



Indira Gandhi National Open University  
SCHOOL OF HEALTH SCIENCE

**BNS-042**

**Primary Health Care  
in Common Conditions**

**Essential Drugs**

**6**



Indira Gandhi  
National Open University  
School of Health Sciences

# BNS-042

## Primary Health Care in Common Conditions

Block

# 6

## ESSENTIAL DRUGS

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### UNIT 1

**Essential Drugs - 1** **5**

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**Essential Drugs - 2** **39**

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## **BLOCK INTRODUCTION**

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The goal of Community Health is to provide comprehensive need based health care services to the population during health and illness which also includes dispensing of drugs. Drugs are not always used to treat the diseases but are also used as preventive measure for some problems such as consumption of iron tablets will prevent the development of anemia.

You as a health care provider need to understand the dose, action, use, indication, contra- indication and side effects of commonly used drugs especially those which you may come across while working at sub centre. In a Subcentre many patients who are on different drug regimes (as per prescription of a doctor) may approach you for advise, so you should be able to counsel these patients regarding taking regular medications, not breaking schedule at their own wish, avoiding self-medications and do regular follow up in case of chronic illnesses. When the patient is discharged from the hospital, you need to follow up the patient at home also. One of the important tasks you need to perform is to educate and motivate them to take prescribed medications, adhere to the treatment especially in communicable disease and non-communicable disease such as diabetes, hypertension, asthma, cancer etc. and provide follow up care.

This block comprises three units as given below:

Unit 1 deals with Essential Drugs – 1

Unit 2 focuses on Essential Drugs – 2

Unit 3 explain Essential Drugs – 3

You have to follow Standard Operating Procedures (SOPs) in relation to drugs and you should not prescribe the drugs.



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# UNIT 1 ESSENTIAL DRUGS - 1

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## Structure

- 1.0 Introduction
- 1.1 Objectives
- 1.2 Vaccines under UIP
  - 1.2.1 Contraindications and Precautions
  - 1.2.2 Adverse Reactions
- 1.3 Antacids and Antiulcer Drugs
- 1.4 Antibiotics and Topical Medications
- 1.5 Anti-pyretics and Analgesics
- 1.6 Anti-scabies Drugs
- 1.7 Antiemetics
- 1.8 Antispasmodics
- 1.9 Oral Rehydration Solutions (ORS)
- 1.10 Hematinics, Vitamins and Minerals
- 1.11 Diuretics
- 1.12 Sedatives and Antiepileptics
- 1.13 Expectorants and Mucolytics
- 1.14 Prenatal Steroids
- 1.15 Surface Anaesthesia for Repair of Minor Injury
- 1.16 Antibiotics for Eye, Ear Drops and Ointments
- 1.17 Drugs Used in Resuscitation and Life Support
- 1.18 Let Us Sum Up
- 1.19 References

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## 1.0 INTRODUCTION

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In this unit, we would discuss about essential drugs which play vital role in managing certain illness, prevention of certain vaccine preventable diseases and many more drugs which supplement to maintain health of an individual. As a mid level health care provider, it is important for you to know about the indications, doses, precautions while giving medications, their side effects. You will come across many patients who are on medications for chronic illness and taking drugs for a long period, you would be able to assess their conditions and help in follow up as and when required. This unit on essential drug would help you to review you previous knowledge and you will be more confident in dealing with the health related problems.

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## 1.1 OBJECTIVES

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After reading this unit, you will be able to:

- explain vaccines, route and doses and schedule of administering;

- list the common medications used for fever, pain, infections;
- enumerate drugs for scabies treatment;
- discuss anti-emetics and its indications;
- list antispasmodics and when to use;
- counsel the correct use of ORS and Hematinies, Vitamins and Minerals;
- explain how and when to use diuretics, antihypertensives and sedatives;
- enumerate appropriate use of drugs under National Health Programmes.

## 1.2 VACCINES UNDER UIP

Vaccine is biological preparation that provides active acquired immunity to a particular disease.

Vaccines, which are currently under Universal Immunisation Programme (UIP), are listed below:

S. no	Vaccine & its Presentation	Protection	Route	Number of Doses	Vaccination Schedule
1	<b>BCG</b> (Bacillus Calmette Guerin)- Lyophilized vaccine	Tuberculosis	Intra-dermal	1	At birth (upto 1 year if not given earlier)
2	<b>OPV</b> (Oral Polio Vaccine) Liquid vaccine	Poliomyelitis	Oral	5	Birth dose for institutional deliveries, Primary three doses at 6, 10 & 14 week and one booster dose at 16-24 month of age. Given orally
3	<b>Hepatitis B</b> Liquid vaccine	Hepatitis B	Intra-muscular	4	Birth dose (within 24 hours) for institution aldeliveries, Primary three doses at 6, 10 & 14 week.
4	<b>DPT</b> (Diphtheria, Pertussis and Tetanus Toxoid) Liquid vaccine	Diphtheria, Pertussis and Tetanus	Intra-muscular	5	Three doses at 6, 10 & 14 week and two booster dose at 16-24 month and 5-6 years of age
5	<b>Measles</b> Lyophilized vaccine	Measles	Sub-cutaneous	2	9-12 months of age and 2 <sup>nd</sup> dose at 16-24 months
6	<b>TT</b> (Tetanus Toxoid) – Liquid vaccine	Tetanus	Intra-muscular	2	10 years and 16 years of age. For pregnant woman, two doses given (one dose if

					previously vaccinated within 3 Year)
7	<b>JE</b> vaccination (in selected high disease burden districts) Lyophilized vaccine	Japanese Encephalitis (Brain fever)	Sub-cutaneous	2	9-12 months of age and 2 <sup>nd</sup> dose at 16-24 months (6 months after vaccination drive)
8	<b>Hib</b> (given as pentavalent containing Hib+DPT+ Hep B) (in 8 states) – Liquid vaccine	Hib pneumonia and Hib meningitis	Intra-muscular	3	6, 10 & 14 week of age

### 1.2.1 Contraindications and Precautions

Recipients of any vaccine should be observed for an adverse reaction.

- Anaphylaxis though rare, can occur and epinephrine (adrenaline) must always be immediately available whenever immunisation is given. If a serious adverse event (including anaphylaxis, collapse, shock, encephalitis, encephalopathy, or non-febrile convulsion) occurs following a dose of any vaccine, a subsequent dose should not be given.
- Immunisation should be postponed in acute illness, which may limit the response to immunisation, but minor infections without fever or systemic upset are not contraindications. A definite reaction to a preceding dose is a definite contraindication.

If alcohol or other disinfecting agent is used to wipe the injection site it must be allowed to evaporate, otherwise inactivation of a live vaccine may occur.

The intramuscular route must not be used in patients with bleeding disorders such as haemophilia or thrombocytopenia.

In the case of a severe reaction to Diphtheria, Pertussis, and Tetanus vaccine, the pertussis component should be omitted and the vaccination completed with Diphtheria and Tetanus vaccine.

Hypersensitivity may occur to antimicrobials preservatives or egg proteins in vaccine.

### 1.2.2 Adverse Reactions

Local reactions including inflammation and lymphangitis may occur.

Sterile abscess may develop at the injection site;

- Fever
- Headache
- Malaise starting a few hour after injection and lasting for 1–2 days may occur.
- Hypersensitivity reactions can occur including rarely, anaphylaxis.

**Check Your Progress 1**

1) Fill in the blanks:

- a) BCG is given for protection against \_\_\_\_\_.
- b) OPV is given as primary three doses at \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_ weeks.
- c) Hepatitis B is administered through \_\_\_\_\_ route.
- d) Measles is administered through \_\_\_\_\_ route.
- e) Pentavalent contains \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.

2) List the adverse effects of vaccination.

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**1.3 ANTACIDS AND ANTIULCER DRUGS**

These are drugs, which are used in the treatment of peptic ulcer (gastric and duodenal ulcer), gastroesophageal reflux disease and stress/drug induced ulcers. Antacids are basic substances, which is used to provide symptomatic relief and anti-ulcer drugs decreases the production of hydrochloric acid in stomach.

Medicine	Dose	Adverse Effects
<b>Antacids</b>		
Aluminium hydroxide + Magnesium hydroxide	10 to 20 ml 4 times a day (maximum: 80 ml in 24 hours)	Constipation, faecal impaction, stomach cramps, and hypophosphatemia
<b>Proton Pump Inhibitors</b>		
Omeprazole	Benign gastric and duodenal ulcers: 20 mg once daily for 4 weeks. Maintenance for recurrent duodenal ulcers: 20 mg once daily	Nausea, abdominal pain, constipation, flatulence, diarrhoea, arthralgia, decreased B12 absorption.
Pantoprazole	Benign gastric and duodenal ulcers: 40 mg once daily for 4 weeks. (administer 1 hour before food)	Nausea, abdominal pain, constipation, flatulence, diarrhoea, arthralgia, decreased B12 absorption.
<b>H<sub>2</sub> blockers</b>		
Ranitidine	Benign gastric and duodenal ulceration:	Diarrhoea; headache; dizziness; rash; tiredness; acute

	150 mg twice daily or 300 mg at night for 4 to 8 weeks, up to 6 weeks in chronic episodic dyspepsia.	pancreatitis.
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## 1.4 ANTIBIOTICS AND TOPICAL MEDICATIONS

Antibiotics are substances that kill or inhibit the growth of microbes (bacteria, viruses, fungi, protozoa, helminths).

Based on action on the type of organism, these are classified as anti-bacterial, anti-viral, anti-fungal, and anti-protozoal and anti-helminths.

These drugs elicit their action by targeting one of the components of the microbe rather than host cell. According to the mechanism of action, the antibiotics are classified as:

- 1) Inhibit cell wall synthesis: Penicillin, Cephalosporin, Cycloserine, Vancomycin and Bacitracin.
- 2) Cause leakage from cell membranes:
  - a) Poly-peptides-Polymyxins, Colistin, Bacitracin,
  - b) Polyenes-Amphotericin B, Nystatin, Hamycin.
3. Inhibit protein synthesis: Tetracycline, Chloramphenicol, Erythromycin, Clindamycin, and Linezolid.
4. Cause misreading of m-RNA code and affect cell permeability: Aminoglycosides-Streptomycin, Gentamicin, etc.
5. Inhibit DNA gyrase: Fluoroquinolones–Ciprofloxacin, ofloxacin, norfloxacin, moxifloxacin.
6. Interfere with DNA function: Rifampin, Metronidazole.
7. Interfere with DNA synthesis: Acyclovir, Zidovudine.
8. Interfere with intermediary metabolism: Sulfonamides, Sulfones, PAS, Trimethoprim, Pyrimethamine, and Ethambutol

Antibiotic resistance is the worldwide health problem. The important reasons could be:

- 1) overuse of antibiotics in viral infections
- 2) misuse of antibiotics in infections (underdosing, inappropriate duration) hence judicious use of antibiotics is of paramount importance.

Let us now discuss the important antibiotics as explained below:

Medicine	Indications	Dose	Adverse Effects
<b>Sulfonamides</b>			
<b>Cotrimoxazole</b> fixed drug dose combination of sulfamethoxazole (SMZ) and trime-	<ul style="list-style-type: none"> <li>• Urinary-tract infections</li> <li>• Respiratory-tract infections including bronchitis,</li> </ul>	<b>Adult:</b> 1 to 2 tablet twice daily for 7-14 days (160 + 800 mg).	<ul style="list-style-type: none"> <li>• Nausea,</li> <li>• vomiting,</li> <li>• stomatitis, headache and rashes</li> </ul>

Medicine	Indications	Dose	Adverse Effects
thoprim (TMP) given in the dose ratio of 5:1	pneumonia, <ul style="list-style-type: none"> <li>• Infections in cystic fibrosis;</li> <li>• Otitis media;</li> <li>• Skin infections;</li> <li>• Pneumocystis carinii pneumonia</li> </ul>	<b>Child:</b> Suspension 5 ml twice daily (40 + 200 mg); infant 2.5 ml.	
<b>Beta-lactams</b>			
<b>Ampicillin</b>	Active against both gram positive & gram negative bacteria causing Otitis media; respiratory tract and urinary tract infections; mastoiditis; gynaecological infections; septicemia; peritonitis; endocarditis; meningitis; cholecystitis; osteomyelitis; respiratory tract infection.	<b>Oral (Adults)</b> - 250 mg to 1g every 6 h at least 30 min before food. Urinary tract infection <b>Adults:</b> 500 mg every 8 h. Administer on an empty stomach with a full glass of water (i.e., 30 minutes prior to or 2 hours after meals) to increase total absorption	Nausea and vomiting, diarrhoea; rashes, high fever (hypersensitivity or toxic response-may be serious reaction, discontinue treatment); hypersensitivity reactions including urticaria, angioedema
<b>Amoxicillin</b>	Active against both gram positive & gram negative bacteria causing Urinary tract infections, upper respiratory tract infections, bronchitis; pneumonia; otitis media; dental abscess; osteomyelitis; Lyme's disease in children; endocarditis prophylaxis	<b>Adults:</b> 250 mg every 8 h, double in severe infections. Otitis media: 1g every 8 h. Enteric fever: 2 to 4g daily in divided doses for 14 to 21 days. <b>Child upto 10 years:</b> 125 mg every 8 h, double in severe infections. Otitis media: 40 mg/kg body weight daily in	Nausea and vomiting, diarrhoea, rashes; hypersensitivity reactions

Medicine	Indications	Dose	Adverse Effects
		three divided doses. Enteric fever: 50 to 100 mg/kg body weight in three divided doses for 14 to 21 days.	
<b>Aminoglycosides</b>			
<b>Gentamicin</b>	Active against gram-negative bacteria. Pneumonia; cholecystitis; peritonitis; septicemia; acute pyelonephritis; prostatitis; skin infections; pelvic inflammatory disease; endocarditis; meningitis; listeriosis; tularaemia; brucellosis; plague; surgical prophylaxis; ocular bacterial infection.	Intravenous infusion - Once daily dose regime; 5 to 7 mg/kg body weight, then adjust as per serum gentamicin concentration. Multiple daily dose regimens: 3mg/kg body-weight divided into 8 hourly doses. Child - 2 weeks to 12 years; 2 mg/kg body weight 8 hourly.	Vestibular and auditory damage, nephrotoxicity, rarely hypomagnesaemia on prolonged therapy; antibiotic-associated colitis, also nausea, vomiting, rash.
<b>Fluroquinolones</b>			
<b>Ciprofloxacin</b>	Active against aerobic gram negative bacilli. <b>Gastroenteritis</b> - including cholera, shigellosis, travellers' diarrhoea, campylobacter and salmonella enteritis; typhoid;  Gonorrhoea; chancroid; legionnaires' disease; meningitis (including meningococcal meningitis prophylaxis);  Respiratory-tract	<b>Oral Adults:</b> Urinary tract infection, respiratory tract infection: 250 to 500 mg, twice daily. <b>Severe</b> respiratory tract infections: upto 750 mg twice daily <b>Chronic prostatitis:</b> 500 mg twice daily for 28 days. <b>Gonorrhoea:</b> 500 mg as a	Nausea, vomiting, dyspepsia, abdominal pain, flatulence, diarrhoea dysphagia, tremor, hyperglycemia, headache, dizziness, sleep disorders, rash and pruritus. <b>Contraindications</b> Epilepsy and hypersensitivity to quinolones.

Medicine	Indications	Dose	Adverse Effects
	<p>infections including pseudomonas infections in cystic fibrosis, but not pneumococcal pneumonia;</p> <p>Urinary-tract infections; bone and joint infections; septicemia; anthrax;</p> <p>Skin infections; prophylaxis in surgery</p>	<p>single dose.</p> <p><b>Children:</b> Not recommended.</p> <p>May administer with food to minimise GI upset; avoid antacid use</p>	
<b>Norfloxacin</b>	<p>Urinary and genital tract infections, bacterial diarrhoeas. It is not effective against upper respiratory infections</p>	<p>Urinary Tract Infection: 200 to 400 mg daily preferably in the morning. Increase if necessary in upper urinary tract infection to 400 mg twice daily</p> <p>Uncomplicated genital Chlamydia infections, non-gonococcal urethritis: 400 mg daily in single dose for 7 days or divided doses for 7 days.</p>	<p>Nausea, vomiting, dyspepsia, abdominal pain, diarrhoea (rarely, antibiotic-associated colitis), headache, dizziness.</p>
<b>Macrolides</b>			
<b>Azithromycin</b>	<p>Community acquired Pneumonia, Uncomplicated genital chlamydial infections and trachoma</p>	<p><b>Adults:</b> 500 mg once daily for 3 days or 500 mg on first day then 250 mg once daily for 4 days. (Take on an empty stomach 1 hr before or 2 hr after meals)</p>	<p>Renal impairment; exacerbation of symptoms of myasthenia gravis; impaired hepatic functions.</p>

Medicine	Indications	Dose	Adverse Effects
<b>Tetracycline</b>			
<b>Doxycycline</b>	Respiratory tract infections, including Pneumonia and Chronic bronchitis; Urinary-tract infections; syphilis; chlamydia, mycoplasma and Rickettsia; Prostatitis; Lymphogranuloma venereum; Pelvic Inflammatory Disease (PID)	<p><b>Severe</b> infections: 200 mg daily. Early syphilis: 100 mg twice daily for 14 days.</p> <p><b>Latent</b> syphilis: 200 mg twice daily for 28 days.</p> <p><b>Uncomplicated genital Chlamydia</b>, non-gonococcal urethritis: 100 mg twice daily for 7 days.</p> <p><b>Children:</b> Only if alternate antibacterial cannot be given 5 mg/kg body weight in two divided doses.</p>	<p>Hypotension, pericarditis, angioneurotic oedema, dyspnoea, serum sickness, peripheral oedema, tachycardia, urticaria, haemolytic anaemia, thrombocytopenia, neutropenia, porphyria, eosinophilia, blurring of vision, scotomata, diplopia, tinnitus, abdominal pain, jaundice, pancreatitis, rashes, exfoliative dermatitis, photo-onycholysis, photosensitivity, arthralgia, myalgia, vaginitis.</p> <p><b>Contraindications</b> Pregnancy and children; porphyria; systemic lupus erythematosus</p>
<b>Nitrofurantoin</b>	Urinary-tract infections; cystitis.	<p><b>Adults:</b> 50 mg every 6 h with food for 3-7 days.</p> <p><b>Children:</b> over 3 months: 3 mg/kg body weight daily in four divided doses. Severe chronic recurrent infections: 100 mg every 6 h with food for 7 days, discontinue or reduce dosage in case of nausea.</p>	<p>Dose-related gastrointestinal disorders, nausea; hypersensitivity reactions including urticaria, rash, sialadenitis, pruritus, angioedema; anaphylaxis reported; rarely, cholestatic jaundice, hepatitis.</p>

### Topical Medications

Topical antibiotics are used to treat skin infections such as impetigo, folliculitis, furunculi, cellulitis and erysipelas. They are usually caused by streptococcal and staphylococcal infections.

In all skin infections, an important part of treatment is cleansing and thorough drying. Washing with soap and water will often help to prevent infection. Light localised infections can often be treated effectively with an antiseptic solution such as chlorhexidine.

Medicine	Indication	Dose & Administration	Adverse Effects
<b>Topical antibiotics</b>			
<b>Silver Sulfadiazine</b> Availability: Cream: 1%w/w	Prophylaxis and treatment of infection in burns	Apply with a sterile-gloved hand. Burned area should be covered with cream at all times; reapply to areas where cream has been removed by patient activity. Dressings may be used if necessary	Allergic reactions include rashes; burning and itching; sulfonamide induced systemic toxicity; transient leucopenia
<b>Neomycin + Bacitracin</b> Cream: 5, 10 and 15g (Aluminium tubes).	Superficial bacterial infections of the skin due to staphylococci and streptococci.	Adults and children- Bacterial skin infections over 2 years: apply as a thin layer 3 times daily.	Sensitisation; especially to neomycin; causing reddening and scaling; systemic absorption leading to irreversible ototoxicity; particularly in children; elderly; and in renal impairment; pregnancy
<b>Gentian Violet</b> Availability: Solution: 0.5% Tincture: 0.5%.	Superficial fungal and bacterial infections	Skin infections: apply 2 or 3 times daily for 2 to 3 days.	Redness, swelling; irritation; allergic reaction.
<b>Topical antifungal</b>			
<b>Benzoic Acid + Salicylic Acid</b> Cream: 25 and 50 g (Aluminium tubes, jars).	Mild dermatophyte infections, particularly caused by <i>Tinea pedis</i> and <i>Tinea corporis</i> .	Fungal skin infections: apply twice daily until the infected skin is shed (usually at least 4 weeks).	Occasionally localised; mild inflammatory reaction; swelling of face, lips and tongue; difficulty in breathing.

Medicine	Indication	Dose & Administration	Adverse Effects
		<p>Gently rinse the affected skin with saline or water before treating it with this medicine. Pat the skin dry with a clean towel or cotton gauze. Apply a generous amount of the medicine and spread it evenly to form a 1/8-inch thick layer over the treated area. It is best to apply this medicine to your skin with a clean cotton swab. Throw the swab away after one use. You may also apply the medicine to a cotton gauze pad and then place the gauze over your skin.</p>	
<p><b>Miconazole</b>            Cream: 10 and 15g (2% w/w)            Gel: 2% w/w.</p>	<p>Superficial fungal infections due to dermatophytes and yeasts, and secondary infections caused by Gram-positive cocci including ringworm, intertrigo, candida napkin rash, paronychia, and pityriasisversicolor.</p>	<p>Skin infections: apply twice daily to clean dry lesions, continuing for atleast 10 days after the condition has cleared.            Nail infections: apply 1 to 2 times daily.</p>	<p>Occasional local irritation and burning; also contact dermatitis, discontinue if sensitisation occurs.</p>

Medicine	Indication	Dose & Administration	Adverse Effects
<b>Topical steroids</b>			
<b>Betamethasone</b> Cream: 0.1% w/w Ointment: 0.1% w/w	Atopic dermatitis, Seborrheic dermatitis, Lichen simplex chronicus, Later phase of allergic contact dermatitis, Later phase of irritant dermatitis, Nummular eczematous dermatitis, Stasis dermatitis, Psoriasis, especially of genitalia and face.	Adults and children- Inflammatory skin conditions, over 2 years of age: Apply small quantity to the affected area 1 to 2 times daily until improvement occurs, then less frequently.	Skin atrophy, telangiectasia, erythema, and hypertrichosis
<b>Hydrocortisone</b> Cream: 10 and 15g (1% w/w)		Inflammatory skin conditions- Apply a small quantity to the affected area 1 to 2 times daily until improvement occurs, then less frequently	
<b>Emmolients</b>			
<b>Calamine</b> Lotion 50 and 100 ml (8% w/w) Cream 1g.	Mild pruritus.	Mild pruritus: apply liberally 3 to 4 times daily.	

Penicillin is an antibiotic which kills bacteria. It is also the world's first wonder drug. It can be given in injection and oral forms.

**Uses:** Penicillin can be used for the cure of a Streptococcal Infection, Upper Respiratory Tract Infection, Skin or Soft Tissue Infection, Tonsillitis/Pharyngitis, Rheumatic Fever Prophylaxis, Otitis Media, Pneumonia.

**Precautions:** Persons who are allergic to any penicillin antibiotic, such as amoxicillin, ampicillin, carbenicillin, dicloxacillin or oxacillin should not take it.

Hypersensitivity reactions with penicillin are more common and more serious with intravenous therapy, but have also been reported with oral therapy. An initial sensitising exposure is required. Hypersensitivity side effects include skin eruptions, pruritus, urticaria, laryngeal oedema, fever, eosinophilia, hypersensitivity myocarditis, serum sickness- like reactions (chills, fever, oedema, arthralgia, and prostration), severe or fatal anaphylaxis, shock, and death.

**Side Effects:** The major side effects include diarrhoea, sore mouth or tongue vaginal itching and discharge, white patches in the mouth end/or on the tongue.

**Remember :**

Pencillin is rarely used now a days.

## 1.5 ANTI-PYRETICS AND ANALGESICS

Analgesics are drugs used to relieve/reduce pain and antipyretics are used to reduce elevated body temperature.

**Mechanism of action of non-opioid analgesics:** Prostaglandins are autacoids responsible for inflammation, pain and fever. Cyclooxygenase (COX 1& 2) is the enzyme responsible for the production of prostaglandins. Inhibition of COX activity leads to antipyretic, analgesic and anti-inflammatory activity. These are also commonly referred as non steroidal anti-inflammatory drugs.

### Indications

Mild to moderate pain including dysmenorrhoeal pain, headaches, pain relief in osteoarthritis, rheumatoid arthritis, autoimmune arthritis and soft tissue lesions, pyrexia including post-immunisation pyrexia, acute migraine attack.

### Adverse effects

Gastrointestinal: Gastric irritation, erosions, peptic ulceration, gastric bleeding/perforation, oesophagitis.

Hepatic: Raised transaminases, hepatic failure (rare)

CNS: Headache, mental confusion, behavioural disturbances, seizure precipitation

Haematological: Bleeding, thrombocytopenia, haemolytic anaemia, agranulocytosis

Others: Asthma exacerbation, nasal polyposis, skin rashes, pruritus, angioedema

Commonly used non steroidal anti-inflammatory drugs (NSAIDs) and their doses are as given below:

Medicine	Dose	Adverse Effects
<b>Paracetamol</b>	<p><b>Oral</b> Adults- 0.5 to 1g every 4 to 6 h (max. 4g, max 2g in alcoholics per day). Children up to 2 months - for post-immunisation pyrexia: 60 mg. 3 months to 1 year: 60 to 120 mg every 4 to 6 h. 1 to 5 years: 120 to 250 mg every 4 to 6 h. 6 to 12 years: 250 to 500 mg every 4 to 6 h.</p> <p><b>Intramuscular injection</b> Adults- 250 mg every 4 to 6 h or as required.</p>	Nausea and rashes rarely occur
<b>Aspirin(acetyl)</b>	Adults: Analgesic and	Nausea, vomiting,

Medicine	Dose	Adverse Effects
<b>salicylic acid)</b>	antipyretic including migraine attacks: 0.3 to 0.9 g, 3 to 4 times a day (max. 4 g daily). Acute rheumatic fever: 4 to 6 g or 75 to 100 mg/kg daily in divided doses. Anti-platelet: 75-325 mg/day Children under 16 years: not recommended (can cause Reye's syndrome).	epigastric distress, peptic ulcer, salicylism-(dizziness, tinnitus, vertigo, reversible impairment of hearing and vision, excitement and mental confusion, hyperventilation and electrolyte imbalance).
<b>Diclofenac</b>	Oral: 100 to 150 mg daily in 2 to 3 divided doses, (max 150 mg/day) maintenance by 50 to 100 mg in divided doses. Intramuscular injection: 75 mg, 2 to 3 times daily. Topically: Adults- Apply 1% w/w gel on to affected area 3 to 4 times daily. Instill to eye post-operative ocular inflammation: Adult- as sodium (1% w/v), 4 times daily starting 24 h after surgery for up to 28 days. Rectal: Post-operative pain. Adults- 75 to 150 mg daily in divided doses (maximum 150 mg/day, inclusive of diclofenac administered through other routes). Children - 6 to 12 year: 1 to 2 mg/kg/day in divided doses for maximum of 4 days.	Epigastric pain, nausea, headache, dizziness, rashes.
<b>Ibuprofen</b>	Adults and children over 12 years- initially 300 to 400 mg 3 to 4 times daily, increase if necessary(max. 2.4g daily), maintenance dose of 0.6 to 1.2g daily may be adequate. Infants or children over 3 months- 5-10 mg/kg, 3 to 4 times/day, maximum daily dose: 40 mg/kg/day.	Gastric discomfort, nausea and vomiting, headache, dizziness, blurring of vision, tinnitus and depression can occur.

**Check Your Progress 2**

- 1) List antacids used to decrease production of hydrochloric acid in stomach.

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- 2) Name antibiotics indicated for treating UTIs.

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- 3) Name the antibiotics indicated for treating Respiratory Tract Infections (RTIs).

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- 4) List the indications for using anti-pyretics and analgesics.

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- 5) List the adverse effects of anti-pyretics and analgesics.

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**1.6 ANTI-SCABIES DRUGS**

These are drugs, which are active against scabies. Scabies is an infestation of the skin by the mite *Sarcoptes scabiei* that results in an intensely pruritic eruption with a characteristic distribution pattern.

Name	Dose	Adverse Effects
Benzyl benzoate Availability <b>Lotion</b> 100 ml (25% w/v), <b>Ointment</b> 25% w/w (25g)	Adults: Apply 3 times at 12-hrly intervals, over the whole body. Wash off 12 hr after the last application.	Local irritation, particularly in children.
Gamma Benzene Hexachloride	Take a proper bath and dry the skin then apply	Insomnia; paraesthesia; giddiness, agranulocytosis,

Name	Dose	Adverse Effects
Availability <b>Lotion</b> 1% w/v <b>Ointment</b> 1% w/w <b>Cream</b> 1% w/w <b>Shampoo</b> 1% w/v	lotion in a thin layer below the neck upto the sole of feet. Leave it for 8-12 hours and then take bath.	aplastic anaemia, skin irritation, contact dermatitis; ataxia; alopecia; severe neurologic toxicities have been reported <b>Contraindication:</b> seizures

## 1.7 ANTIEMETICS

Antiemetics are drugs effective against nausea and vomiting.

### Mechanism of action

They act on the brain by preventing the stimulation of the vomiting centre (chemoreceptor trigger zone-CTZ). Some medications act on the gut by speeding up the rate at which the stomach empties and help to facilitate the quick transit of food through intestine (prokinetic action).

### Indications

They are typically used to treat motion sickness and the side effects of opioid analgesics, general anesthetics and chemotherapy induced nausea and vomiting in cancer patients either alone or in combination.

Medicine	Indication	Dose	Adverse Effects
<b>Dopamine D<sub>2</sub>-receptor antagonists</b>			
<b>Domperidone</b>	Prophylaxis of post-op nausea and vomiting	Adults- tablet 10 to 20 mg 3 to 4 times a day Children- 0.3 to 0.6 mg/kg 3 times a day administer 15 to 30 minutes prior to meals and at bedtime if needed.	GI disturbances (including cramps) and hyperprolactinaemia, extrapyramidal effects and rashes; headache; dizziness; dry mouth.
<b>Metoclopramide</b>	Prophylaxis of post-op nausea and vomiting GERD Diabetic gastric stasis Prophylaxis of chemotherapy-induced nausea and vomiting	Oral: Tablet 10 mg, up to thrice daily. Max duration: 5 days.	Extrapyramidal symptoms (especially in children and young adults); tardive dyskinesias on prolonged use; hyperprolactinaemia; drowsiness, restlessness, dizziness, headache, diarrhoea, depression, hypotension and hypertension reported; rarely, neuroleptic malignant syndrome; rashes, pruritus, oedema; cardiac

Medicine	Indication	Dose	Adverse Effects
			conduction abnormalities following intravenous administration; galactorrhoea; amenorrhoea; bradykinesia; gynaecomastia; insomnia.

## 1.8 ANTISPASMODICS

These are drugs, which are used to relieve spasm of smooth muscle.

Medicine	Indications	Dose	Adverse Effects
<b>Dicyclomine (Anticholinergic activity)</b>	<ol style="list-style-type: none"> <li>1. Intestinal and renal colic, abdominal cramps: symptomatic relief is afforded if there is no mechanical obstruction.</li> <li>2. Nervous and drug induced diarrhoea, functional diarrhoea,</li> <li>3. Spastic constipation, irritable bowel syndrome.</li> <li>4. Pylorospasm, gastric hyper motility, gastritis, nervous dyspepsia.</li> <li>5. To relieve urinary frequency and urgency, enuresis in children.</li> <li>6. Dysmenorrhoea</li> </ol>	<p>Oral Adults: 10-20 mg three times a day.</p> <p>Parenteral IM injection: 80 mg daily in 4 divided doses.</p>	<p>Dry mouth; nausea; vomiting; constipation; taste loss; anorexia; dizziness; dyskinesia; lethargy, respiratory arrest; drowsiness; photophobia, blurred vision; increased ocular pressure; tachycardia; urinary retention</p> <p><b>Contraindication:</b> GI obstruction</p>

## 1.9 ORAL REHYDRATION SOLUTIONS (ORS)

Let us now go through the Oral Rehydration Solutions (ORS).

### Indications

Dehydration from acute diarrhoea. Available in the form of ORS powder.

Constituents of ORS as given below:

Constituents	Amount per Litre of Water
Glucose salt solution	5 and 37.5 G
Sodium chloride	2.6 g/litre of water
Sodium citrate	2.9 g/litre of water
Potassium chloride	1.5 g/litre of water
Glucose (anhydrous)	13.5 g/litre of water
Sodium bicarbonate	2.5 g/litre of water

In cases of cholera, oral rehydration salt containing a higher concentration of sodium may be required to prevent hyponatremia.

**Preparation of ORS solution**

The solution may be prepared either from prepackaged sugar/salt mixtures or from bulk substances and water. Solutions must be freshly prepared, preferably with recently boiled and cooled water. Accurate weighing and thorough mixing and dissolution of ingredients in the correct volume of clean water are important. Administration of more concentrated solutions can result in hypernatremia.

**Dose**

Oral 5 g (single use): Dissolve in water and drink; 37.5 g: to reconstitute it with 1 litre of clean water. Adults- Fluid and electrolyte loss in acute diarrhoea; 200 to 400 ml solution after every loose motion.

**Adverse Effects**

Vomiting- may indicate too rapid administration; hypernatremia and hyperkalemia may result from overdose in renal impairment.

<p><b>Check Your Progress 3</b></p> <p>1) Define scabies.</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>2) Discussed the indication for antiemetic.</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>3) Write the use of antispasmodics.</p> <p>.....</p> <p>.....</p> <p>.....</p>
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**1.10 HEMATINICS, VITAMINS AND MINERALS**

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Let us now go through the Hematinics, Vitamins and Minerals alongwith their indications, dose and adverse effects.

Medicine	Indications	Dose	Adverse Effects
<b>Ascorbic Acid (Vitamin C)</b>	Prevention and treatment of scurvy.	Dose Adult and child- Prophylaxis of scurvy: 25to 75 mg daily.	Gastrointestinal disturbances reported with large doses; failure of conception; kidney oxalate stones.

Medicine	Indications	Dose	Adverse Effects
		Treatment of scurvy: 0.5 to 1.5 g/day.	<b>Contraindications</b> Hyperoxaluria.
<b>Calcium Carbonate + Vitamin D<sub>3</sub></b>	Prevention and treatment of osteoporosis and osteomalacia, nutritional supplement.	Calcium 1000 - 1300 mg daily Vitamin D <sub>3</sub> 200 - 800 IU daily.	Constipation, flatulence, nausea, abdominal pain and diarrhoea; pruritus, rash and urticaria.
<b>Iodine</b>	Prevention and treatment of iodine deficiency, thyrotoxicosis and hyperthyroidism.	Oral: Adult- Endemic moderate to severe iodine deficiency: during pregnancy and one year postpartum, 300 to 480 mg once a year or 100 to 300 mg every 6 months; women of child-bearing age, 400 to 960 mg once a year or 200 to 480 mg every 6 months. Iodine deficiency; 400 mg, <b>during pregnancy</b> , single dose of 200 mg.  Child- Iodine deficiency: infant under 1 year, single dose 100 mg; 1 to 5 years, 200 mg once a year; above 6 years 400 mg once a year.	Hypersensitivity reactions; goiter and hypothyroidism; hyperthyroidism; bronchitis; eosinophilia; rashes; headache; salivation.
<b>Methylcobalamin</b>	To prevent neurological disorder in patients with neuropathy due to diabetes, alcohol or other drug induced neuropathies	Initially 1000 mcg 3 times a day for 2 weeks, thereafter 1000 mcg every 3 months by intramuscular injection in case of pernicious anaemia and other macrocytic anaemia. In cases with neurological involvement, initially 1 mcg on alternate days. Until no further improve-	Itching; anaphylactic shock with parenteral, pulmonary oedema; CHF; polycythemia vera.

Medicine	Indications	Dose	Adverse Effects
		ment, thereafter 1000 mcg every 2 to 3 months. Prophylaxis: 1000 mcg every 2 to 3 months.	
<b>Nicotinamide</b>	Treatment of pellagra; hartnup's disease; inflammatory skin disease.	Adults- Treatment of pellagra: up to 500 mg daily in divided doses.	Dryness of skin; also pruritus, erythema, burning and irritation; hepatotoxicity, cholestasis; portal fibrosis; transient liver dysfunction; tautness of face.
<b>Pyridoxine</b>	Treatment of pyridoxine deficiency due to metabolic disorders; isoniazid neuropathy; sideroblastic anaemia.	Adults- Deficiency states: 25 to 50 mg up to 3 times daily. Isoniazid neuropathy, prophylaxis: 10 mg daily. Isoniazid neuropathy, treatment: 50 mg, 3 times daily Sideroblastic anaemia: 100 to 400 mg daily in divided doses.	Chronic administration of high doses may cause peripheral neuropathies; paresthesia; neurotoxicity; muscular weakness
<b>Riboflavin</b>	Vitamin B <sub>2</sub> deficiency; ariboflavinosis.	Adults and children- Treatment of vitamin B <sub>2</sub> deficiency: up to 30 mg daily in divided-doses Prophylaxis of vitamin B <sub>2</sub> deficiency: 1 to 2 mg daily	Swelling of lips, face and tongue and difficulty in breathing.
<b>Vitamin A</b>	Prevention and treatment of vitamin A deficiency; prevention of complications of measles.	Adults- Prevention of vitamin A deficiency: 2,00,000 units every 6 months; Pregnant woman, maximum of 10,000 units daily or maximum 25,000 units weekly; mothers, 200,000 units at delivery or within 6 weeks. Treatment of	No serious or irreversible adverse effects in recommended doses; high intake may cause birth defects; transient increased intracranial pressure in adults or a tense and bulging fontanelle in infants (with high dosage); massive overdose can cause rough skin, dry hair,

Medicine	Indications	Dose	Adverse Effects
		<p>xerophthalmia; (except woman of childbearing age) 2,00,000 units on diagnosis, repeated next day and then after 2 weeks; (woman of childbearing age), 5000 to 10,000 units daily for at least 4 weeks or up to 25000 units weekly.</p> <p>Children - Prevention of vitamin A deficiency: infant under 6 months, 50,000 units; 6 to 12 months, 100,000 units every 4 to 6 months, preferably at measles vaccination; Over 1 year, 200,000 units every 4 to 6 months.</p> <p>Treatment of xerophthalmia; infant under 6 months, 50,000 units on diagnosis, repeated next day and then after 2 weeks; 6 to 12 months, 1,00,000 units immediately on diagnosis, repeated next day and then after 2 weeks; over 1 year, same as adults.</p> <p><b>Contraindications</b> Hypervitaminosis.</p>	<p>enlarged liver, raised erythrocyte sedimentation rate, raised serum calcium and raised serum alkaline phosphates concentrations; hair loss; redness of skin; anorexia; weight loss.</p>
<p><b>Iron Salts</b> Oral-Ferrous Gluconate, Ferrous Sulphate, Iron Sucrose,</p>	<p>Iron-deficiency anaemia.</p>	<p>Oral: Adults- Iron-deficiency anaemia: Elemental iron 100 to 200 mg daily in divided doses.</p>	<p>Nausea, vomiting, metallic taste; constipation, diarrhoea, dark stools, epigastric pain, gastrointestinal irritation; long-term or</p>

Medicine	Indications	Dose	Adverse Effects
Sodium Ferric Gluconate Parenteral - Iron Dextran		Prevention of iron deficiency anaemia (in those at particular risk): for woman elemental iron 60 mg daily. Children- Under 5 years: Elemental iron 2 mg/kg (max. 30 mg) daily. Over 5 years: elemental iron 30 mg daily. Over 5 years: folic acid may also be given.	excessive administration may cause haemosiderosis; allergic reaction; back pain; staining of teeth. Parenteral: Pain at injection site, sterile abscess
<b>Folic Acid</b>	Treatment of folate-deficiency megaloblastic anaemia; prevention of neural tube defect in pregnancy.	Adults- Treatment of folate-deficiency, megaloblastic anaemia: 5 mg daily for 4 months (up to 15 mg daily may be necessary in mal-absorption states).	Neuropathy; bronchospasm; skin eruption; anorexia; skin rash; status epilepticus

## 1.11 DIURETICS

Diuretics increase urinary excretion of water and electrolytes and are used to relieve oedema associated with heart failure, nephrotic syndrome or hepatic cirrhosis. Some diuretics are used at lower doses to reduce raised blood pressure.

Medicine	Indications	Dose	Adverse Effects
<b>Loop diuretics:</b>			
Furosemide	To relieve oedema associated with heart failure, nephrotic syndrome or hepatic cirrhosis	Adults- Oedema: initially 40 mg daily on waking up; maintenance dose 20 to 40 mg daily; may be increased to 80 mg daily or more in resistant edema. Children- 1 to 3 mg/kg daily (max. 40 mg daily).	Renal failure with anuria; pre-comatose states associated with liver cirrhosis; hypersensitivity.
<b>Thiazide diuretics:</b>			
Hydrochlorothiazide	Hypertension To relieve oedema	Adults- Hypertension: 12.5	Hypokalaemia; oliguria; hypomagnesaemia;

Medicine	Indications	Dose	Adverse Effects
	Nephrogenic diabetes insipidus	to 25 mg daily. Oedema: initially 25 mg daily on waking up increased to 50 mg daily if necessary. Severe oedema in patients unable to tolerate loop diuretics: up to 100 mg either daily or on alternate days (max. 100 mg daily). Elderly- Hypertension: initially 12.5 mg daily. Oedema: initially 12.5 mg daily.	hyponatraemia; hypochloreaemic alkalosis; hypercalcaemia; hyperglycemia; hyperuricaemia.
<b>Osmotic diuretics:</b>			
Mannitol	Treatment of glaucoma and cerebral oedema	Raised intracranial or intraocular pressure: By i.v. infusion as a 20% solution infused over 30-60 minutes, Adults- 0.25-2g/kg; Children - 0.5-1.5g/kg.  Cerebral oedema: By i.v. infusion as a 20% solution infused rapidly, Adults and Children- 1g/kg.	Headache, nausea, vomiting, dehydration, oedema, hypernatraemia, inflammation, skin necrosis, urticaria, chills, convulsions, fluid and electrolyte imbalance, acidosis, circulatory overload, visual disturbance.

## 1.12 SEDATIVES AND ANTIEPILEPTICS

Sedatives are drugs that are used to calm the recipient without inducing sleep. These are commonly indicated for management of anxiety, seizure control and insomnia.

These are commonly classified into:

- **Barbiturates:** Phenobarbitone
- **Benzodiazepines:** Diazepam, lorazepam, midazolam, alprazolam
- **Non benzodiazepines:** Zopiclone, Zolpidem, Zaleplon

Some of the commonly used sedatives in clinical practice are discussed below:

Medicine	Dose	Adverse Effects
<b>Benzodiazepines</b>		
Diazepam	<p>Adults- <b>Anxiety:</b> 2 mg 3 times daily, increased if necessary to 15 to 30 mg daily in divided doses. <b>Insomnia:</b> 5 to 15 mg at bedtime. Children- Oral 1-2.5 mg, 3 or 4 times daily (Not for use under 6 months). Elderly or debilitated- <b>Anxiety:</b> half adult dose. Adults-<b>Treatment of status epilepticus and convulsions due to poisoning:</b> 10 mg at the rate of 1 ml/min (5 mg) repeated if necessary after 10 min. Children-Under 12 years: 300 to 400 µg/kg, repeated after 10 min if necessary.</p>	Drowsiness and light-headedness the next day; confusion and ataxia (especially in the elderly); amnesia; dependence; paradoxical increase in aggression; muscle weakness; increased appetite; weight gain.
Alprazolam	<p>Adults- 0.25 to 0.5 mg daily 2 to 3 times a day. Children- Not recommended</p>	Drowsiness and light-headedness on the next day; confusion and ataxia (especially in the elderly); amnesia; dependence; paradoxical increase in aggression; muscle weakness; occasionally: headache, vertigo, hypotension, salivation changes, gastrointestinal disturbances, visual disturbances, dysarthria, tremor, changes in libido, incontinence, urinary retention; blood disorders and jaundice reported; skin reactions.
Lorazepam	2 to 6 mg/day given in divided doses, initial dose of 2 to 3 mg/day given twice or thrice a day. Elderly or debilitated patients: Initial dosage of 1 to 2 mg/day in divided doses	Nausea and vomiting, dizziness; weakness; blurred vision; vertigo.

**Anti-epileptics**

These are drugs, which are commonly used to treat seizures. Seizure is a condition in which there is abnormal excessive electrical activity of the brain. Epilepsy is a

disease condition with recurrent seizures. This is characterised by increased excitatory pathway (glutamate) and decreased inhibitory pathway (GABA).

Status epilepticus is a medical emergency, which carries a high mortality rate.

Commonly used drugs are phenytoin, phenobarbitone, valproate, carbamazepine, levotiracetam, lamotrigine, topiramate.

Medicine	Dose	Adverse Effects
Phenytoin	<p>Oral or slow intravenous injection or infusion Adults- Status epilepticus: (with regular BP and ECG monitoring) 18 mg/kg at rate not exceeding 50 mg/min as loading dose, maintenance dose of about 100 mg should be given thereafter at an interval of 6 to 8 h (dose can be reduced according to weight). Children- Status epilepticus: 20 mg/kg at a rate not exceeding 1 mg/kg/min, maintenance dose 4-7 mg/kg/day in 2 divided doses, max dose 300 mg/day.</p>	<p>Gum hypertrophy, acne, hirsutism, ataxia, cerebellar-vestibular symptoms like nystagmus, diplopia; slurred speech (may be signs of overdose); behavioural disorders, hyperglycemia; fever; neurological changes (peripheral neuropathy, choreiform movements, impaired cognition, increased seizure frequency); osteomalacia, rickets (associated with reduced plasma calcium levels); lymph-node enlargement; blood disorders including megaloblastic anaemia (may be treated with folic acid), leucopenia, thrombocytopenia, agranulocytosis with or without bone marrow depression; rashes (discontinue; if mild reintroduce cautiously, but discontinue if recurrence); very rarely, Stevens-Johnson syndrome (erythema multiforme), systemic lupus erythematosus, toxic epidermal necrolysis; hepatitis, hepatic failure.</p>
Phenobarbitone	<p>Slow intravenous injection Status epilepticus: (dilute injection 1 in 10 with water for injections), Adults- 10 mg/kg at a rate of not more than 100 mg/min (up to max. total dose of 1 g); Children- 10-20 mg/kg at a rate of not more than 30 mg/min. Oral</p>	<p>Sedation, mental depression, agitation, hallucination, syncope; ataxia, nystagmus; allergic skin reactions including rarely, exfoliative dermatitis, toxic epidermal necrolysis, Steven's- Johnson syndrome (erythema multiforme); paradoxical excitement,</p>

Medicine	Dose	Adverse Effects
	Adults- 60-180 mg daily at night. Children-1 month- 12 years: 1-1.5 mg/kg twice daily, maintenance dose 2.5-4 mg/kg once/twice daily. 12-18 years: Initially 60-180 mg twice daily, maintenance dose 60-180 mg once daily.	restlessness and confusion in the elderly; irritability and hyperactivity in children.
Sodium Valproate	Adults- 600 mg daily in two divided doses (preferably after food) thereafter increases by 200 mg at 3 days interval clinical response till desired. Children- Initial dose 20 mg/kg/day max. dose 60 mg/kg/day.	Gastrointestinal irritation, nausea, increased appetite and weight gain, hyperammonaemia; ataxia, tremor; transient hair loss (regrowth may be curly); oedema, thrombocytopenia, inhibition of platelet aggregation; impaired hepatic function and rarely, fatal hepatic failure, extrapyramidal symptoms, leucopenia, pancytopenia, red cell hypoplasia, fibrinogen reduction; irregular periods, amenorrhoea, gynaecomastia, hearing loss, vasculitis, hirsutism and acne reported; hallucinations; abnormal gut; pneumonia; headache; taste perversion; polycystic ovary.
Carbamazepine	Adults- Initially 100 and 200 mg 1 to 2 times daily increased slowly to usual dose of 400 mg to 1.2 g daily in divided doses. In some cases 1.6 to 2 g may be needed. Administer lower initial dose to elderly. Children- Start with 5-10 mg/kg/day in two to three divided doses then gradually increases at weekly intervals to a max. dose of 30-35 mg/kg/day.	Sedation, dizziness, vertigo, diplopia and ataxia. Vomiting, diarrhoea, worsening of seizures are also seen with higher doses. Hypersensitivity reactions are rashes, photosensitivity, hepatitis, lupus like syndrome, rarely agranulocytosis and aplastic anaemia.

### 1.13 EXPECTORANTS AND MUCOLYTICS

These are mucokinetic agents used to increase bronchial secretion or reduce its viscosity, facilitating its removal by coughing. Expectorants are occasionally used alone and they are commonly combined with antihistaminic,

These are further classified as bronchial secretion enhancers or mucolytics.

**Bronchial secretion enhancers:**

**Sodium or Potassium citrate:** It is considered to increase bronchial secretion by salt action.

**Potassium iodide:** It is secreted by bronchial glands and can irritate the airway mucosa. Prolonged use may lead to iodism.

**Guaiphenesin, balsum of Tolu, vasaka:** Plant products which are supposed to enhance bronchial secretion and mucociliary function while being secreted by tracheobronchial glands.

**Ammonium chloride:** Reflex increase respiratory secretions.

**Mucolytics**

Name	Dose	Adverse Effects
<b>Mucolytics</b>		
Bromhexine	Adults: 8 mg TDS, Children 1- 5 years- 4 mg BD. Children 5-10 years- 4 mg TDS.	Rhinorrhoea and lacrimation, gastric irritation, hyper- sensitivity
Ambroxol	As amucolytic Adults: 60-120 mg daily, in 2-3 divided doses. Children: <2 yr: 7.5 mg twice daily; 2-5 yr: 7.5 mg twice/ thrice daily; 6-12 yr: 15 mg twice/thrice daily.	Rhinorrhoea and lacrimation, gastric irritation, hyper- sensitivity
Acetylcysteine	Adults: Tab: 600 mg daily as a single or in 3 divided doses.Paracetamol poisoning as 5% soln.: Initial: 140 mg/kg followed by 70 mg/kg 4 hourly for additional 17 doses. Inhalation As 10% soln.: 6-10 ml 3-4 times/day or 2-20 ml 2- 6 hourly as necessary. As 20% soln.: 3-5 ml 3-4 times/day, or 1-10 ml 2-6 hourly as necessary.Endotracheal As a mucolytic 10% or 20% soln.: 1-2 ml every hr.	GI irritation and rashes

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## 1.14 PRENATAL STEROIDS

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Corticosteroid stimulation of developmentally regulated gene expression and physiologic functions result in maturation of the lungs and some other tissues. Antenatal steroids accelerate development of type 1 and type 2 pneumocytes, leading to structural and biochemical changes that improve both lung mechanics (maximal lung volume, compliance) and gas exchange.

**Drugs:**

**Betamethasone:** Two doses of 12 mg given intramuscularly 24 hours apart OR

**Dexamethasone:** Four doses of 6 mg given intramuscularly 12 hours apart.

A non-sulfite containing preparation should be used as the sulfite preservative (NNF60211) commonly used in dexamethasone preparations may be directly neurotoxic in newborns

## 1.15 SURFACE ANAESTHESIA FOR REPAIR OF MINOR INJURY

Adequate anaesthesia is necessary for complete examination, cleansing and repair of wounds.

**Topical anaesthesia**

**EMLA (a eutectic mixture of lignocaine 2.5% and prilocaine 2.5% )**

**Indications:**

Normal intact skin for local analgesia

Genital mucous membranes for superficial minor surgery and as pretreatment for infiltration anaesthesia

**Dose:** The dose of EMLA Cream that provides effective analgesia depends on the duration of the application over the treated area. (1-2 gm/cm<sup>2</sup> of skin)

**Adverse effects:** erythema or oedema or may be the locus of abnormal sensation

**Local anaesthesia**

- 1% lignocaine with adrenaline slowly infiltrated into the wound, (care should be taken not to use adrenaline on finger tips)

**Lignocaine+ adrenaline:**

**Indications:** For infiltration and nerve block anaesthesia

**Dose:** Lignocaine dose should be kept below 500 mg (maximum dose 7 mg/kg)

**Precautions:** Local anaesthetic effect may be reduced if injected into an inflamed or infected area.

**Adverse effects:** Topical and local infiltration may lead to papules, burns, rash, skin irritation, burning sensation and blanching.

## 1.16 ANTIBIOTICS FOR EYE, EAR DROPS AND OINMENTS

Medicine	Indications	Dose	Adverse Effects
<b>Gatifloxacin</b> 0.3 % solution for eye/ear drops	Bacterial conjunctivitis	Adults: Ophthalmic As 0.3% soln.: Instill 1 drop 2 hourly into	Conjunctival irritation, increased lacrimation, keratitis, papillary conjunctivitis, chemosis,

Medicine	Indications	Dose	Adverse Effects
		affected eye(s) while awake (up to 8 times/day) for the 1st 2 days then reduce to 1 drop 4 times/day while awake for the next 5 days.	conjunctival haemorrhage, ocular dryness and redness, ocular discharge/irritation/pain, eyelid oedema, headache, reduced visual acuity, and taste disturbance.
<b>Chloramphenicol</b> 5% solution for ear drops 0.5% solution for eye drops 1% ointments	Bacterial conjunctivitis, otitis externa	Otitis externa: As 5% soln.: Instill 2-3 drops 2-3 times/day. Ocular infections: Instill 1 drop of a 0.5% solution every 2 hr. Increase dosage interval upon improvement. To continue treatment for at least at 48 hr after complete healing. Reduce dose once symptoms are controlled or apply a 1% ointment 3-4 times daily.	Conjunctival irritation, increased lacrimation
<b>Erythromycin</b> 0.5% ointment	Treatment and prophylaxis of ophthalmic infections	Adults: As 0.5% ointment. Apply approx 1 cm length to the affected eye(s) up to 6 times daily. Children: As 0.5% ointment. Apply approx 1 cm in length into each of the lower conjunctival sac, then massage gently to spread the ointment.	Conjunctival irritation, increased lacrimation

## 1.17 DRUGS USED IN RESUSCITATION AND LIFE SUPPORT

Let us now go through the drugs used in resuscitation and life support.

Medicine	Indications	Dose	Adverse Effects
Adrenaline (Epinephrine)	Severe anaphylactic reaction; severe angioedema; cardiac arrest; haemostatic agent.	Intramuscular injection Anaphylaxis: preferable site is the midpoint in anterior thigh [1:1000 solution]. This route should be used by specialists only with extreme care. Slow intravenous injection When there is doubt regarding adequacy of circulation and absorption from the intramuscular site; slow intravenous injection of 1:10000 (10 mg/ml) solution be injected in severely ill patients only.	“Epinephrine fastness”, tachycardia and arrhythmias, hypertension, tremor, anxiety, sweating, nausea, vomiting, weakness, hyperglycemia, dizziness, pulmonary oedema have all been reported; headache common.
Atropine	To inhibit salivary secretions; to inhibit arrhythmias resulting from excessive vagal stimulation; to block the parasympathomimetic effects of anticholinesterases such as neostigmine; organophosphate poisoning; antispasmodic; mydriasis and cycloplegia.	Intravenous injection Adults- 0.3 to 0.6 mg immediately before induction of anaesthesia. Intraoperative bradycardia; 300 to 600 mcg (longer dose in emergency). Inhibition of bradycardia; 0.4 to 1 mg. Reversal of neuromuscular block; 0.6 to 1.2 mg. Children: Pre-medication: 20 mcg/kg; Inhibition of bradycardia: 10 to 30 mcg/kg. Reversal of neuromuscular block: 20 mcg/kg.	Dry mouth; blurred vision; photophobia; flushing and dryness of skin; rash; difficulty in micturition; less commonly arrhythmias.

Medicine	Indications	Dose	Adverse Effects
		<p>Intramuscular route or subcutaneous</p> <p>Premedication (30 to 60 min before induction of anaesthesia): 300 to 600 mcg.</p> <p>Children- 20 mcg/kg (max. 60 mcg).</p> <p>Intra operative bradycardia: (1 to 12 years) 10 to 20 µg/kg.</p>	
Noradrenaline	Acute hypotension, adjunct in cardiac arrest, upper gastrointestinal haemorrhage.	<p><b>Parenteral</b></p> <p>Intravenous</p> <p>Acute hypotension</p> <p>Adults: 8-12 mcg/minute, up to 8-30 mcg/minute in refractory shock.</p> <p>Infused using a solution of 4 mcg/ml in glucose 5%, or sodium chloride 0.9% and glucose 5% at a rate of 2-3 ml/minute. Adjust according to blood pressure response.</p> <p>Average maintenance dose: 0.5-1 ml/minute (2-4 mcg/minute).</p> <p>Infuse via a central venous catheter or into a large vein.</p> <p>Children: Administer at a rate of 2 mcg/minute. Alternatively, 2 mcg/ml/minute. Adjust rate according to BP response and perfusion. Elderly: Initial dose should be at low end of dose range. Upper gastrointestinal</p>	Elevation of blood pressure, bradycardia, peripheral ischemia, arrhythmias, anxiety, transient headache, respiratory difficulty, extravasation necrosis at injection site.

Medicine	Indications	Dose	Adverse Effects
		<p>haemorrhage: Adults: 8 mg in 250 ml of 0.9% sodium chloride injection via intraperitoneal route. Alternatively, instill 8 mg in 100 ml of 0.9% sodium chloride solution through a nasogastric tube every hr for 6-8 hrs, then every 2 hrs for 4-6 hrs. Withdraw drug gradually. Dilute with 5% glucose injection, with or without sodium chloride; dilution with sodium chloride injection alone is not recommended.</p>	
Magnesium sulphate	Prevention of recurrent seizures in eclampsia; prevention of seizures in pre-eclampsia; acute nephritis in children.	<p>Intravenous injection (concentration of magnesium sulphate should not exceed 20%) Prevention of seizure occurrence in eclampsia: initially 4 g over 5 to 15 min, followed by infusion 1g/h for at least 24 h after last seizure. If seizures recur, additional dose of 2 g (or 4 g if body weight is over 70 kg).</p>	<p>Generally associated with hypermagnesaemia, nausea, vomiting, thirst, flushing of skin, hypotension, arrhythmias, and coma, respiratory depression, drowsiness and confusion, loss of tendon reflexes, muscle weakness; hypothermia; stupor.</p>

## 1.18 LET US SUM UP

In this unit we have discussed about vaccines, route and doses and schedule of administering; common medications used for fever, pain, infections; drugs for scabies treatment; anti-emetics and its indications; antispasmodics and when to

use; counsel the correct use of ORS and Hematinies, Vitamins and Minerals; how and when to use diuretics, antihypertensives, drugs for diabetes mellitus and sedatives; appropriate use of drugs under National Health Programmes.

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## 1.19 MODEL ANSWERS

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### Check Your Progress 1

- 1)
  - a) TP
  - b) 6, 10 and 14
  - c) Intra-muscular
  - d) Sub-cutaneous
  - e) HIB, DPT and Hep B
- 2) Local reactions including inflammation and lymphangitis may occur. Sterile abscess may develop at the injection site;
  - Fever
  - Headache
  - Malaise starting a few hour after injection and lasting for 1-2 days may occur.
  - Hypersensitivity reactions can occur including rarely, anaphylaxis.

### Check Your Progress 2

- 1) Aluminium hydroxide + Magnesium hydroxide, Omeprazole, Pantoprazole and Ranitidine
- 2) Cotrimoxazole, Ampicillin, Amoxicillin, Ciprofloxacin and Norfloxacin
- 3) Cotrimoxazole, Ampicillin, Amoxicillin and Ciprofloxacin
- 4) Mild to moderate pain including dysmenorrhoeal pain, headaches, pain relief in osteoarthritis, rheumatoid arthritis, autoimmune arthritis and soft tissue lesions, pyrexia including post-immunisation pyrexia, acute migraine attack.
- 5) Gastrointestinal: Gastric irritation, erosions, peptic ulceration, gastric bleeding/perforation, oesophagitis.

Hepatic: Raised transaminases, hepatic failure (rare)

CNS: Headache, mental confusion, behavioural disturbances, seizure precipitation

Haematological: Bleeding, thrombocytopenia, haemolytic anemia, agranulocytosis

Others: Asthma exacerbation, nasal polyposis, skin rashes, pruritus, angioedema

### Check Your Progress 3

- 1) These are drugs, which are active against scabies. Scabies is an infestation of the skin by the mite *Sarcoptes scabiei* that results in an intensely pruritic eruption with a characteristic distribution pattern.

- 2) They are typically used to treat motion sickness and the side effects of opioid analgesics, general anesthetics and chemotherapy induced nausea and vomiting in cancer patients either alone or in combination.
- 3) These are drugs, which are used to relieve spasm of smooth muscle.

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## UNIT 2 ESSENTIAL DRUGS - 2

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### Structure

- 2.0 Introduction
- 2.1 Objectives
- 2.2 Drugs Used to Treat Intestinal Infestation
  - 2.2.1 Anthelmintic Drugs
  - 2.2.2 Anti-Amoebic Drugs
- 2.3 Corticosteroids in Pregnancy
  - 2.3.1 Risks of Taking Steroid in Pregnancy
- 2.4 Nutritional Supplements
  - 2.4.1 Calcium
  - 2.4.2 Iron
  - 2.4.3 Folic Acid
  - 2.4.4 Zinc
- 2.5 Intravenous Fluids
  - 2.5.1 Normal Saline
  - 2.5.2 Ringer's Lactate
- 2.6 Drugs Used for Gastrointestinal Disturbances
  - 2.6.1 Enzyme Preparations
  - 2.6.2 Laxatives
- 2.7 Drugs Used for Hypertensive Disorders and Diabetes Mellitus
- 2.8 Drugs Used for Epilepsy
- 2.9 Drugs Used for Difficulty in Respiration
- 2.10 Let Us Sum Up
- 2.11 Model Answers
- 2.12 Key Words
- 2.13 References

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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> Neurocysticersoris	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, amebic 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) Antihelminthic 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. ..... ..... .....
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 be 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	Hypersensitivityintestinal 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, hypercholes- terolemia, hyperuricemia or gout, hypercalcemia
Frusemide	Hypertension, oedema	20-80 mg PO divided q12hr	Hyperuricemia, hypokalemia, anaphylaxis, anaemia, ano- rexia, diarrhoea, dizziness, glu- cose intolerance	Renal failure	In excessive amounts, may lead to pro- found 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 inhibi- tor-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	Hypersensi- tivity	Angioedema, volume-deple- tion, severe congestive heart failure (CHF), hepatic or renal impairment
Atenolol Beta-blockers	Hypertension	25-50 mg/ day PO initially; may	Tiredness, Hypotension, Bradycardia,	Hypersensi- tivity, Uncompen-	Use with cau- tion in anes- thesia 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.

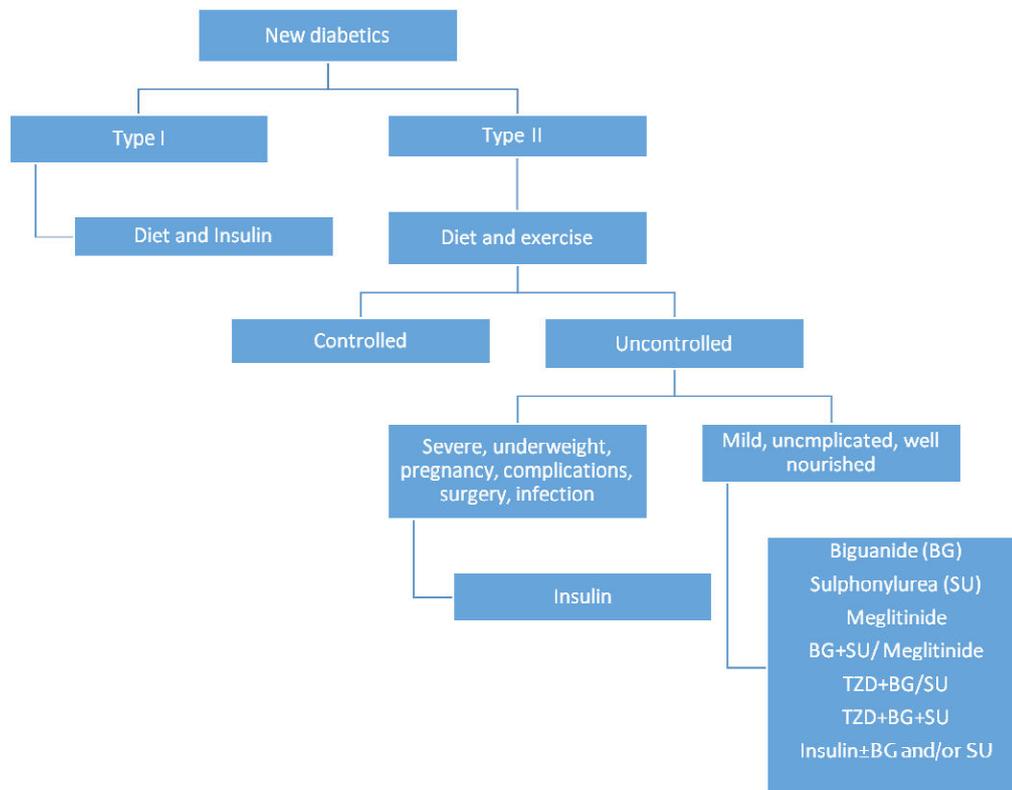


Fig. 2.1: Flow chart of management of Diabetes mellitus

## 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.

Some commonly used drugs are:

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>	<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.</p>
<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>	<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.</p>

**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 paralysing 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 diarrheal 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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## UNIT 3 ESSENTIAL DRUGS - 3

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### Structure

- 3.0 Introduction
- 3.1 Objectives
- 3.2 Expectorants
  - 3.2.1 Difference between Expectorants and Mucolytics
  - 3.2.2 Natural Remedies for Cough
  - 3.2.3 A Word of Caution While Using Cough Syrups
- 3.3 Misoprostol
- 3.4 Drugs for Postpartum Haemorrhage
  - 3.4.1 Oxytocin
  - 3.4.2 Methylergonovine
  - 3.4.3 Syntometrine
  - 3.4.4 Carboprost
  - 3.4.5 Managing PPH
- 3.5 Oral Contraceptives
  - 3.5.1 Combined Oral Contraceptives
  - 3.5.2 Progesterone-only Contraceptives
  - 3.5.3 Non-steroidal oral Contraceptive
  - 3.5.4 Emergency Contraception
- 3.6 Topical Anaesthetic Agents
- 3.7 Nasal Decongestants
- 3.8 Drugs Used in Shock
- 3.9 Drugs Used in Vector Borne Diseases
  - 3.9.1 Antimalarial drugs
  - 3.9.2 Drugs used for Kalaazar
- 3.10 Anti-tubercular Drugs
  - 3.10.1 Essential First line Anti-Tuberculosis Drugs (ATDs)
  - 3.10.2 Treatment for MDR-TB
  - 3.10.3 Treatment for Leprosy
- 3.11 Antiretroviral Drugs
- 3.12 Let Us Sum Up
- 3.12 Key Words
- 3.13 References

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## 3.0 INTRODUCTION

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In the previous two units we have discussed about the pharmacology of some common drugs. There are many molecules which are used as medicines for treatment of various diseases. New drugs are being discovered regularly. It is important to have new drugs, as the pathogens which causes infectious diseases develops resistance to the old drugs due to indiscriminate use of antibiotics. But at the same time we should not discard or undervalue the time tested drugs. The proverb 'old is gold' is true in case of medicines

too. Many drugs which were discovered many decades ago are still being used to treat many dreaded diseases. It is repeated here that medicines, are active chemicals and should be used judiciously and should be prescribed by only those who have required qualification plus enough knowledge about its various aspects.

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### 3.1 OBJECTIVES

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

- explain the use of expectorant in day to day practice;
- explain the correct use of misoprostol as abortifacient and to control post-partum haemorrhage;
- counsel the eligible couple about the correct usage of oral contraceptive pills;
- list the common medications used for surface anaesthesia while treating minor injuries;
- enumerate drugs used to resuscitate individuals;
- discuss the harmful effects of regular usage of nasal decongestants and antibiotics with your clients; and
- explain the drugs used in various national health programmes.

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### 3.2 EXPECTORANTS

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A recurrent and chronic cough is an irritating symptom. It can affect one's work and sleep, and it can disturb others around the person having cough, too. Everyone wants to get rid of the cough as soon as possible. Expectorants are drugs that increase the airway secretion and enhance the expulsion of mucous by air passages of the lungs. This makes it is easier to cough up the phlegm or sputum. Expectorants are used in cough syrups and are used by someone who is having nagging cough. Often the term 'expectorant' is incorrectly extended to any cough syrup.

#### 3.2.1 Difference between Expectorants and Mucolytics

A mucolytic agent is an agent which dissolves thick mucous and is usually used to help relieve respiratory difficulties. It does so by dissolving various chemical bonds within secretions, which in turn can lower the viscosity by altering the mucin-containing components. There is a difference in the terms 'expectorant' and 'mucolytic agent'. An expectorant increases bronchial secretions and mucolytics help loosen thick bronchial secretions.

#### 3.2.2 Natural Remedies for Cough

Before prescribing someone with a cough syrup it is advisable to give him some natural expectorants to stop the cough. The natural remedies for stopping cough are honey and steam. Inhalation of soothing vapours of herbs like eucalyptus, peppermint, rosemary, and clove oil helps in forming a more productive cough. The vapour rubs available in the medicine stores usually contain a mixture of petroleum jelly and essential oils. Some replace petroleum with coconut oil or almond oil. These vapour rub or ointments can loosen mucous when they are rubbed onto the chest and neck. Drinking lots of warm liquids helps to thin mucous. Warm chicken soup is an effective and proven way for movement of mucous, providing relief.

### 3.2.3 A Word of Caution While Using Cough Syrups

There are cough syrups available in the market which contain a mix of cough suppressant or expectorant with medicines for other symptoms. That medicine may be an antihistaminic, a decongestant or a pain reliever. The mixture can be a good thing if the person has a range of cold symptoms, like body aches, coughs, and congestion. The downside is that he may get a medicine which he does not need. So all cough syrups are not suitable for any type of cough.

However in day to day practice, most of the times, dry and irritating cough could be allergic or due to acid reflux. In these situations, you need to prescribe an appropriate antiallergic or a proton pump inhibitor/ H2 blocker as per the history and clinical impression. Also, the cough suppressants will be of immense use in non-specific dry cough especially associated with haemoptysis.

#### Check Your Progress 1

1) Define Expectorants.

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2) Explain natural remedies for cough.

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3) Explain cautions while using cough syrup.

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## 3.3 MISOPROSTOL

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It is a synthetic prostaglandin E 1 analog. This is used for a variety of illnesses. Misoprostol is a medication used to start labour, cause an abortion, prevent, and treat postpartum bleeding due to poor contraction of the uterus. For abortions it is often used with mifepristone. By itself effectiveness of Misoprostol for abortion is between 66% and 90%. It is taken either by mouth, kept under the tongue, or placed in the vagina. Mifepristone 200 mg tablet 3 tablets orally followed by misoprostol 200 µg 2 tablets orally 2 days later is an effective way to terminate pregnancy of upto 49 days. The common side effects of the drug include diarrhoea and abdominal pain. Uterine rupture may occur if it is given as abortifacient without much consideration and the pregnant lady is not under medical supervision. Misoprostol is commonly used for labour induction. It causes uterine contractions and the ripening of the cervix. It is significantly less expensive than the other commonly used ripening agent. Misoprostol is also used to prevent and treat post-partum bleeding. Orally administered misoprostol is marginally less effective than oxytocin. The use of rectally administered misoprostol is optimal in cases of bleeding. Misoprostol is recommended due to its cost,

effectiveness, stability, and low rate of side effects. For post-partum haemorrhage oxytocin must also be given by injection, while misoprostol can be given orally or rectally. This strategy is very useful in areas where trained nurses and physicians are not available.

### 3.4 DRUGS FOR POSTPARTUM HAEMORRHAGE

Postpartum Haemorrhage (PPH) is commonly defined as a blood loss of 500 ml or more within 24 hours after child birth. PPH is the leading cause of maternal mortality in low-income countries including India and the primary cause of nearly one quarter of all maternal deaths globally. Most deaths resulting from PPH occur during the first 24 hours after birth. The unfortunate part is that the majority of these deaths could be avoided through the use of prophylactic medications and by timely and appropriate management. The group of drugs which are used to control postpartum haemorrhage is known as uterotonics. These drugs stimulate contraction of the uterine muscle, helping to control PPH. These agents are useful in the treatment and prophylaxis of PPH. Following are the drugs which are commonly used during PPH.

#### 3.4.1 Oxytocin

Oxytocin has variety of actions. It produces rhythmic uterine contractions, can stimulate the gravid uterus, and has vasopressive and antidiuretic effects. It is widely used to control postpartum bleeding. It can be used prophylactically in the third stage of labour.

#### 3.4.2 Methylergonovine (Methergine)

It is an ergot alkaloid. Only the amine ergot alkaloid ergometrine (ergonovine) and its derivative methyl-ergometrine are used in obstetrics. It acts directly on uterine smooth muscle, causing a sustained tetanic uterotonic effect that reduces uterine bleeding and shortens the third stage of labour. It is administered intra-muscularly during puerperium, during delivery of placenta, or after delivering the anterior shoulder of the baby. Ergometrine is contraindicated in women with a history of hypertension, heart disease, preeclampsia, or eclampsia.

#### 3.4.3 Syntometrine

It is a combination of 5 IU oxytocin plus 0.5 mg ergometrine. It controls PPH effectively by combined rapid action of oxytocin and sustained action of ergometrine.

#### 3.4.4 Carboprost

It has a longer duration of action and produces myometrial contractions that induce haemostasis at the placental site, which reduces postpartum bleeding. It is given as 0.25 mg IM every 30–120 minutes for PPH.

**Table 3.1: Common Drugs used to Control Post-partum haemorrhage**

Name of Drug	Use	Dose	Side Effects	Contraindications	Precautions
Oxytocin	Induction of labour, abortion, PPH	For PPH: 10 to 40 units IV infusion in 1000 mL at	Confusion, convulsions, difficulty in breathing,	Allergic, cephalopelvic disproportion	May interact with other drugs

Name of Drug	Use	Dose	Side Effects	Contraindications	Precautions
		a rate sufficient to control bleeding. 10 units IM after delivery of placenta.	dizziness fast or irregular heartbeat		
Ergometrine	PPH	0.2 mg IM; may repeat in 2-4 hr; not to exceed 5 doses total	Dizziness, headache, hypertension, nasal congestion, nausea and vomiting	Hypertension, toxemia, pregnancy, hypersensitivity	IV only in emergency because of potential for hypertension and stroke
Syntometrine	Following the birth of the placenta, to prevent or treat PPH	IM injection of 1 ml following expulsion of the placenta, or when bleeding occurs	Headache, dizziness, myocardial infarction, hypertension, vomiting, nausea, abdominal pain	Severe hypertension, pre-eclampsia, eclampsia, severe cardiac disorders	In breech presentations and other abnormal presentations, Syntometrine should not be given until after delivery of the child
Carboprost	Treatment of PPH due to uterine atony and refractory to conventional methods of treatment with oxytocic agents and ergometrine	1 ml deep IM, may be repeated after an hour	Flushing, hot flush, chills, headache	Acute pelvic inflammatory disease, cardiac, pulmonary, renal, or hepatic disease.	should not be used for induction of labor

### 3.4.5 Managing PPH

Uterine massage is recommended for the treatment of PPH as soon as it is diagnosed. Initial fluid resuscitation with isotonic crystalloids are recommended. The use of tranexamic acid is advised in cases of refractory atonic bleeding or persistent trauma-related bleeding. Bimanual uterine compression, external aortic compression, and the use of non-pneumatic anti-shock garments are recommended as temporary measures until substantive care is available. If bleeding persists despite treatment with uterotonic drugs and other conservative interventions, intervention radiology or surgical intervention should be used without further delay.

#### Box 3.1: Recommendations for the Prevention of PPH

- The use of uterotonics for the prevention of PPH during the third stage of labour is recommended for all births.
- Oxytocin (10 IU, IV/IM) is the recommended uterotonic drug for the prevention of PPH.

- If oxytocin is unavailable, we can use other injectable uterotonics (if appropriate, ergometrine/methylergometrine or the fixed drug combination of oxytocin and ergometrine) or oral misoprostol (600 mg).
- Community health care workers or lay health workers can use Tablet Misoprostol (600 mg PO) for the prevention of PPH if skilled birth attendants are not present and oxytocin is unavailable.
- Late cord clamping (performed after 1 to 3 minutes after birth) is recommended for all births while initiating simultaneous essential new-born care.
- Early cord clamping (<1 minute after birth) is not recommended unless the neonate is asphyxiated and needs to be moved immediately for resuscitation.
- Sustained uterine massage is not recommended as an intervention to prevent PPH in women who have received prophylactic oxytocin.
- Postpartum abdominal uterine tonus assessment for early identification of uterine atony is recommended for all women.
- Oxytocin (IV or IM) is the recommended uterotonic drug for the prevention of PPH in caesarean section.
- Controlled cord traction is the recommended method for removal of the placenta in caesarean section.

**Box 3.2: Recommendations for the Treatment of PPH**

- Intravenous oxytocin alone is the recommended uterotonic drug for the treatment of PPH.
- If intravenous oxytocin is unavailable, or if the bleeding does not respond to oxytocin, the use of intravenous ergometrine, oxytocin-ergometrine fixed dose, or a prostaglandin drug (including sublingual misoprostol, 800 µg) is recommended.
- The use of isotonic crystalloids is recommended in preference to the use of colloids for the initial intravenous fluid resuscitation of women with PPH.
- The use of tranexamic acid is recommended for the treatment of PPH if oxytocin and other uterotonics fail to stop bleeding or if it is thought that the bleeding may be partly due to trauma.
- Uterine massage is recommended for the treatment of PPH.
- If women do not respond to treatment using uterotonics, or if uterotonics are unavailable, the use of intrauterine balloon tamponade is recommended for the treatment of PPH due to uterine atony.
- If bleeding does not stop in spite of treatment using uterotonics and other available conservative interventions (e.g. uterine massage, balloon tamponade), the use of surgical interventions is recommended.
- The use of bimanual uterine compression is recommended as a temporizing measure until appropriate care is available for the treatment of PPH due to uterine atony after vaginal delivery.

- The use of external aortic compression for the treatment of PPH due to uterine atony after vaginal birth is recommended as a temporizing measure until appropriate care is available.
- The use of non-pneumatic anti-shock garments is recommended as a temporizing measure until appropriate care is available.
- The use of uterine packing is not recommended for the treatment of PPH due to uterine atony after vaginal birth.
- If the placenta is not expelled spontaneously, the use of IV/IM oxytocin (10 IU) in combination with controlled cord traction is recommended.
- The use of ergometrine for the management of retained placenta is not recommended as this may cause tetanic uterine contractions which may delay the expulsion of the placenta.
- The use of PGF<sub>2</sub>α (dinoprostone) for the management of retained placenta is not recommended.
- A single dose of antibiotics (ampicillin or first-generation cephalosporin) is recommended if manual removal of the placenta is practised.

**Check Your Progress 2**

1) List indications for misoprostol.

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2) Define Postpartum Haemorrhage (PPH).

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3) Define uterotonics.

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4) List indications of Oxytocin injection.

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5) Enumerate drugs which control Postpartum Haemorrhage (PPH).

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## 3.5 ORAL CONTRACEPTIVES

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Hormonal contraception is one of the most effective methods of reversible fertility control. These are classified further on the basis of components.

### 3.5.1 Combined Oral Contraceptives

Estrogen plus progestogen combinations are the most widely used hormonal contraceptives. They produce a contraceptive effect mainly by suppressing the hypothalamic-pituitary system resulting in prevention of ovulation; in addition, changes in the endometrium make it unreceptive to implantation. Ovulation usually resumes within three menstrual cycles after oral contraception has been discontinued; anovulation and amenorrhoea persisting for six months or longer requires investigation and appropriate treatment if necessary. Potential non-contraceptive benefits of combined oral contraceptives include improved regularity of the menstrual cycle, decreased blood loss, less iron-deficiency anaemia and significant decrease in dysmenorrhoea.

#### Availability

Tablets:

- 1) Levonorgestrel + Ethinylestradiol  
0.15 mg + 0.03 mg  
0.25 mg + 0.05 mg
- 2) Levonorgestrel 0.15 mg + Ethinylestradiol 0.03 mg + Ferrous fumarate 60 mg.
- 3) Norethisterone + Ethinylestradiol  
0.5 mg + 0.03 mg  
1.0 mg + 0.03 mg

#### Dose

Adults- Contraception: 1 TAB (pill) daily for 21 days; subsequent courses repeated after 7-day pill-free interval (during which withdrawal bleeding occurs). Each tablet (pill) should be taken at approximately the same time each day; if delayed by longer than 24 h contraceptive protection may be lost. It is important to bear in mind that the critical time for loss of protection is when a pill is omitted at the beginning or end of a cycle (which lengthens the pill-free interval).

#### Adverse effects

These are frequent, especially in the first 1–3 cycles and then disappear gradually.

Nausea and vomiting: Similar to morning sickness of pregnancy. Headache is generally mild; migraine may be precipitated or worsened. Breakthrough bleeding or spotting: Especially with progestin only preparations. Amenorrhoea may occur in few, or the cycles may get disrupted especially with injectable and maniple. Breast discomfort. These adverse effects appear later after several months of use. Weight gain, acne and increased body hair. Chloasma: pigmentation of cheeks, nose and forehead Pruritus vulvae. Carbohydrate intolerance and precipitation of diabetes. Mood swings, abdominal distention are occasional; especially reported with progesterone only contraceptives.

**Serious complications**

- 1) Leg vein or pulmonary thrombosis
- 2) Cerebral or coronary thrombosis leading to stroke or Myocardial infraction
- 3) Hypertension
- 4) Genital carcinoma
- 5) Dyslipidemia
- 6) Benign hepatoma
- 7) Gallstones

**Contraindications**

Thromboembolic, coronary and cerebrovascular disease or a history of it. Moderate-to-severe hypertension; hyperlipidemia. Active liver disease, hepatoma or history of jaundice during past pregnancy. Suspected/overt malignancy of genital and breast. Porphyria. Impending major surgery-to avoid operative thromboembolism.

**3.5.2 Progesterone-only Contraceptives**

Progestogen-only contraceptives, such as oral levonorgestrel may offer a suitable alternative when estrogens are contraindicated but the oral progestogen-only preparations do not prevent ovulation in all cycles and have a higher failure rate than combined estrogen-containing preparations. Progestogen only contraceptives carry less risk of thromboembolic and cardiovascular disease than combined oral contraceptives and are preferable for women at increased risk of such complications, for example smokers over 35 years. They can be used as an alternative to estrogen-containing combined preparations prior to major surgery. Oral progestogen-only contraceptives may be started 3 weeks after birth; lactation women should preferably start at least 6 weeks after birth. Menstrual irregularities (oligomenorrhoea, menorrhagia, and amenorrhoea) are common.

**3.5.3 Non-steroidal Oral Contraceptive****Centchroman**

It probably acts as an anti-implantation agent by inducing embryo-uterine asynchrony, accelerated tubal transport and suppression of decidualization. It prevents conception as long as taken, with return of fertility on withdrawal.

**Availability**

Tablet: 30 mg.

**Dose**

30 mg tablet. A single tablet should be taken twice a week (on a Sunday and a Wednesday) for the first three months and then weekly (every Sunday) thereafter.

**Adverse Effects**

Water retention; tender breasts; acne; heavy menstruation.

**Contraindications**

Medical history of liver disease, jaundice; ovarian disease (polycystic ovaries); cervical hyperplasia; cervicitis; chronic renal disorders.

### 3.5.4 Emergency Contraception

**Levonorgestrel** is used for emergency contraception.

Levonorgestrel 1.5 mg should be taken as a single dose within 72 h of unprotected intercourse; alternatively, levonorgestrel 750 µg can be taken within 72 h of unprotected intercourse followed 12 h later by another 750 µg. Under these circumstances levonorgestrel prevents about 86% of pregnancies that would have occurred if no treatment had been given.

#### Adverse effects

Nausea, vomiting, headache, dizziness, breast discomfort and menstrual irregularities. If vomiting occurs within 2–3 h of taking the tablet, replacement tablet can be given with an antiemetic.

**Table 3.2: Common oral Contraceptive Pills**

Name of Drug	Use	Dose	Side Effects	Contraindications	Precautions
Estrogen progestin combination	Prevent pregnancy	Comes in 21 or 28 tablets packet. Take once daily	Nausea, breakthrough bleeding, skin colour changes, breast changes	Suspected pregnancy, genital bleeding, migraine, liver disease, breastfeeding, bleeding disorders, high blood pressure, breast cancer	Use with caution in women above 35 years of age
Progestin only pills	Prevent pregnancy	There are 28 pills in a pack of progestogen-only pills. Take once daily	Acne, breast tenderness and breast enlargement, mood changes, headache and migraine, nausea or vomiting	Heart disease, liver disease, breast cancer, ovarian cysts, unexplained vaginal bleeding	Take the progestogen-only pill at the same time each day
Emergency contraceptive pills	After unprotected intercourse	1.5 mg as soon as possible after unprotected intercourse	Nausea, vomiting, headache, feeling tired, fatigue, lower abdominal pain, vaginal bleeding, breast tenderness	Suspected pregnancy, hypersensitivity	Repeated ECP use is an indication that the woman requires further counselling on other contraceptive options. Frequently repeated ECP use may be harmful

**Check Your Progress 3**

- 1) List advantages of Oral contraceptives.

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- 2) List the importance of dose of contraception.

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- 3) Explain progesterone only contraceptives.

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- 4) Explain emergency contraception with dose.

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### 3.6 TOPICAL ANAESTHETIC AGENTS

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A topical anaesthetic is a local anaesthetic that is used to numb the surface of a body part. They can be used to numb any area of the skin as well as the front of the eyeball, the inside of the nose, ear or throat, the anus and the genital area. Topical anaesthetics are available in creams, ointments, aerosols, sprays, lotions, and gels. Drugs include benzocaine, butamben, dibucaine, lidocaine, oxyethazaine, and tetracaine.

Many options to deliver anaesthesia have developed over the last several decades. Administration of topical anaesthetics to control pain associated with procedures such as laceration repair may avoid the need for infiltrative local anaesthesia injections and associated pain from the injections. Topical anaesthesia also avoids the risk of wound distortion that exists with infiltrative injection administration.

#### **Mechanism of action**

Topical anaesthetics reversibly block nerve conduction near their site of administration, thereby producing temporary loss of sensation in a limited area. Nerve impulse conduction is blocked by decreasing nerve cell membrane permeability to sodium ions, possibly by competing with calcium-binding sites that control sodium permeability.

#### **Duration of topical anaesthetic**

The duration of topical anaesthesia depends on the type and amount applied, but is usually about half an hour. Adequate anaesthesia is necessary for complete examination, cleansing and repair of wounds.

## Usage of topical anaesthetics

Topical anaesthetics are used to relieve pain and itching caused by conditions such as sunburn or other minor burns, insect bites or stings, and minor cuts and scratches. Topical anaesthetic eye drops are used in ophthalmology to numb the surface of the eye to perform some tests for eye condition like glaucoma and also to remove foreign bodies and prior to surgeries of the eye. Topical anaesthetics find its use in dentistry to numb oral tissue before performing any dental procedure. Some topical anaesthetics (e.g. oxybuprocaine) are also used in ENT setup. Topical anaesthetics are poorly absorbed through intact skin and hence are safe to use.

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## 3.7 NASAL DECONGESTANTS

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Nasal congestion happens when the blood vessels in the mucous membranes lining the nose become swollen, affecting breathing. For most people, a blocked nose is simply an annoyance, but for others, nasal congestion can affect their ears, their hearing and in severe cases, their sleep. In young babies who are being breast-fed or bottle-fed, nasal congestion can affect feeding, because babies need to breathe through their nose while they feed. A nasal decongestant is a type of drug that is used to relieve nasal congestion. The active ingredient in most decongestants is either pseudoephedrine or phenylephrine. Regular use of these agents for long periods should be avoided because mucosal ciliary function is impaired. Atrophic rhinitis and anosmia can occur due to persistent vasoconstriction. Decongestants can be absorbed from the nose via an inhaler and produce systemic effects, mainly CNS stimulation and rise in blood pressure. These drugs should be used cautiously in hypertensives and in those receiving some medications. Besides hypertension, common side-effects include sleeplessness, anxiety, dizziness, excitability, and nervousness.

### Mechanism of action

The vast majority of decongestants act via enhancing norepinephrine and epinephrine, adrenergic activity. This induces vasoconstriction of the blood vessels in the nose, throat, and paranasal sinuses, which results in reduced inflammation (swelling) and mucous formation in these areas.

### Warning

Topical nasal decongestants quickly develop tachyphylaxis (a rapid decrease in the response to a drug after repeated doses over a short period of time). Long-term use is not recommended, since these agents lose effectiveness after a few days. Medicated nasal decongestants should not be used in babies younger than 6 months, as rebound congestion may cause breathing difficulty. Decongestants containing pseudoephedrine, phenylephrine, oxymetazoline or xylometazoline should not be given to children younger than 6 years.

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## 3.8 DRUGS USED IN SHOCK

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A person in shock is an emergency condition. He needs advanced life support. Good quality cardio-pulmonary resuscitation (CPR) is the cornerstone of advanced life support. This includes delivery of chest compressions over the lower half of the sternum at a depth of at least 5 cm, and at a rate of approximately 100–120 per minute, while minimising interruptions for compressions at all times. Some conditions may precipitate cardiac arrest or decrease the chances of successful resuscitation. These conditions

should be sought and, if present, corrected in every case. These conditions can be remembered as 4 Hs and 4 Ts (hypoxaemia, hypovolaemia, hyper/hypokalaemia and metabolic disorders, hypo/hyperthermia and Tension pneumothorax, Tamponade, Toxins / poisons / drugs, Thrombosis-pulmonary / coronary). Following drugs are commonly used as life saving measures in advanced life support.

**Epinephrine:** This is a first line drug. Epinephrine has combined  $\alpha$ -adrenergic and  $\beta$ -adrenergic effects. The  $\alpha$ -adrenergic effects may augment coronary diastolic pressure, thereby increasing sub-endocardial perfusion during chest compressions. Epinephrine also increases the likelihood of successful defibrillation.

**Check Your Progress 4**

1) Write meaning of topical anaesthetic agents.

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2) In which form are these drugs available.

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3) List uses of topical anaesthetic agents.

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4) Nasal decongestants need to be used with precautions in which group of patients.

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5) Name drugs used for treatment of shock.

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**3.9 DRUGS USED IN VECTOR BORNE DISEASES**

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Let us now discuss the drugs used in vector born diseases under antimalarial and Kala-azar

### 3.9.1 Anti-malarial Drugs

Malaria is caused by a parasite called plasmodium. Its two species plasmodium vivax and plasmodium falciparum are prevalent in India. There are many drugs available for malaria. The first drug invented and still in use is quinine. Government of India regularly revises its national antimalarial drug policy because of the changing pattern of infection and growing resistance against the established antimalarials. In 1982, Ministry of Health and Family Welfare, Government of India formulated the first antimalarial drug policy. Initially chloroquine was the drug of choice to treat all malaria cases. Later when plasmodium developed resistance to chloroquine, the need of new drug arose.

#### Box 3.3: Currently registered antimalarial drugs in India

- 1) Amodiaquine
- 2) Artemether + Lumefantrine FDC
- 3) Arterolane + Piperaquine FDC
- 4) Artesunate + Amodiaquine FDC
- 5) Artesunate + Mefloquine blister pack and FDC
- 6) Artesunate + Sulphadoxine-Pyrimethamine blister pack
- 7) Chloroquine: Confirmed *P. vivax* cases should be treated with chloroquine in full therapeutic dose of 25 mg/kg as per the age-wise dosage schedule
- 8) Injectable artemisinin derivatives
- 9) Mefloquine
- 10) Primaquine: In some patients *P. vivax* may cause relapse. For its prevention, primaquine should be given at a dose of 0.25 mg/kg body weight daily for 14 days under supervision in all cases of plasmodium vivax infection except in pregnant women, infants and known G6PD deficient patients. Primaquine can lead to haemolysis in G6PD deficiency. Patient should be advised to stop primaquine immediately if he/she develops any of the following symptoms and should report to the physician immediately: dark coloured urine, yellow conjunctiva, bluish discolouration of lips, abdominal pain, nausea, vomiting, breathlessness, etc.
- 11) Proguanil
- 12) Pyrimethamine
- 13) Quinine
- 14) Sulphadoxine-Pyrimethamine

**Artemisinin Combination Therapy (ACT):** It should be given to all the confirmed *P. falciparum* cases found positive by microscopy or rapid diagnostic test (RDT). This is to be accompanied by single dose of primaquine (0.75 mg/kg body weight) on Day 2. ACT consists of an artemisinin derivative combined with a long acting antimalarial (amodiaquine, lumefantrine, mefloquine, piperaquine or sulfadoxine-pyrimethamine). The ACT recommended in the National Programme all over India except north-eastern states is artesunate (4 mg/kg body weight) daily for 3 days and

sulfadoxine (25 mg/kg body weight) -pyrimethamine (1.25 mg/kg body weight) on Day 0. In the north-eastern states due to the recent reports of late treatment failures to the current combination of AS+SP in *P. falciparum* malaria, the presently recommended ACT in national drug policy is fixed dose combination (FDC) of Artemether-lumefantrine (AL).

**Table 3.3: Treatment of uncomplicated Malaria**

Malaria	Drug Treatment
<i>P. vivax</i>	Chloroquine 10 mg base/kg stat. Followed by: 10 mg/kg at 24 hour and 5 mg/kg at 48 hour and Primaquine 0.25 mg/kg body weight daily for 14 days
<i>P. falciparum</i> (NE states)	Age-specific ACT-AL (Artemether 20 mg and Lumefantrine 120 mg) for 3 days + primaquine 0.75 mg/kg body weight on day 2 single dose
<i>P. falciparum</i> (other states)	Artesunate 4 mg/kg body weight daily for 3 days Plus Sulfadoxine (25 mg/kg body weight) – Pyrimethamine (1.25 mg/kg body weight) on first day. Primaquine 0.75 mg/kg body weight on day 2.
Mixed infections (NE states)	Age-specific ACT-AL (Artemether 20 mg and Lumefantrine 120 mg) for 3 days + Primaquine 0.25 mg per kg body weight daily for 14 days.
Mixed infections (other states)	Artesunate 4 mg/kg body weight daily for 3 days Plus Sulfadoxine (25 mg/kg body weight) – Pyrimethamine (1.25 mg/kg body weight) on first day + Primaquine 0.25 mg per kg body weight daily for 14 days.

### 3.9.2 Drugs Used for Kala-azar

The Kala-azar is also known as Visceral leishmaniasis

Kala-azar is an intracellular protozoal infection caused by *Leishmania donovani* and transmitted by phlebotomine sandflies.

The following drugs can be used in order of preference at all levels as shown in Table 3.4.

**Table 3.4**

Name of drug / Availability	Indications	Dose	Precautions	Contraindications
<b>Amphotericin B</b> Availability Vials: 10, 25, 50 and 100 mg plain, 50 mg/vial (liposomal).	Life-threatening fungal infections Unresponsive to pentavalent antimony compounds; Severe meningitis, perioral candidiasis	<i>Intravenous infusion (plain)</i> <b>Adults</b> - Systemic fungal infection: 250 µg/kg body weight daily, increase gradually 1 mg/kg body weight if tolerated (max 1.5 mg/kg body weight	Close medical supervision throughout treatment; renal impairment; pregnancy; hepatic and renal function tests; blood counts and plasma electrolyte monitoring; corticosteroid (avoid, except to	Toxic effects must be weighed against benefits. Regular kidney, liver function tests and blood counts must be conducted; lactation; antineoplastic therapy.

Name of drug / Availability	Indications	Dose	Precautions	Contraindications
		daily) or alternate days. <b>Children</b> - Same as for Adult based on body weight. <i>Intravenous (liposomal)</i> For fever in neutropenic patients: 3 mg/kg/day max. dose 5 mg/kg/day i.v. For cryptococcal meningitis: 3-4 mg/kg, max. 6 mg/kg, i.v. once daily. Visceral leishmaniasis: Immunocompetent patients: 3 mg/kg. Immunocompromised patients: 4 mg/kg.	control reactions); lactation; avoid rapid infusion (risk of arrhythmias); geriatric use. Anaphylaxis occurs rarely, with intravenous Amphotericin B and a test dose is advisable before the first infusion. The patient should be observed for about 30 min after the test dose.	
<b>2. Miltefosine</b> <b>Availability</b> Capsule: 10 mg, 50 mg	As directly observed therapy (DOT) of visceral Leishmaniasis caused by <i>Leishmania donovani</i> .	<b>Dose</b> <b>Adults</b> - (>12 years): Weighing >25 kg: 100 mg/day, twice a day, after meals for 28 days. <25 kg: 50 mg/day, after meals for 28 days <b>Children</b> (2-11 years): 2.5 mg/kg daily after meals for 28 days, i.e., 50 mg once daily.	Avoid contact with eyes, kidney or liver impairment, may impair ability to drive or operate machinery.	<b>Contraindications</b> Children below 2 years, patients with HIV, newborns, and lactation.
<b>3. Paramomycin</b> <b>Availability</b> Injection 375 mg/ml		<b>Dose</b> <b>Adults:</b> 25-35 mg/kg daily in 3 divided doses for 5-10 days. <b>Children:</b> Same as adult dose	Patient with ulcerative bowel lesions. Prolonged use may result in overgrowth of non-susceptible organisms. Renal impairment. Pregnancy and lactation	<b>Contraindications</b> Hypersensitivity to Paramomycin and other aminoglycosides. Intestinal obstruction.

Let us discuss the adverse effects of the above mentioned drugs used for Kala-azar treatment as given below:

### Adverse Effects of Amphotericin B

Fever, headache, anorexia, weight loss, nausea and vomiting, malaise, diarrhea, muscle and joint pain, dyspepsia and epigastric pain; renal function disturbances including hypokalaemia, hypomagnesaemia and renal toxicity; blood disorders; cardiovascular

toxicity (including arrhythmias); neurological disorders (including peripheral neuropathy); abnormal liver function (discontinue treatment); rash; anaphylactoid reactions (see above); pain and thrombophlebitis at injection site; respiratory failure. Store in a tightly closed container between 2 to 8 p C, protected from light.

### Adverse Effects of Miltefosine

Nausea and vomiting, GI irritation, diarrhoea, constipation, ocular, hepatic, renal toxicity, skin rash, leukocytosis, thrombocytosis. Store in a cool place, protected from light and moisture.

### Adverse Effect of Paramomycin

Ototoxicity, anorexia, nausea, vomiting, epigastric burning and pain, increased GI motility, abdominal cramps, diarrhoea, pruritus ani, hypocholesterolaemia, malabsorption of xylose and sucrose, abnormal fat metabolism, headache, vertigo, eosinophilia, exanthema, unexplained haematuria.

We have also discussed in details about other vector borne diseases such as Japanese Encephalitis and Dengue, Chikungunya along with primary management including medications in BNS-041, Block 3, Unit 2. You may refer that Block.

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## 3.10 ANTI-TUBERCULAR DRUGS (ATDS)

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Tuberculosis is caused an acid fast bacilli (AFB) named *Mycobacterium tuberculosis*. It can infect any organ or tissue of the body except nail, hair and teeth. TB of the lungs is the most common. In around 15% of all TB cases other organs like lymph nodes, CNS, bone is affected. These are known as extra-pulmonary TB cases. The investigation of choice for lung TB is sputum smear examination for AFB. Around half of all the pulmonary TB cases will have AFB in the sputum. These cases are known as smear-positive pulmonary TB patients. Other group of pulmonary TB cases in which AFB are not seen under microscope are labelled as smear-negative pulmonary TB patients. The main objectives of tuberculosis therapy are to cure the patients and to minimise the possibility of transmission of the bacillus to healthy individuals. There are many drugs available to treat tuberculosis. The first line drugs are Isoniazid (H), Rifampicin (R), Pyrazinamide (Z), Ethambutol (E) and Streptomycin (S).

The patient is categorised in either of the two groups based upon the previous intake of ATDs. The treatment duration of TB is long. New patients are defined as those who have no history of prior TB treatment or who received less than 1 month of anti-TB drugs (regardless of whether their smear results are positive or not). New patients with pulmonary TB should receive a regimen containing 6 months of rifampicin: 2HRZE/4HR. The drugs are given three times weekly dosing throughout therapy [2(HRZE)3/4(HR)3]. For previously treated, 8 months of treatment is required. The entire treatment duration is divided into phases: intensive and continuation. For smear-positive pulmonary TB patients treated with first-line drugs, sputum smear microscopy is performed at completion of the intensive phase of treatment. In new patients, if the specimen obtained at the end of the intensive phase (month 2) is smear-positive, sputum smear microscopy should be obtained at the end of the third month. In new patients, if the specimen obtained at the end of month 3 is smear-positive, sputum culture and drug susceptibility testing (DST) is performed. Similarly, in previously treated patients, if the specimen obtained at the end of the intensive phase (month 3) is smear-positive, sputum culture and drug susceptibility testing (DST) should be performed. Now-a-days drug resistant in TB is of wide importance. For diagnosing these drug resistant TB cases early, specimens for culture and drug susceptibility testing should be obtained from all

previously treated TB patients at or before the start of treatment. DST is performed for at least isoniazid and rifampicin, two most important and most commonly used ATDs world over. ATB patient-wise box (PWB) contains the full course of treatment for a single patient and thus assures the TB patient that his or her medicines will be available throughout treatment. This helps limit confusion and wastage, and makes it easier to monitor the regularity of treatment; avoiding stock-outs and most important helps to maintain patient confidence in the health system. The patient may feel a sense of 'ownership' of the PWB and enhanced motivation to complete the full course of treatment – during visits to the health centre he or she can actually see the quantity of medicines that must be taken to achieve cure. It should be noted that the TB patient-wise box does not eliminate the need for directly observed treatment (DOT) which is the cornerstone of TB treatment. Standardised treatment is given to TB patients. This means that all patients in a defined group receive the same treatment regimen.

Previous TB treatment is a strong determinant of drug resistance, and previously treated patients comprise a significant proportion (13%) of the global TB notifications in 2007. Of all the forms of drug resistance, it is most critical to detect multidrug resistance (MDR) because it makes regimens with first-line drugs much less effective and resistance can be further amplified. Prompt identification of MDR and initiation of MDR treatment with second-line drugs gives a better chance of cure and prevents the development and spread of further resistance. At the global level, 15% of previously treated patients have MDR, which is five times higher than the global average of 3% in new patients.

### 3.10.1 Essential First-line Anti-Tuberculosis Drugs (ATDs)

**Isoniazid:** Isoniazid is highly bactericidal against replicating tubercle bacilli.

**Streptomycin:** Streptomycin is an aminoglycoside antibiotic derived from *Streptomyces griseus* that is used in the treatment of TB and sensitive Gram-negative infections. Streptomycin is not absorbed from the gastrointestinal tract but, after intramuscular administration, it diffuses readily into the extracellular component of most body tissues and attains bactericidal concentrations, particularly in tuberculous cavities. Streptomycin must be administered by deep intramuscular injection. Syringes and needles should be adequately sterilised to exclude any risk of transmitting pathogens. It is also available for intravenous administration. The dose is 15 mg/kg (12–18 mg/kg) daily, or 2 or 3 times weekly; maximum daily dose is 1000 mg. Patients aged over 60 years and weighing less than 50 kg may not be able to tolerate more than 500–750 mg daily. The major contraindications are auditory nerve impairment, myasthenia gravis and pregnancy. Streptomycin should be used with caution in patients with renal insufficiency, because of the increased risk of nephrotoxicity and ototoxicity. Streptomycin injections are painful. Rash, induration, or sterile abscesses can form at injection sites. Numbness and tingling around the mouth occur immediately after injection. Cutaneous hypersensitivity reactions can occur. Impairment of vestibular function is uncommon with currently recommended doses. Hearing loss is less common than vertigo. Manifestations of damage to the 8th cranial (auditory) nerve include ringing in the ears, ataxia, vertigo and deafness.

**Ethambutol:** A synthetic congener of 1,2-ethanediamine, ethambutol is active against *M. tuberculosis*, *M. bovis* and some nonspecific mycobacteria. It is used in combination with other anti-TB drugs to prevent or delay the emergence of resistant strains. It is readily absorbed from the gastrointestinal tract. Ethambutol is administered orally. The dose is 15 mg/kg (15–20 mg/kg) daily or 30 mg/kg (25–35 mg/kg) 3 times weekly. The major contraindication is pre-existing optic neuritis from any cause. Patients should

be advised to discontinue treatment immediately and to report to a clinician if their sight or perception of colour deteriorates. Ocular examination is recommended before and during treatment. Whenever possible, renal function should be assessed before treatment. Dose-dependent optic neuritis can result in impairment of visual acuity and colour vision in one or both eyes. Early changes are usually reversible, but blindness can occur if treatment is not discontinued promptly. Ocular toxicity is rare when ethambutol is used for 2–3 months at recommended doses. Signs of peripheral neuritis occasionally develop in the legs.

**Adverse effects of anti-tubercular drugs:** Although the therapeutic regimens for tuberculosis are extremely effective, undesirable drug interactions can occur, as can adverse reactions of varying degrees of severity. Drug interactions can be defined as reciprocal reactions among drugs, resulting in undesirable or unexpected effects. Drug interactions can alter the serum concentrations of the drugs involved, thereby reducing their effectiveness. Adverse reactions to anti-tuberculosis drugs are related to various factors, and the principal determinants of such reactions are the dose and time of day at which the medication is administered, as well as patient age and nutritional status, together with the presence of pre-existing diseases or dysfunctions, such as alcoholism, impaired liver function, impaired kidney function, and HIV coinfection. Minor adverse effects include nausea, vomiting, epigastric pain, abdominal pain, arthralgia, arthritis, peripheral neuropathy, cutaneous pruritus, headache, and changes in behaviour (insomnia, anxiety, decreased libido, and euphoria). Major adverse effects include exanthema, vertigo, psychosis, and hepatotoxicity.

**Table 3.5: Category of TB Patients and their Treatment**

Category	Treatment	Drugs
<b>New (category I)</b> New sputum smear-positive New sputum smear-negative New extrapulmonary tuberculosis	2 H <sub>3</sub> R <sub>3</sub> Z <sub>3</sub> E <sub>3</sub> + 4H <sub>3</sub> R <sub>3</sub>	H: Isoniazid (300 mg) Z: Pyrazinamide (1500 mg) S: Streptomycin (750 mg) R: Rifampicin (450 mg) E: Ethambutol (1200 mg)
<b>Previously treated (Category II)</b> Sputum smear-positive relapse Sputum smear positive failure Sputum smear positive treatment after default	2H <sub>3</sub> R <sub>3</sub> Z <sub>3</sub> E <sub>3</sub> S <sub>3</sub> + 1H <sub>3</sub> R <sub>3</sub> Z <sub>3</sub> E <sub>3</sub> + 5H <sub>3</sub> R <sub>3</sub> E <sub>3</sub>	

**Table 3.6: TB Drug Side Effects**

Drug	Side Effects	Notes
Ethambutol	Rash, joint pain, gut upset, fever, headache, dizziness, eyesight problems	Check eyesight often
Isoniazid	Gut upset, loss of appetite, fever, rash, liver problems, peripheral neuropathy	Take on an empty stomach. Take pyridoxine (vitamin B6) to prevent peripheral

Drug	Side Effects	Notes
		neuropathy. Monitor liver function.
Pyrazinamide	Gut upset, fever, rash, joint pain, hepatitis, gout, light sensitivity	Monitor liver function.
Rifampicin	Gut upset, rash, fever, orange urine/tears/saliva, light sensitivity, liver problems, acute renal failure	Take on an empty stomach.

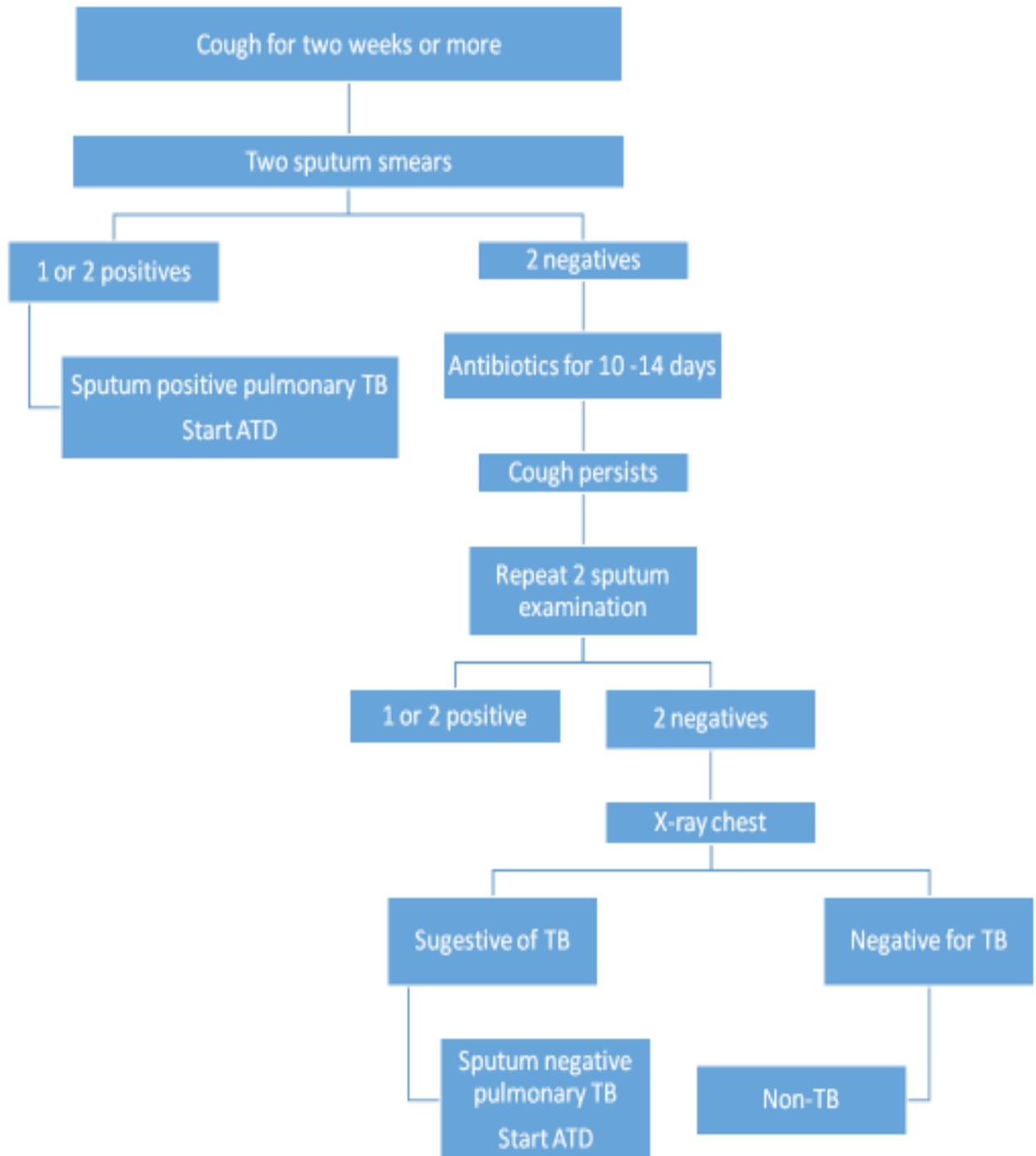


Fig. 3.1: Diagnostic algorithm for pulmonary tuberculosis

### 3.10.2 Treatment of MDR-TB

Multi-drug resistant tuberculosis is difficult to treat. There are different drugs used for them. These drugs are divided in these groups:

- Group 1 (First-line oral agents): Pyrazinamide (Z), Ethambutol (E), Rifabutin (Rfb)
- Group 2 (Injectable agents): Kanamycin (Km), Amikacin (Am), Capreomycin (Cm), Streptomycin (S)
- 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), High-dose isoniazid (high-dose H), Clarithromycin (Clr)

### 3.10.3 Treatment for Leprosy

(As per National Leprosy Eradication Programme)

Leprosy is a chronic infectious disease caused by *Mycobacterium leprae*. And usually affects skin and peripheral nerves. It is classified as paucibacillary leprosy in which 5 or less skin lesions are present and multibacillary leprosy, in which more than 5 or skin lesions are present.

#### 6 month regimen for Paucibacillary (PB) Leprosy

	Dapsone	Rifampicin
Adults 50-70 kg	100 mg once daily	600 mg once monthly under supervision
Children 10-14 years	50 mg once daily	450 mg once monthly under supervision

#### 12 month regimen for Multibacillary (MB) Leprosy

	Dapsone	Rifampicin	Clofazimine
Adults 50-70 kg	100 mg once daily	600 mg Once monthly under supervision	50 mg once daily & 300 mg once monthly under supervision
Children 10-14 years	50 mg once daily	450 mg once monthly. under supervision	50 mg every other day & 150 mg once monthly under supervision

Individual drugs used in the treatment of leprosy are given in the table below.

Medicine Name	Mechanism of Action	Dose	Adverse Effects
Dapsone	Inhibit folate synthesis	Paucibacillary and multibacillary (see the above table)	GI irritation, anaemia, peripheral neuropathy, haemolysis (G6PD deficient) and methaemoglobinaemia (dose-related), nephrotic syndrome, psychological changes, hepatitis
Rifampicin	Inhibit RNA polymerase	Paucibacillary and multibacillary (see the above table)	Facial flushing and itching, with or without a rash, flu-like syndrome characterised by episodes of fever, chills, headache, dizziness, bone pain, shortness of breath, and malaise, hepatitis, orange-red discolouration of the urine, faeces, sweat & other body fluids
Clofazimine	Interferes with template function of DNA	Paucibacillary and multibacillary (see the above table)	Red-brownish black discolouration of skin especially areas exposed to sunlight, hair, sweat, sputum, urine, faeces. Rash, pruritus, photosensitivity, diarrhoea, nausea, abdominal pain, vomiting, weight loss, headache, drowsiness, dizziness, taste disorders, dryness of the skin, ichthyosis, decreased tear and sweat production.

### 3.11 ANTI-RETROVIRAL DRUGS

Treatment with medicines against HIV is called antiretroviral therapy (ART). People on ART take a combination of HIV medicines every day. A person's initial HIV regimen generally includes three HIV medicines from at least two different drug classes. ART is not a cure of HIV; they help people with HIV live longer, healthier lives. ART also reduce the risk of HIV transmission. The antiretroviral drug classes currently approved are:

- Nucleoside and nucleotide reverse transcriptase inhibitors (NRTIs/NtRTIs), also called nucleoside or nucleotide analogues: NRTIs block reverse transcriptase, an

enzyme HIV needs to make copies of itself: Abacavir, didanosine, emtricitabine, lamivudine, stavudine, tenofovir disoproxil fumarate, zidovudine

- Non-nucleoside reverse transcriptase inhibitors (NNRTIs): NNRTIs bind to and later alter reverse transcriptase, an enzyme HIV needs to make copies of itself: efavirenz, nevirapine, etravirine, rilpivirine
- Protease inhibitors (PIs): PIs block HIV protease, an enzyme HIV needs to make copies of itself: atazanavir, darunavir, fosamprenavir, ritonavir, saquinavir, tipranavir, nelfinavir, indinavir
- Integrase inhibitors: Integrase inhibitors block HIV integrase; an enzyme HIV needs to make copies of itself: dolutegravir, elvitegravir, raltegravir
- Fusion Inhibitors: Fusion inhibitors block HIV from entering the CD4 cells of the immune system: enfuvirtide
- Entry Inhibitors: Entry inhibitors block proteins on the CD4 cells that HIV needs to enter the cells: maraviroc
- Pharmacokinetic Enhancers: Pharmacokinetic enhancers are used in HIV treatment to increase the effectiveness of an HIV medicine included in an HIV regimen: cobicistat

#### Goals of ARV therapy:

- Clinical goals: Prolongation of life and improvement in quality of life
- Virological goals: Greatest possible reduction in viral load for as long as possible
- Immunological goals: Immune reconstitution that is both quantitative and qualitative
- Therapeutic goals: Rational sequencing of drugs in a fashion that achieves clinical, virological and immunological goals while maintaining treatment options, limiting drug toxicity and facilitating adherence
- Reduction of HIV transmission in individuals: Reduction of HIV transmission by suppression of viral load

**Table 3.7: Initiation of ART based on CD4 Count and WHO Clinical Staging**

Classification of HIV-associated Clinical Disease	WHO Stage	CD4 not Available	CD4 Available
Asymptomatic	1	Do not treat	Treat if CD4 < 350
Mild symptoms	2	Do not treat	
Advanced symptoms	3	Treat	Consider treatment if CD4 < 350 and initiate ART before CD4 falls below 200
Severe/ advanced symptoms	4	Treat	Treat irrespective of CD4 count

**Adverse effects:** Each class and individual antiretroviral carries unique risks of adverse side effects.

- NRTIs: The NRTIs can interfere with mitochondrial DNA synthesis and lead to high levels of lactate and lactic acidosis, liver steatosis, peripheral neuropathy,

myopathy and lipoatrophy. Current first line NRTIs such as lamivudine/emtricitabine, tenofovir, and abacavir are less likely to cause mitochondrial dysfunction.

- NNRTIs: NNRTIs are generally safe and well tolerated. The main side effect is neuro-psychiatric effects including suicidal ideation. Other significant side effects are severe hepatotoxicity, especially in women with high CD4 counts.
- Protease inhibitors: They may cause lipodystrophy, elevated triglycerides and elevated risk of heart attack.
- Integrase inhibitors: Integrase inhibitors (INSTIs) are among the best tolerated of the antiretrovirals with excellent short and medium term outcomes. They are associated with an increase in creatinine kinase levels and rarely myopathy.

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### 3.11 LET US SUM UP

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In this unit we have learnt about some more medicines. We have also seen that there are non-pharmacological management available for cough. Correct use of oral contraceptive pills helps in planning the pregnancy better. Proper selection of client for OCPs will improve the compliance and decreases the unwanted effects of the pills. Emergency contraceptive is for emergency use only. It is not recommended to take ECs on regular basis. Miso-prostol should be taken only on doctor's advice and woman should be under medical supervision while on Misoprostol as there is high chance of severe bleeding following its administration. PPH can be prevented if the third stage of labour is managed effectively. For the management of malaria, tuberculosis and HIV, government of India has very good guidelines and these should be used judiciously.

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### 3.12 KEY WORDS

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<b>Abortifacient</b>	:	A drug causing abortion.
<b>Advanced Life Support</b>	:	A set of life-saving protocols and skills that extend basic life support to further support the circulation and provide an open airway and adequate breathing.
<b>Emergency contraceptive Pills</b>	:	Also called emergency post-coital contraception or morning-after pill, are birth control measures that may be used after unprotected sexual intercourse to prevent pregnancy.
<b>Patient-Wise box</b>	:	A box containing the treatment of TB for entire duration.
<b>Multi-drug Resistant Tuberculosis</b>	:	A form of TB infection caused by bacteria that are resistant to treatment with at least two of the most powerful first-line anti-TB drugs, isoniazid and rifampicin.
<b>Tachyphylaxis</b>	:	A rapid decrease in the response to a drug after repeated doses over a short period of time.
<b>Ventricular Fibrillation</b>	:	A heart rhythm problem that occurs when the heart beats with rapid, erratic electrical impulses (irregularly irregular).

**Ventricular Tachycardia** : A type of rapid heartbeat that arises from improper electrical activity of the heart presenting as a rapid heart rhythm, that starts in the bottom chambers of the heart, called the ventricles.

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### 3.13 MODEL ANSWERS

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#### Check Your Progress 1

- 1) Expectorants are drugs that increase the airway secretion and enhance the expulsion of mucous by air passages of the lungs. This makes it is easier to cough up the phlegm or sputum.
- 2) The natural remedies for stopping cough are honey and steam. Inhalation of soothing vapours of herbs like eucalyptus, peppermint, rosemary, and clove oil helps in forming a more productive cough.
- 3) Medicine may be an antihistaminic, a decongestant or a pain reliever. The mixture can be a good thing if the person has a range of cold symptoms, like body aches, coughs, and congestion. The downside is that he may get a medicine which he does not need. So all cough syrups are not suitable for any type of cough.

#### Check Your Progress 2

- 1) Misoprostol is a medication used to start labor, cause an abortion, prevent, and treat postpartum bleeding due to poor contraction of the uterus.
- 2) Postpartum Haemorrhage (PPH) is commonly defined as a blood loss of 500 ml or more within 24 hours after child birth.
- 3) The group of drugs which are used to control postpartum haemorrhage is known as uterotonics. These drugs stimulate contraction of the uterine muscle, helping to control PPH. These agents are useful in the treatment and prophylaxis of PPH.
- 4) It produces rhythmic uterine contractions, can stimulate the gravid uterus, and has vasopressive and antidiuretic effects. It is widely used to control postpartum bleeding. It can be used prophylactically in the third stage of labour.
- 5) Drugs which control PPH
  - a) Oxytocin
  - b) Ergometrine
  - c) Syntometrine
  - d) Carboprost

#### Check Your Progress 3

- 1) Benefits of combined oral contraceptives include improved regularity of the menstrual cycle, decreased blood loss, less iron-deficiency anaemia and significant decrease in dysmenorrhoea.
- 2) Adults- Contraception: 1 TAB (pill) daily for 21 days; subsequent courses repeated after 7-day pill-free interval (during which withdrawal bleeding occurs). Each tablet (pill) should be taken at approximately the same time each day; if delayed by longer than 24 h contraceptive protection may be lost. It is important to bear in

mind that the critical time for loss of protection is when a pill is omitted at the beginning or end of a cycle (which lengthens the pill-free interval).

- 3) Progestogen-only contraceptives, such as oral levonorgestrel may offer a suitable alternative when estrogens are contraindicated but the oral progestogen-only preparations do not prevent ovulation in all cycles and have a higher failure rate than combined estrogen-containing preparations. Progestogen only contraceptives carry less risk of thromboembolic and cardiovascular disease than combined oral contraceptives and are preferable for women at increased risk of such complications, for example smokers over 35 years. They can be used as an alternative to estrogen-containing combined preparations prior to major surgery. Oral progestogen-only contraceptives may be started 3 weeks after birth; lactation women should preferably start at least 6 weeks after birth. Menstrual irregularities (oligomenorrhoea, menorrhagia, and amenorrhoea) are common.
- 4) Emergency contraception  
Levonorgestrel is used for emergency contraception.  
Levonorgestrel 1.5 mg should be taken as a single dose within 72 h of unprotected intercourse; alternatively, levonorgestrel 750 µg can be taken within 72 h of unprotected intercourse followed 12 h later by another 750 µg. Under these circumstances levonorgestrel prevents about 86% of pregnancies that would have occurred if no treatment had been given.

#### Check Your Progress 4

- 1) A topical anaesthetic is a local anaesthetic that is used to numb the surface of a body part. They can be used to numb any area of the skin as well as the front of the eyeball, the inside of the nose, ear or throat, the anus and the genital area.
- 2) Topical anaesthetics are available in creams, ointments, aerosols, sprays, lotions, and gels. Drugs include benzocaine, butamben, dibucaine, lidocaine, oxyethazaine, and tetracaine.
- 3) Topical anaesthetics are used to relieve pain and itching caused by conditions such as sunburn or other minor burns, insect bites or stings, and minor cuts and scratches. Topical anaesthetic eye drops are used in ophthalmology to numb the surface of the eye to perform some tests for eye condition like glaucoma and also to remove foreign bodies and prior to surgeries of the eye. Topical anaesthetics find its use in dentistry to numb oral tissue before performing any dental procedure. Some topical anaesthetics (e.g. oxybuprocaine) are also used in ENT setup. Topical anaesthetics are poorly absorbed through intact skin and hence are safe to use.
- 4) These drugs should be used cautiously in hypertensives and in those receiving some medications.
- 5) Epinephrine: This is a first line drug. Epinephrine has combined α-adrenergic and β-adrenergic effects. The α-adrenergic effects may augment coronary diastolic pressure, thereby increasing sub-endocardial perfusion during chest.

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# **LCertificate in Community Health for Nurses (BPCCHN)**

## **Theory Course**

### **BNS-042 Primary Health Care in Common Conditions**

**Block-1** : **Management of Common Conditions and Emergencies including First Aid**

**Unit 1** : **Common Conditions – 1 Gastro Intestinal System**

**Unit 2** : **Common Conditions – 2 Respiratory System**

**Unit 3** : **Common Conditions – 3 Heart, Urinary System and Blood Disorders**

**Unit 4** : **Common Conditions – 4 Eye, Ear, Nose and Throat**

**Unit 5** : **First Aid in Common Emergency Conditions**

**Unit 6** : **Disaster Management**

**Block – 2** : **Maternal Health**

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**Unit 2** : **Ante Natal Care**

**Unit 3** : **Intranatal care**

**Unit 4** : **Early Identification, Management and Referral of Complications**

**Unit 5** : **Post Partum Care**

**Block – 3** : **Reproductive Health and Adolescent Health**

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**Unit 2** : **Family Planning Methods, Spacing Techniques and Counseling**

**Unit 3** : **Medical Abortion and MTP Act**

**Unit 4** : **Counselling in Reproductive and Sexual Health including problems of Adolescents**

**Unit 5** : **Management of Teenage Pregnancies**

**Block – 4** : **New Born and Child Health Care**

**Unit 1** : **Essential Care of Newborn at Birth**

**Unit 2** : **Management of Common Neonatal and Child Health Problems**

**Unit 3** : **Integrated Management of Neonatal and Childhood Illness**

**Unit 4** : **Introduction to Rashtriya Bal Swasthiya Karyakaram**

**Unit 5** : **Universal Immunisation Programme (UIP)**

**Block-5** : **Overview of Common Surgical Conditions**

**Unit 1** : **Common Surgical Conditions-1**

**Unit 2** : **Common Surgical Conditions -2**

**Unit 3** : **Congenital Malformations**

**Unit-4** : **Screening for Common Cancers**

**Block – 6** : **Essential Drugs**

**Unit 1** : **Essential Drugs – 1**

**Unit 2** : **Essential Drugs – 2**

**Unit 3** : **Essential Drugs – 3**