cramps. It is also used for sickle cell disease and inherited disorders such as acro dermatitis enteropathica, thalassemia, and Wilson’s disease. Zinc is also applied to the skin for treating acne, aging skin, and herpes simplex infections. Zinc citrate is used in toothpaste and mouthwash to prevent dental plaque formation and gingivitis. Taking zinc supplements regularly is not recommended.

**Check Your Progress 2**

1) Explain uses of corticosteroids in pregnancy.

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2) Name corticosteroids which are used in pregnancy.

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3) List the group of people who are in need for nutritional supplements.

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4) List symptoms of anaemia.

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5) Target group for iron supplementation is

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6) List indications for Zinc.

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## 2.5 INTRAVENOUS FLUIDS

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Intravenous fluid administration is undoubtedly the most common procedure done for all admitted patients in the hospital. There are different type of IV fluids and each has its distinct use. We will learn about the two most commonly used IV fluids in clinical settings: Normal saline or NS and Ringer's lactate or RL.

### 2.5.1 Normal Saline

Normal saline is a mixture of salt and water. It is called normal because its salt concentration is similar to tears, blood, and other body fluids (0.9% saline, as it contains 9.0 g of salt per liter). It is also called isotonic solution. In medicine, saline (also saline solution) is a solution of sodium chloride (NaCl, table salt) in water. It is used to flush wounds and skin abrasions, as eye drops, for intravenous infusion, rinsing contact lenses, nasal irrigation, and a variety of other purposes.

**Uses:** IV Saline is most commonly used for supplying extra water to rehydrate patients or supplying the daily water and salt needs of a patient who is unable to take them by mouth. The amount of normal saline infused depends largely on the needs of the patient.

**Precautions:** Hypervolemia should be avoided. It should be used with great care in patients with congestive heart failure, severe renal insufficiency and in clinical states in which there exists oedema with sodium retention.

**Adverse reactions:** Reactions which may occur because of the solution or the technique of administration include febrile response, infection at the site of injection, venous thrombosis or phlebitis extending from the site of injection, extravasation, and hypervolemia.

### 2.5.2 Ringer's Lactate

Ringer's lactate injection is a sterile, non-pyrogenic solution for fluid and electrolyte replenishment in single dose containers for intravenous administration. Ringer's lactate solution is used for fluid resuscitation after a blood loss due to trauma, surgery, or a burn injury. The solution is used because the by-products of lactate metabolism in the liver counteract acidosis, which is a chemical imbalance that occurs with acute fluid loss.

**Dosage:** The IV dose of Ringer's lactate solution is usually calculated by estimated fluid loss and presumed fluid deficit. For fluid resuscitation the usual rate of administration is 20 to 30 ml/kg body weight/hour. It is not suitable for maintenance therapy because the sodium and potassium contents is very low in it. Moreover, since the lactate is converted into bicarbonate, long term use will cause patients to become alkalotic. Ringer's lactate and other fluids are also used as vehicles for the IV delivery of drugs.

**Precautions:** Lactated Ringer's Injection, should be administered with particular caution to patients with hyperkalemia or conditions predisposing to hyperkalemia (such as severe renal impairment or adrenocortical insufficiency, acute dehydration, or extensive tissue injury or burns) and in patients with cardiac disease. Regular monitoring of vital signs and electrolyte concentration in blood is required while the patient is on Ringer's lactate solution.

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## 2.6 DRUGS USED FOR GASTROINTESTINAL DISTURBANCES

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Indigestion and constipation are the most common gastrointestinal symptoms complained by many individuals besides gastritis. Some take enzyme preparations without consulting a physician thinking that it will help in digesting the food. Let us learn a bit about the various enzyme preparations and laxatives available in the market.

### 2.6.1 Enzyme Preparations

Enzymes are naturally occurring bio-catalysts found in the living organisms. There is no cell or tissue in the body which is devoid of an enzyme. They facilitate many biochemical reactions in the body. They require specific set of conditions for efficient function. These conditions include optimal temperature, pH, concentration of substrate etc. Due to advanced knowledge and technology, these enzymes are isolated for human use by various methods.

**Uses:** There are various enzymes which has a variety of uses, not just for digesting food.

- Enzymes are used to assist metabolism. In geriatric patients, the digestive capacity is low due to insufficient secretion of digestive enzymes. Hence their digestive system cannot digest food materials efficiently. In such cases they can experience malnutrition, constipation, bloating etc. To aid digestion, enzymes like Papain are administered orally after food for easier digestion.
- Enzymes like Streptokinase, Urokinase are used in dissolution of blood clots following head or spinal injuries, stroke or heart attacks.
- Enzymes like trypsin, chymotrypsin, serratopepetidase are used to dissolve the swelling and helps in faster wound healing.
- Some drugs need to penetrate deeper tissues for better action. For this some enzymes are used along with drugs in intra-muscular injection forms to help proper penetration of tissues. One of the such enzyme is Hyaluronidase.

### 2.6.2 Laxatives

How often one have a bowel movement varies, but people normally have as many as three bowel movements a day to as few as three a week. A person may be constipated if he has fewer bowel movements than normal for him. In addition, constipation may involve stools that are difficult to pass because they are hard, dry or small. Laxatives are substances that loosen stools and increase bowel movements. They are used to treat and prevent constipation. But not all laxatives are safe for long-term use. Ideally, laxatives should only be used occasionally and for short periods of time. One should stop taking a laxative when his constipation improves. Overuse of certain laxatives can lead to dependency and decreased bowel function. So, it is important that before turning to laxatives, one should follow some lifestyle changes to help with constipation like eating fiber-rich foods, such as wheat bran, fresh fruits and vegetables, and oats, drink plenty of fluids, and exercise regularly. Lifestyle improvements relieve constipation for many people, but if problems continue despite these changes, mild laxative may be prescribed.

**Classification:**

- Bulk forming relieves constipations by increasing faecal mass: Ispaghula Adults 6 teaspoonful of water or milk at night. Children 1–3 teaspoonful of water or milk at night.
- Stool softener: Liquid paraffin, docusates. Dose upto 45 ml/day usually in the evening.
- Stimulant purgatives: Bisacodyl, Senna, Castor oil
- Osmotic purgatives: Magnesium salts, Sodium salts, Lactulose

**Mechanism of action:** Laxatives work in different ways, and the effectiveness of each laxative type varies from person to person. In general, bulk-forming laxatives, also referred to as fiber supplements, are the mildest and safest to use for long term. Stimulant laxatives, such as Dulcolax are the harshest and should be used only occasionally. All laxatives increase the water contents of faeces. Some increases the motility of gut.

**Side effects:** Oral laxatives may interfere with body's absorption of some medications and nutrients. Some laxatives can lead to an electrolyte imbalance, especially after prolonged use. Other common side effects of most laxatives are bloating, flatulence, abdominal cramps and dehydration. Laxative use can be dangerous if constipation is caused by a serious condition, such as appendicitis or a bowel obstruction. If laxatives are used too frequently for weeks or months, they can decrease colon's ability to contract and actually worsen constipation.

**Precautions for pregnant women and children:** Children should not be given laxatives without a physician's recommendation. Bulk-forming laxatives and stool softeners are generally safe to use during pregnancy, but stimulant laxatives may be harmful.

**Table 2.4: Common Laxatives**

Name of Drug	Use	Dose	Side Effects	Contraindications	Precautions
Psyllium	Bulk laxative	1 teaspoonful in 250 ml water	Abdominal cramping Constipation Flatulence	Hypersensitivity, GI obstruction, fecal impaction	Safe
Magnesium hydroxide	Lubricant laxative	30-60 ml/day HS	Hypotension, respiratory depression, abdominal cramping, electrolyte imbalance, muscle weakness	Renal failure, existing electrolyte imbalance, acute surgical abdomen, myocardial damage, heart block, faecal impaction, rectal fissures, intestinal obstru-	Renal insufficiency

Name of Drug	Use	Dose	Side Effects	Contraindications	Precautions
				ction or perforation, pregnant, bedridden, dysphagia	
Lactulose	Osmotic laxative	5-30 mL PO once daily	Dehydration, diarrhoea, excessive bowel activity, hypernatremia, hypokalemia	Galactosemia (patients require low-galactose diet)	Diabetes, monitor for electrolyte imbalance
Bisacodyl	Stimulant laxative	5-15 mg PO once daily	Abdominal cramping, electrolyte and fluid imbalance, excessive diarrhoea, Nausea	Hypersensitivity, obstruction or severe impaction, symptoms of appendicitis or acute surgical abdomen, vomiting, rectal bleeding	Avoid chronic use; may cause laxative dependence
Docusate	Stool softener	50-300 mg PO once daily or divided doses	Abdominal cramping Diarrhoea, intestinal obstruction Throat irritation	Hypersensitivity intestinal obstruction, symptoms of appendicitis or acute abdominal pain, faecal impaction	Electrolyte imbalance, dependence

**Check Your Progress 3**

1) List precautions while using normal saline.

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2) Explain the uses of Ringer Lactate solution.

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3) Explain uses of enzymes.  
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4) List side effects due to laxatives.  
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5) List common laxatives.  
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## 2.7 DRUGS USED FOR HYPERTENSIVE DISORDERS AND DIABETES MELLITUS

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Hypertension is defined as level of blood pressure which is high for one’s age and sex. Usually if anyone’s blood pressure is consistently above 140/90 mm of Hg despite strictly following the non-pharmacological ways of controlling blood pressure, s/he needs to take anti-hypertensive medication. There are a variety of anti-hypertensive medicines available. The goal is to reduce BP to <140/90 mmhg.

Antihypertensive therapy prevents the complications of high blood pressure, such as stroke and heart attacks. Evidence suggests that reduction of the blood pressure by 5 mm of Hg can decrease the risk of stroke by 34% and ischemic heart disease by 21%. They also reduce the likelihood of dementia, heart failure, and mortality from cardiovascular disease. There are many classes of antihypertensives, which lower blood pressure by different means (see Table 2.5). Among the most important and most widely used drugs are thiazide diuretics, calcium channel blockers, ACE inhibitors, angiotensin II receptor antagonists (ARBs), and beta blockers.

Which type of medication to use initially for hypertension has been the subject of several large studies and resulting national guidelines. Patient age, associated clinical conditions and end-organ damage plays a part in determining dosage and type of medication administered. The several classes of antihypertensives differ in side effect profiles, ability to prevent endpoints, and cost. As of now, the best available evidence favours the thiazide diuretics as the first-line treatment of choice for high blood pressure when drugs are necessary. Although clinical evidence shows calcium channel blockers and thiazide-type diuretics are preferred first-line treatments for most, an ACE inhibitor is recommended for those under 55 years old. For mild blood pressure elevation, experts suggest medically supervised lifestyle changes and observation before recommending initiation of drug therapy. People with hypertension should follow these advices:

- quit smoking;
- reduce salt intake;

- eat less preserving and processed food;
- drink less caffeinated beverages;
- do moderate exercise regularly;
- keep optimal body weight and;
- learn self-relaxation techniques like Yoga.

**Side Effects:** Side effects of antihypertensive drugs vary with individual drugs. Common side effects include headache, weakness or fatigue, dizziness upon rising quickly from a sitting or lying position, numbness or sharp pain in fingers or toes, cold hands and feet, dry eyes, mouth and throat, and cough.

**Table 2.5: Common Antihypertensives**

Name of Drug	Use	Dose	Side Effects	Contraindications	Precautions
Hydrochlorothiazide	Hypertension	12.5-50 mg PO once daily	Anaphylaxis Anorexia Confusion Disorder of haematopoietic structure Dizziness Epigastric distress	Hypersensitivity	Use with caution in diabetes mellitus, fluid or electrolyte imbalance, hypercholesterolemia, hyperuricemia or gout, hypercalcemia
Furosemide	Hypertension, oedema	20-80 mg PO divided q12hr	Hyperuricemia, hypokalemia, anaphylaxis, anaemia, anorexia, diarrhoea, dizziness, glucose intolerance	Renal failure	In excessive amounts, may lead to profound diuresis with water and electrolyte depletion
Enalapril	Hypertension	2.5-40 mg PO daily	Dizziness, hypotension, headache, chest pain, dry cough, rash	History of ACE inhibitor-induced angioedema	Pregnancy
Losartan	Hypertension and Left Ventricular Hypertrophy	25-100 mg/day PO in 1 or 2 daily doses	Fatigue, Hypoglycemia, Anaemia, urinary tract infection, chest pain, weakness, diarrhoea	Hypersensitivity	Angioedema, volume-depletion, severe congestive heart failure (CHF), hepatic or renal impairment
Atenolol Beta-blockers	Hypertension	25-50 mg/day PO initially; may	Tiredness, Hypotension, Bradycardia,	Hypersensitivity, Uncompen-	Use with caution in anesthesia or

Name of Drug	Use	Dose	Side Effects	Contraindications	Precautions
		be increased to 100 mg/day PO	Cold extremities, Postural hypotension, Depression	sated cardiac failure Pulmonary oedema	surgery, bronchospastic disease, cerebrovascular insufficiency, diabetes mellitus, hyperthyroidism
Amlodipine (Calcium channel blockers)	Hypertension	5 mg/day PO initially	Oedema, pulmonary Oedema, headache, fatigue, palpitations	Hypersensitivity	Congestive heart failure (CHF) Persistent progressive dermatologic reactions

### Diabetic Mellitus

Diabetes mellitus is the disorder of metabolism of carbohydrates. People call it 'sugar disease' in different parts of India because sugar or glucose level in blood is raised in those patients. The pathogenesis primarily lies in the pancreas, an organ embraced by the C-shaped duodenum from three sides. The pancreas secretes two hormones, insulin and glucagon. These hormones have opposite actions on the level of blood glucose in the blood. While insulin helps in keeping the level of glucose low in blood by helping it to transfer to different tissues, glucagon brings glucose from tissues to blood by breaking down complex sugars stored in different tissues. When this harmonisation between insulin and glucagon is broken down, diabetes mellitus develops. Pancreas either does not secrete enough insulin to keep the blood glucose level under control or the tissues become resistance to the action of insulin. As a result, there is chronic rise in the level of blood glucose. Later in the course of the disease blood level of other enzymes are also deranged. The patient often remains unaware of the rise in sugar level in their blood as symptoms hardly appears in the early stage of the disease. The classic symptoms of increased thirst, urination and appetite start appearing years after first rise in blood sugar. By that time the raised sugar level may have caused many complications inside the body. Diabetes is notorious in affecting every organ system of the body. The patient remains lifelong diabetic and suffers from one or the other complications of diabetes if s/he does not take medicine/s to control the raised blood sugar level in his/ her body.

### Principles of diabetes treatment

The goal of management of diabetes is to diagnose it as early as possible, before it gets time to affect other organs. Once diagnosed, the patient should maintain healthy lifestyle throughout his lifetime. He should follow a diet which does not have any ingredient which causes sudden and sharp increase in blood glucose level. Being physical active is another way of controlling the blood sugar and warding off the complications. Pharmacological management of diabetes is also important as the diabetic will eventually require one or more drug to control the



disease. The drugs to control diabetes are either insulin injections or the oral tablets known as oral hypoglycemic agents (OHAs).

## Drugs to manage Diabetes Mellitus

### 1) Insulin

Insulin is a protein compound and thus cannot be given orally as the enzymes present in the gastro-intestinal tract will dissolve it. It can be given only injections. Commercial available insulins are mainly derived from human, pork or beef's pancreas. Pork insulin is more similar to human insulin as compared to beef insulin. Under normal condition, 1 unit of insulin is secreted per hour by human pancreas. This rises to many folds when we eat. Insulin acts on specific receptors located on the wall of almost all cells of the body. But the number of insulin receptors on cells varies widely based upon their location. Liver and fat cells are very rich in insulin receptors. There are different types of insulin preparations available in the market based upon their onset and duration of action. These insulins are shown in the following table.

**Table 2.6: Types of Insulin Preparations**

Type of Insulin	Onset (hour)	Duration (hour)
<b>Rapid acting</b>		
Insulin lispro	0.2 – 0.4	3 – 5
Insulin aspart	0.2 – 0.4	3 – 5
Insulin glulisine	0.3 – 0.5	2 – 4
<b>Short acting</b>		
Regular insulin	0.5 – 1	6 – 8
<b>Intermediate acting</b>		
Lente	1 – 2	20 – 24
Isophane	1 – 2	20 – 24
<b>Long acting</b>		
Protamin zinc insulin	4 – 6	24 – 36
Insulin glargine	2 – 4	24

It is desirable to use human or highly purified pork insulin in diabetics as others may cause allergic reactions. But for economic reasons other conventional insulins are also used.

### Adverse reactions

Hypoglycemia is the most frequent and potentially the most serious reaction to insulin action. Hypoglycemia can occur in any diabetic following inadvertent injection of large doses of insulin, by missing a meal or by performing vigorous physical exercise. Symptoms can be dizziness, headache, behavioural changes, visual disturbances, hunger, fatigue, weakness, muscular incoordination and fall in blood pressure. The patients on insulin or any oral drugs to control blood sugar should be counselled about the possibility of hypoglycemia. They should be told to keep a source of glucose all the time.

## Indications of insulin

Not all diabetics need insulin to control their disease. Insulin is needed in these patients:

- 1) Not controlled by diet and exercise
- 2) When diet and exercise is not practicable
- 3) Failure of oral hypoglycemic agents
- 4) Intolerance to oral hypoglycemic agents
- 5) Under weight patients
- 6) Temporarily in surgery, pregnancy, infections
- 7) Complications of diabetes

### 2) Oral Hypoglycemic Agents (OHA)

These drugs lower blood glucose levels and are given orally. There are many OHAs which are available in the market. Their classification is shown in the Table 2.7.

**Table 2.7: Classes of Oral Hypoglycemic Agents**

Type of OHA	Generic Names
Sulphonylureas	Tolbutamide, Chlorpropamide Glibenclamide, Glipizide, Gliclazide, Glimiperide
Biguanides	Metformin
Meglitinide	Repaglinide Nateglinide
Thiazolidinediones	Rosiglitazone Pioglitazone
Alpha glucosidase inhibitors	Acarbose Miglitol

### Mechanism of action

Oral hypoglycemic agents provoke a brisk release of insulin from pancreas. Some agents suppress formation of glucose in the liver. Newer agents make the insulin receptor more responsive to insulin.

### Adverse reactions

Incidence of adverse reactions to OHAs varies from drug to drug. The most important is hypoglycemia. Other non-specific side effects are nausea, vomiting, diarrhoea, constipation etc. The flow chart shows the management approach in diabetes mellitus.

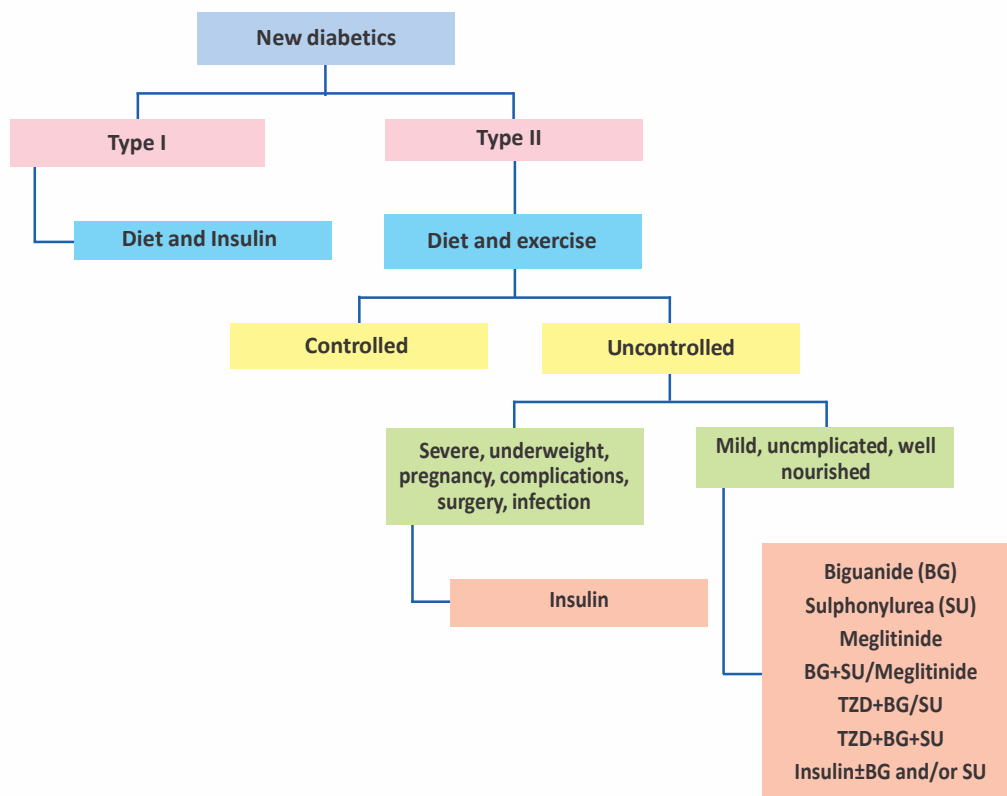


Fig. 2.1: Flow chart of management of Diabetes mellitus

## 2.8 DRUGS USED FOR EPILEPSY

Epilepsy is the tendency to have recurrent seizures unprovoked by systemic or acute neurologic problems. Anticonvulsants (also commonly known as antiepileptic drugs or as antiseizure drugs) are a diverse group of pharmacological agents used in the treatment of epileptic seizures. Anticonvulsants are also increasingly being used in the treatment of bipolar disorder and borderline personality disorder, and for the treatment of neuropathic pain. There are more than 25 AEDs used to treat seizures, and different AEDs work for different seizures. The AEDs can be grouped according to their main mechanism of action, although many of them have several actions and others have unknown mechanisms of action. The main groups include sodium channel blockers, calcium channel blockers, gamma-aminobutyric acid (GABA) enhancers, glutamate blockers, carbonic anhydrase inhibitors, hormones, and drugs with unknown mechanisms of action. It must be remembered that these drugs are often referred to as antiseizure drugs because they provide symptomatic treatment only and have not been demonstrated to alter the course of epilepsy. The therapeutic goal is maximising seizure control while minimising adverse drug effects, thus improving the patient's quality of life.

**Mechanism of action:** A seizure is the clinical manifestation of a hyperexcitable neuronal network, in which the electrical balance underlying normal neuronal activity is pathologically altered. Effective seizure treatment generally augments inhibitory processes or opposes excitatory processes. Since the normal resting neuronal membrane potential is intracellularly negative, inhibitory processes make the neuron more electrically negative, hyperpolarising the membrane, while excitatory processes make the intracellular potential less negative or more positive, depolarising the cell. On an ionic level, inhibition is typically mediated by inward chloride or outward potassium currents, and excitation by inward sodium or

calcium currents. Drugs can directly affect specific ion channels or indirectly influence synthesis, metabolism, or function of neurotransmitters or receptors that control channel opening and closing. The most important central nervous system inhibitory neurotransmitter is gamma-amino-butyric acid (GABA). The most important excitatory neurotransmitter is glutamate, acting through several receptor subtypes.

**Adverse effects:** Most AEDs have a narrow therapeutic window— a small range of serum concentrations within which seizure prevention is achievable without significant toxicity or side effects.

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## 2.9 DRUGS USED FOR DIFFICULTY IN RESPIRATION

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A bronchodilator is a substance that dilates the bronchi and bronchioles, decreasing resistance in the respiratory airway and increasing airflow to the lungs. Bronchodilators are usually used for the treatment of breathing difficulties. They are most useful in obstructive lung diseases, of which asthma and chronic obstructive pulmonary disease are the most common conditions. They are sometimes used in bronchiolitis, bronchiectasis and restrictive lung diseases.

**Common bronchodilators:** Bronchodilators are either short-acting or long-acting. Short-acting medications provide quick relief from acute bronchoconstriction. Long-acting bronchodilators help to control and prevent symptoms. The three types of prescription bronchodilating drugs are short- and long-acting, anticholinergics (short-acting), and theophylline (long-acting).

**Short-acting bronchodilators include:** Salbutamol/albuterol, Levosalbutamol/levalbuterol, Pirbuterol, Epinephrine, Racemic Epinephrine, Ephedrine, Terbutaline. Short-acting bronchodilators are called “quick-acting,” “reliever,” or “rescue” medications. These bronchodilators relieve acute asthma symptoms or attacks very quickly by opening the airways. The rescue medications are best for treating sudden asthma symptoms. The action of inhaled bronchodilators starts within minutes after inhalation and lasts for two to four hours. Short-acting bronchodilators are also used before exercise to prevent exercise-induced asthma.

**Long-acting bronchodilators include:** Salmeterol, Clenbuterol, Formoterol, Bambuterol, Indacaterol.

The long-acting bronchodilators are used to provide control of asthma. They should only be used in conjunction with inhaled steroids for long-term control of asthma symptoms.

These bronchodilators are available in inhaled, tablet, liquid, and injectable forms, but the preferred method of taking the beta-agonists and anticholinergics is by inhalation.

**Adverse effects:** Nervous or shaky feeling, increased heart rate or palpitations, stomach upset, trouble sleeping, muscle aches or cramps.

### Bronchodilators

These are drugs, which are used for bronchodilation in asthma and COPD. These drugs only provide symptomatic relief and do not treat the condition.

Medicine	Dose	Adverse Effects
<b>â2-Adrenoceptor Agonists</b>		
Salbutamol	<p>Oral Adults- Chronic asthma (when inhalation is ineffective): 2 to 4 mg, 3 or 4 times daily; in some patients up to max. of 8 mg, 3 or 4 times daily. Children- Chronic asthma (when inhalation is ineffective): under 2 years; 100 mcg/kg, 4 times daily. 2 to 6 years; 1 to 2 mg, 3 to 4 times daily.</p> <p>Aerosol inhalation Adults- Prophylaxis of exercise-induced bronchospasm: 200 mcg (2 puffs).</p> <p>Chronic asthma (as adjunct in stepped treatment): 100 to 200 mcg (1 to 2 puffs), up to 3 to 4 times daily.</p> <p>Children- Prophylaxis of exercise-induced bronchospasm: 100 mcg (1 puff) increased to 200 mcg (2 puffs); if required.</p> <p>Chronic asthma (as adjunct in stepped treatment): 100 mcg (1 puff) 3 to 4 times daily, increased to 200 mcg (2 puffs) 3 to 4 times daily; if necessary.</p>	Hypokalaemia after high doses; arrhythmias; tachycardia; palpitations; peripheral vasodilatation; fine tremor (usually hands); muscle cramps; headache; insomnia; behavioural disturbances in children; hypersensitivity reactions including paradoxical bronchospasm; urticaria and angioedema; slight pain on intramuscular injection.
<b>Anticholinergics (Antimuscarinic) Bronchodilators</b>		
Ipratropium bromide	<p>Aerosol inhalation Adults- Metered dose inhaler; 20 to 40 mcg, in early treatment up to 80 mcg at a time, 3 to 4 times daily.</p> <p>Children- Metered dose inhaler; up to 6 years; 20 mcg 3 times daily. 6 to 12 years; 20 to 40 mcg 3 times daily.</p>	Dry mouth, constipation, tachycardia, palpitations, arrhythmias, nausea and vomiting, dyspepsia, headaches, dizziness, ocular complications (e.g. mydriasis, narrow-angle glaucoma). Rarely, urinary retention, hypersensitivity reactions (e.g. urticaria, angioedema, rash); nasal dryness, irritation and epistaxis.

**Check Your Progress 4**

1) Discuss management for mild hypertension.

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2) List common side effects of anti-hypertensives drugs.

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3) Enumerate common antihypertensive drugs.

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4) List common antidiabetic (OHAs).

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**2.10 LET US SUM UP**

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In this unit we have learnt about the various drugs used in a variety of conditions. We have also learnt that any drug should be used cautiously as any one of them can have unexpected response in an individual. It was also emphasized that eating a balanced diet is more important than taking any nutritional supplement. There are some drugs which are recommended to be taken by person having high risk of developing a condition like intake of iron, folic acid and calcium by pregnant and lactating mothers. Some drugs are used for life as antihypertensive to control blood pressure. Compliance becomes an important issue while taking drugs for any chronic condition.

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**2.11 MODEL ANSWERS**

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**Check Your Progress 1**

1) They do harm to our body by:

- depriving us of the nutrients which we consume by mouth
- causing blood loss
- injury to tissues and
- secreting toxins.

2) Anthelmintics are a group of drugs that expel parasitic worms and other internal parasites from the body. They act by either paralyzing or killing them.

- 3) Anthelmintics are also used in mass deworming campaigns of school going children in India.
- 4) Hookworm, roundworm, pinworm, whipworm
- 5) Tinidazole and Metronidazole

### Check Your Progress 2

- 1) Tocolytic medicines are given to prevent uterine contractions for preterm labour. Steroid treatment reduces the risk of lung problems in babies who are born early, especially for those born between 29 and 34 weeks of pregnancy. Steroids may also help reduce other complications in the baby like fewer problems with their intestines and bleeding.
- 2) Corticosteroids used in Pregnancy are:
  - Betamethasone 12 mg intramuscularly, 2 doses 24 hours apart; or
  - dexamethasone 6 mg intramuscularly 4 doses 12 hourly.
- 3) Group of people who are in need for nutritional supplements are:
  - Pregnant women
  - Nursing mothers
  - Strict vegetarians
  - People with food allergies or intolerances and
  - Senior citizens.
- 4) On examination
  - Pallor can be seen in the inferior conjunctiva of the eye
  - the nail beds, and the palm.
  - If any of these sites is abnormally pale, the individual should be considered to be severely anaemic.
- 5) Pregnant and postpartum women and children less than 6 years of age are the priority target groups for any iron supplementation programme. Where parasitic infections are common, giving anthelmintic along with iron supplements may increase the effectiveness of supplementation.
- 6) Indications for Zinc are :
  - Stunted growth
  - Acute diarrhoea in children
  - Slow wound healing. Supplementary zinc benefits children with diarrhoea because it is a vital micronutrient essential for protein synthesis, cell growth and differentiation, immune function, and intestinal transport of water and electrolytes. Zinc supplementation has been found to reduce the duration and severity of diarrhoeal episodes and likelihood of subsequent infections for 2 to 3 months.
  - Boosting the immune system

- Treating the common cold
- Recurrent ear infections
- Preventing lower respiratory infections. Some people use zinc for an eye disease called macular degeneration for night blindness, and for cataracts.

### Check Your Progress 3

1) **Precautions:** Hypervolemia should be avoided. It should be used with great care in

- i) Patients with congestive heart failure
- ii) severe renal insufficiency and in clinical states in which there exists oedema with sodium retention.

2) Ringer's lactate solution is used for fluid resuscitation after a blood loss due to trauma, surgery, or a burn injury.

3) Enzymes are used to assist metabolism. In geriatric patients, the digestive capacity is low due to insufficient secretion of digestive enzymes. Hence their digestive system cannot digest food materials efficiently. In such cases they can experience malnutrition, constipation, bloating etc. To aid digestion, enzymes like Papain are administered orally after food for easier digestion.

Enzymes like Streptokinase, Urokinase are used in dissolution of blood clots following head or spinal injuries, stroke or heart attacks.

Enzymes like trypsin, chymotrypsin, serratopepetidase are used to dissolve the swelling and helps in faster wound healing.

Some drugs need to penetrate deeper tissues for better action. For this some enzymes are used along with drugs in intra-muscular injection forms to help proper penetration of tissues. One of the such enzyme is Hyaluronidase.

4) Side effects:

- Oral laxatives may interfere with body's absorption
- an electrolyte imbalance,
- bloating
- flatulence
- abdominal cramps and
- dehydration

5) • Psyllium

- Magnesium hydroxide
- Lactulose
- Bisacodyl
- Docusate



1) For mild blood pressure elevation, experts suggest medically supervised lifestyle changes and observation before recommending initiation of drug therapy. People with hypertension should follow these advices:

- quit smoking;
- reduce salt intake;
- eat less preserving and processed food;
- drink less caffeinated beverages;
- do moderate exercise regularly;
- keep optimal body weight and;
- learn self-relaxation techniques like Yoga.

2) Common side effects include headache, weakness or fatigue, dizziness upon rising quickly from a sitting or lying position, numbness or sharp pain in fingers or toes, cold hands and feet, dry eyes, mouth and throat, and cough.

3) Common Antihypertensive Drugs

Enalapril, Losartan, Atenolol, Beta-blockers, and Amlodipine (Calcium channel blockers)

4) Antidiabetic Drugs are :

- Tolbutamide, Chlorpropamide, Glibenclamide, Glipizide, Gliclazide, Glimiperide
- Metformin
- Repaglinide, Nateglinide
- Rosiglitazone, Pioglitazone
- Acarbose, Miglitol

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## 2.12 KEY WORDS

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**Anticonvulsants** : Also called antiepileptic drugs or as antiseizure drugs, used to control fits.

**Diuretics** : Medicines which cause an increase in excretion of water from bodies.

**Idiosyncratic reaction** : It is genetically determined abnormal reactivity to a chemical.

**Therapeutic window** : Optimal therapeutic effect is exerted only over a narrow range of drug doses.

**Tocolytic** : Drugs which decreases uterine motility.

**Vermicides** : Drugs that kill the worms.

**Vermifuges** : Drugs that paralyses the worms.

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## 2.13 REFERENCES

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- 1) K D Tripathi (2009). Essential of Medical Pharmacology. 6<sup>th</sup> Edition. Jaypee Publishers.
- 2) Hofmeyr G J. Antenatal corticosteroids for women at risk of preterm birth: RHL commentary (last revised: 2 February 2009). The WHO Reproductive Health Library; Geneva: World Health Organization.
- 3) James P A et al. 2014 Evidence-based guideline for the management of high blood pressure in adults: Report from the panel members appointed to the Eighth Joint National Committee (JNC 8). JAMA Dec 18.
- 4) Diarrhoea treatment guidelines including new recommendations for the use of ORS and zinc supplementation for clinic-based healthcare workers. USAID; UNICEF; World Health Organization 2005.
- 5) Guidelines for Control of Iron Deficiency Anaemia. National Iron plus Initiative. Adolescent Division, Ministry of Health and Family Welfare Government of India.

