

Chapter-3 | Unit-1 | Hospital and Clinical Pharmacy

Topic in these Notes

Supply Chain and Inventory Control

Unit-1

- Preparation of Drug lists - High Risk drugs, Emergency drugs, Schedule H1 drugs, NDPS drugs, reserved antibiotics
- Procedures of Drug Purchases – Drug selection, short term, long term and tender/e-tender process, quotations, etc.

Unit-2

- Inventory control techniques: Economic Order Quantity, Reorder Quantity Level, Inventory Turnover etc.
- Inventory Management of Central Drug Store – Storage conditions, Methods of storage, Distribution, Maintaining Cold Chain, Devices used for cold storage (Refrigerator, ILR, Walk-in-Cold rooms) FEFO, FIFO methods.

Unit-3

- Expiry drug removal and their disposal methods e.g., Narcotics
- Documentation - purchase and inventory.

Preparation of Drug lists - High Risk drugs, Emergency drugs, Schedule H1 drugs, NDPS drugs, reserved antibiotics.

Preparation of Drug lists

In most hospitals the reconstitution and preparation of complex drugs takes place in centralized units typically in a controlled environment with experienced staff.

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When preparing intravenous drugs there are key elements that need to be taken into account:

- Accurate dose and concentration
- Sterility
- Stability
- Occupational exposure

High risk drugs:

- High risk drugs are medicines that can cause significant harm to the patient; they may cause serious side-effects especially when administered incorrectly or when a dose is calculated incorrectly.
- High risk drugs may also have a narrow therapeutic range; which means there is little difference between sub-therapeutic, therapeutic and toxic doses.

List of High risk drugs:

Drugs	Monitoring	Symptoms	Actions Required	Interactions
CARBAMAZEPINE	<ul style="list-style-type: none">• Full blood count,• renal function,• liver function	<ul style="list-style-type: none">• Leucopenia• Blurred vision,• Diplopia• Skin Disorders• Hepatic disorders• Antiepileptic• Hypersensitivity Syndrome	<ul style="list-style-type: none">• Advise patient to report immediately to a doctor if any warning signs occur• Ensure the patient receives the same brand of medicine at each time of collecting a prescription and that the patient is aware of which brand they are maintained on• Ensure patient is aware of the law regarding seizures and driving• Inform the patient of potential interactions and the need to check with a pharmacist or doctor before taking any new medication (including OTC, prescribed or herbal medicines)	<ul style="list-style-type: none">• Increased plasma concentration with acetazolamide, cimetidine, clarithromycin, erythromycin, fluoxetine, isoniazid.• Anticonvulsant effect antagonised by mefloquine, antipsychotics.
CICLOSPORIN	<ul style="list-style-type: none">• Full blood count,• Liver function,• Serum electrolytes	<ul style="list-style-type: none">• Neurotoxicity• Liver toxicity• Hypertension• Headache• Gingival hyperplasia	<ul style="list-style-type: none">• Hypertension is a common side-effect of ciclosporin therapy. Advise patient to have their blood pressure monitored regularly	<ul style="list-style-type: none">• Increased plasma concentration with clarithromycin, diltiazem, erythromycin, fluconazole, grapefruit juice, itraconazole,

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	<ul style="list-style-type: none"> Blood pressure 		<ul style="list-style-type: none"> Warn patients that they must not receive immunisation with live vaccines Brand-specific prescribing is recommended (if changing brand monitor closely for changes in ciclosporin level, serum creatinine and blood pressure) Advise patient to avoid excessive exposure to UV light, including sunlight and to use a wide spectrum sunscreen (may reduce risk of secondary skin malignancies). Patients with atopic dermatitis and psoriasis should avoid use of UVB or PUVA Advise patient to avoid a high potassium diet and grapefruit juice. The oral solution formulations can be taken with orange or apple juices to improve taste 	<p>ketoconazole, miconazole, metoclopramide, verapamil, colchicine (with which concomitant use also increases risk of nephrotoxicity and myotoxicity) and tacrolimus (avoid)</p> <ul style="list-style-type: none"> Decreased plasma concentration with carbamazepine, orlistat, phenobarbital, phenytoin, rifampicin Increased risk of hyperkalaemia when ciclosporin given with ACE inhibitors or angiotensin-II receptor antagonists, aldosterone antagonists Increased risk of nephrotoxicity when ciclosporin given with NSAIDs and increased plasma concentration of diclofenac. Increased risk of myopathy when ciclosporin given with atorvastatin, fuvastatin, pravastatin, rosuvastatin, simvastatin (avoid concomitant use)
CORTICOSTEROIDS	<p>Blood pressure, blood lipids, serum potassium, body weight and height (in children and adolescents), bone mineral density, blood glucose, eye exam (for intraocular pressure, cataracts), signs</p>	<ul style="list-style-type: none"> Cough Wheeze Tight chest Nausea Vomiting Weight loss Fatigue Headache Muscular weakness 	<ul style="list-style-type: none"> Give the patient a steroid treatment card if long-term treatment is required. Explain that they must not stop treatment abruptly after prolonged treatment (> 3 weeks) Check the patient is taking oral steroids in the morning as a single dose Ensure that patients rinse their mouth or clean their teeth after 	<ul style="list-style-type: none"> Metabolism of corticosteroids accelerated by carbamazepine, phenobarbital, phenytoin and rifamycins. High dose corticosteroid can impair immune response to vaccines; avoid concomitant use with live vaccines. Hypokalaemia can be severe when given with other drugs that lower serum potassium e.g. loop

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	of adrenal suppression		using inhaled corticosteroids <ul style="list-style-type: none"> If the patient has not had chicken pox and measles in the past, advise them to avoid anyone with these infections 	and thiazide diuretics. <ul style="list-style-type: none"> Effects of antihypertensive and oral hypoglycemic drugs are antagonized by glucocorticoids.
GENTAMICIN AND AMIKACIN	<ul style="list-style-type: none"> Renal function (nephrotoxicity), auditory and vestibular function (ototoxicity which is irreversible), serum-aminoglycoside concentration must be determined in the elderly, those with renal impairment, if high doses given, obesity and in cystic fibrosis 	Hearing impairment or hearing disturbance	<ul style="list-style-type: none"> Advise patient to report immediately to a doctor if any of the warning signs Ensure patient is hydrated and drinking adequate amounts of fluid to prevent dehydration before starting treatment 	<ul style="list-style-type: none"> Increased risk of nephrotoxicity when aminoglycosides such as gentamicin are given with ciclosporin, tacrolimus, vancomycin Increased risk of ototoxicity when aminoglycosides given with loop diuretics, vancomycin.
NSAIDs	<ul style="list-style-type: none"> Progressive unintentional weight loss or difficulty swallowing Pregnancy and breastfeeding Swollen ankles or feet Unexplained, persistent recent-onset dyspepsia Worsening of asthma 	<ul style="list-style-type: none"> All patients of any age prescribed NSAIDs for osteoarthritis or rheumatoid arthritis or patients over 45 years who are prescribed NSAIDs for lower back pain should be co-prescribed gastroprotection (e.g. a proton pump inhibitor) Recommend that oral NSAID is 	----- --	<ul style="list-style-type: none"> Possible increased risk of convulsions when given with quinolones Possible enhanced anticoagulant effect of coumarins and phenindione Possible enhanced effects of sulfonylureas. NSAIDs antagonise hypotensive effect of beta-blockers, calcium-channel blockers, ACEInhibitors, angiotensin-II receptor antagonists, alpha-blockers, nitrates

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		<p>taken with or just after food</p> <ul style="list-style-type: none"> • Inform patient of potential interactions, the need to check with a pharmacist or doctor before taking any new medication (especially OTC NSAIDs) 		
PHENYTOIN	<ul style="list-style-type: none"> • Serum concentration, ECG and blood pressure with intravenous use, liver function, full blood count, serum folate, vitamin D. Phenytoin is highly protein bound; patients with impaired liver function, elderly or those who are gravely ill may show early signs of toxicity 	<ul style="list-style-type: none"> • Fever • Sore throat, • Mouth ulcers • Leucopenia, • Aplastic anaemia, • Megaloblastic anaemia • Suicidal thoughts • Low vitamin d levels e.g. Rickets, osteomalacia 	<ul style="list-style-type: none"> • Use caution when dispensing: Brand-specific prescribing recommended as preparations containing phenytoin sodium (100mg) are equivalent to those containing phenytoin base (92mg). • The dose is the same for all phenytoin products when initiating therapy, but if switching between formulations, the difference in phenytoin content may be clinically significant 	<ul style="list-style-type: none"> • Increased plasma concentrations with amiodarone, chloramphenicol, miconazole, topiramate, trimethoprim (also increased antifolate effect), metronidazole, clarithromycin, telithromycin (avoid during and 2 weeks after phenytoin) • Reduced plasma concentrations with rifamycins.

Emergency drugs:

- Emergency drugs are those drugs which may be required to meet the immediate therapeutic needs of patients and which are not available from any other authorized source in sufficient time to prevent risk or harm to patients.
- Emergency drugs must be available for use by authorized personnel at strategic locations throughout the hospital.
- Emergency drugs including, but not limited to: pharmacologic antagonists appropriate to the drugs used, vasopressors, corticosteroids, bronchodilators, antihistamines, antihypertensives and anticonvulsants.

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List of Emergency drugs:

Drug	Indication	Dose	Quantity
Oxygen	Almost any emergency	100% inhalation	1 "E" cylinder with adjustable regulator (0-15L)
Epinephrine	Anaphylaxis Asthma unresponsive to albuterol/salbutamol	1: 1000 (1mg/ml), auto injector 0.3 mg/ml (EpiPen), 0.15 mg/ml (EpiPen Jr)	1:1000 mg/ml ampule, 1 EpiPen, 1 EpiPen Jr auto injectors
Nitroglycerin	Angina pain	0.4 mg sublingual every 3-5 minutes	1 metered spray bottle (0.4 mg)
Diphenhydramine	Allergic reactions	1 mg/kg IM/IV; max 50 mg <i>dosage by age</i>	50 mg/ml vials and 1 box 25 mg tablets
Albuterol/salbutamol	Asthmatic bronchospasm	2 puffs; repeat as needed	Metered dose inhaler 2.5 mg/3ml nebulized solution
Aspirin	Myocardial infarction	81 mg chewable tablet	Chewable tablet, bottle baby aspirin

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			(81 mg)
Glucose	Hypoglycemia (patient unconscious)	37.5 mg; repeat as needed	1 tube (37.5 mg)
Atropine	Clinically significant bradycardia	0.5 mg IV or IM	1 ampule (1 mg/10 ml)
Hydrocortisone	Adrenal insufficiency Recurrent anaphylaxis	100 mg IV or IM (mixed with 3- 5ml sterile water)	1 vial (100 mg)
Morphine or nitrous oxide	Angina pain unresponsive to nitroglycerin	Titrate 2 mg IV, 5 mg IM ~ 35% N2O inhalation	Titrate 2 mg IV, 5 mg IM ~ 35% N2O inhalation
Naloxone	Reversal of opioid overdose	0.1 mg/kg up to 2mg IV or IM	4 mg/10 ml multi-dose vial
Lorazepam or Midazolam	Status epilepticus	4 mg IM or IV 5 mg IM or IV	50 mg/10 ml multi-dose vial
Flumazenil	Benzodiazepine overdose	0.01 mg/kg at 1- minute intervals up to 1 mg IV or IM	0.5 mg / 5 ml multi-dose vial

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Schedule H1 drugs:

- Schedule H1 has been introduced through to check the indiscriminate use of antibiotics, anti-TB and some other drugs in the country.
- The schedule contains certain 3rd and 4th generation antibiotics, certain habit forming drugs and anti-TB drugs.

SR. No.	Schedule H1 drugs	SR. No.	Schedule H1 drugs
1.	Alprazolam	24.	Doripenem
2.	Balofloxacin	25.	Diazepam.
3.	Buprenorphine	26.	Ertapenem
4.	Capreomycin	27.	Ethambutol Hydrochloride
5.	Cefdinir	28.	Zolpidem
6.	Cefditoren	29.	Ethionarnide
7.	Cefepime	30.	Feropenem
8.	Cefixime	31.	Imipenem
9.	Cefetamet	32.	Isoniazid
10.	Cefopeiazone	33.	Levofloxacin
11.	Cefotaxime	34.	Meropenem
12.	Cefpodoxime	35.	Midazolam
13.	Cefpirome	36.	Moxifloxacin
14.	Ceftazidime	37.	Nitrazepam
15.	Chlordiazepoxide	38.	Pentazocine
16.	Clofazimine	39.	Prulifloxacin
17.	Codeine	40.	Pyrazinamide
18.	Ceftibuten	41.	Rifabutin
19.	Ceftizoxime.	42.	Rifampicin
20.	Gemifloxacin	43.	Sodium Para-aminosalicylate
21.	Ceftriaxone	44.	Sparfloxacin
22.	Cycloserine	45.	Thiacetazone
23.	Diphenoxylate	46.	Tramadol

Note.- Preparations containing the above drug substances and their salts excluding those intended for topical or enernal use (except ophthatmic and ear or nose preparations) containing above substances are also covered by this Schedule.

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NDPS drugs (Narcotic Drugs and Psychotropic Substances)

The central acts like Opium Act 1857, the opium Act, 1878 & the Dangerous Drugs Act, 1930 were erected a long time ago.

- With the changing circumstances and the developments in the field illicit drugs traffic and drugs abuse at national and International level many drawbacks have come to notice in the said Acts.
- The government of India has repealed these old Acts passed the:
- These Acts established in 14 November 1985.
- It also provides the licensing system for both central & state government.

Cannabis:

1. Charas: Separated resin in crude or purified form obtained from the cannabis plant and resin called "**Hashish oil**".
1. Ganja: The flowering or fruiting tops of the cannabis plants.
2. Caca Derivative: Includes crude cocaine which is a methyl ester of benzoyl-ecogonine and its salts.
3. Opium: Means the coagulated juice of the opium poppy and its mixture with or without neutral material.

Effects of drugs

When abused, drugs produce a variety of effects depending upon the drug:

- **Stimulants** increase the activity of the abuser and make him more lively and active. Some stimulants such as amphetamines were used in wars to make the soldiers more active.
- **Sedatives** make the person feel sleepy and reduce his activity. Opium and opiates are good examples of sedatives.
- **Hallucinogens** create hallucinations in the abuser. LSD is one of the well known hallucinogens.
- **Tranquilisers** calm the nerves of the addict without making him feel sleepy.

S.N.	Drug Lists of NDPS drugs
1.	Amphetamine
2.	Buprenorphine
3.	Charas/Hashish
4.	Cocaine
5.	Codeine
6.	Diazepam
7.	Ganja
8.	Heroin
9.	MDMA
10.	Methamphetamine
11.	Methaqualone
12.	Morphine
13	Poppy straw

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Reserved Antibiotics

The reserved antibiotics are those antibiotics which are reserved for the treatment of suspected or diagnosed infection caused by multi-resistant organism, and they are used when all other antibiotics have failed.

1. Aztreonam	2. Oritavancin
3. Carumonam	4. Polymyxin B (Injection)
5. Colistin (Oral)	6. Tedizolid
7. Ceftaroline	8. Daptomycin
9. Cefiderocol	10. Faropenem
11. Ceftobiprole	12. Iclaprim
13. Ceftazidime + Avibactam	14. Iefamulin
15. Ceftolozane + Tazobactam	16. Meropenem + Vaborbactam
17. Colistin (Injection)	18. Omadacycline
19. Dalbavancin	20. Plazomicin
21. Dalfopristin + Quinupristin	22. Polymyxin B (Oral)
23. Eravacycline	24. Telavancin
25. Fosfomycin (Injection)	
26. Imipenem + Cilastatin + Relebactam	
27. Linezolid	
28. Minocycline (Injection)	

Procedures of Drug Purchases – Drug selection, short term, long term and tender/e-tender process, quotations, etc.

Procedures of Drug Purchases

- **Drug Purchase** means to obtain or get different types of medicines from external network.
- Pharmacies purchase drugs from wholesalers, and occasionally directly from manufacturers. After purchasing these drugs, pharmacies must safely store and dispense these drugs to patients.

Procedure for purchase

1) Purchase request form / Purchase requisition:

- a) The pharmacist prepares the drug list to be buy and fills purchase request form.
- b) This form provides information regarding required drugs, their quality and quantity.
- c) This form will be sent to administration for approval, after approval it will be sent to purchasing officer.

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2) Quotation Invitation:

- Now the Purchasing officer send this form to different suppliers and ask their quotations

3) Purchase form:

- The purchasing officer checks all the quotations and select suppliers on the price, quality etc. and place the purchase orders.

4) Receipt of good products:

- When the ordered products delivered to the purchasing department, their quality, quantity and prices are checked. If the any products miss the desired quality, quantity, or price they should returned to supplier.

5) Payment:

- After satisfactory completion all these process, the purchasing officer pay the amount to the suppliers.

Tender /e-tender

- It is a process in which a person or organization, who need goods / services etc. invites the other parties to submit a proposal to provide to provide their goods or services.

E-tender:

If this process is done by electronic machinery without using paper then it called E-tender.