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Diploma in Pharmacy 2nd Year
Hospital & Clinical Pharmacy
Chapter 1 : Hospital Pharmacy

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Chapter 1

Hospital Pharmacy

Hospital

- Hospital is a complex organisation.
- It is an institute of providing health to individuals with the help of complex and special scientific equipments in the presence of trained staff well-educated in the problems of modern medical science.
- As per WHO, hospitals are reservoirs of critical resources and knowledge.
- They can be classified according to the interventions they provide, the roles they play in the health system and the health and educational services they offer to the communities in and around them.

HOSPITAL PHARMACY

- Hospital Pharmacy is a healthcare service provider in which medicines storing , compounding , dispensing are performed and medical devices and advices are provided to patients with safe and effective manner.

or

- Hospital pharmacy functions for receiving, storing and dispensing drugs and medicines to patients. The hospital pharmacy may also manufacture pharmaceuticals and parenteral products.
- The department provides a range of pharmacy services for the hospitalised and ambulatory patients, including purchase manufacture, compounding, storage, dispensing, distribution, and maintaining record for the same.

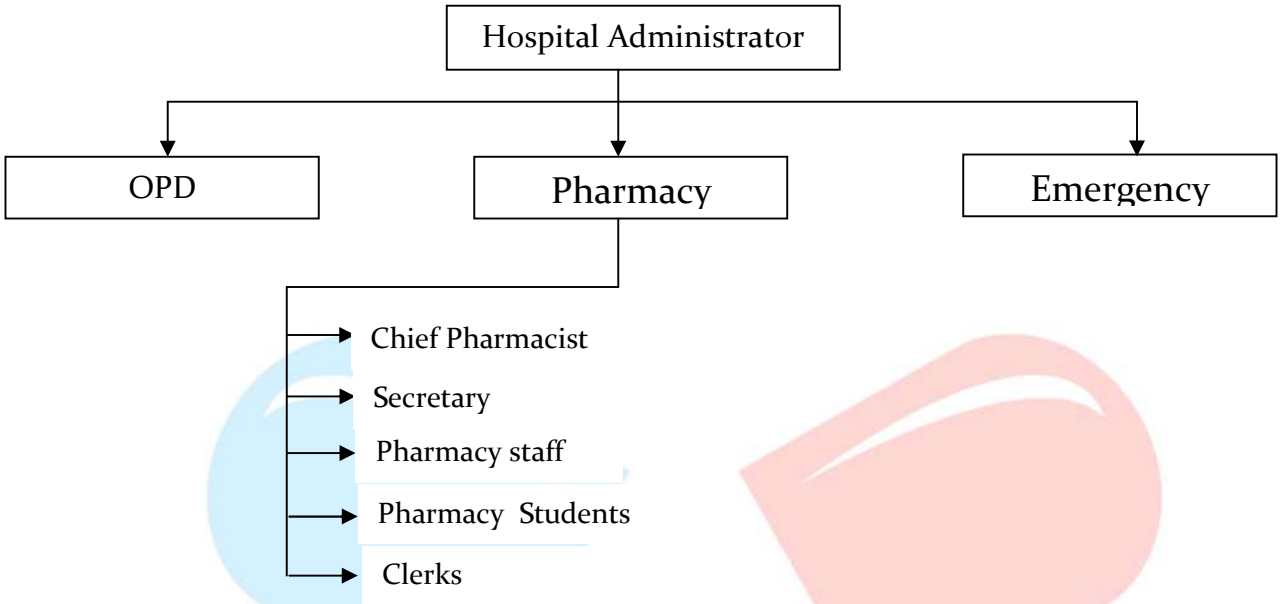
Scope of Hospital Pharmacy

- It attains supply of drugs, chemicals, biological and pharmaceutical formulations only from licensed vendors and manufacturers
- It inspects the received items and maintains an inventory for the same.
- It dispenses drugs, chemicals, and pharmaceutical preparations to the patients.
- It keeps a record of all the narcotic drugs and alcohol received and issued.
- It predicts the demand for drugs, chemicals, antibiotics, biologicals, radio pharmaceuticals, etc. and takes suitable steps to fulfil the demand.
- It keeps a record of each supply dispensed.
- It manufactures large volume parenterals and other drug preparations in case of unavailability, high cost, or lack of authentic vendors or cautious.
- It discusses about the drug related information with the medical staff residents nurses, health care team, and the patients.
- It participates in minimising the incidence of illness, and improves the general health of the population.

National and International Scenario of Hospital Pharmacy

- The third-largest group of healthcare professionals in the world is pharmacists, and during the past ten years, the field has undergone steady growth.
- Conventionally, the only role of pharmacist is to manufacture and dispense drugs. But this role is now evolving and the pharmacist play a role of essential team member in the care of patients.
- In many parts of the world, the focus has switched from product-centered services to patient-centered services (patient education and counseling, illness prevention, health promotion, various disease states management, and offering specialised clinical advice to other healthcare professionals) as a result of complexities caused by a growth in variety of drugs and poor compliance.
- The pharmacy profession still lags behind in developing nations in comparison to industrialised nations in that neither the general public nor healthcare professionals have ever regarded pharmacy specialists as a component of healthcare team.
- To reduce the responsibilities of doctors and enhance the standard of care, many industrialised countries, like Australia, United Kingdom, and United States, have also granted pharmacists the right to write prescriptions.
- Pharmacists have been granted the ability to prescribe medications for some diseases in nations, like UK.
- The WHO adopt the Good Pharmacy Practice Guidelines which was created by the FIP declares that a pharmacist's top priority should be patient welfare.
- Hospital pharmacists are expected to deliver high-quality patient care by implementing both clinical and standard pharmacy services.
- But, due to differences in healthcare structures, public policies, economic resources, cultural norms, and educational systems, the nature and scope of provided services may change across different locations.
- Pharmacists in India have the potential to play a larger role in patient care, but it can be challenging to define those obligations and get hospital administrators, the government, and patients to acknowledge them.
- The clinical pharmacist's role is still not well understood by the healthcare professionals and community in India, where the pharmacy profession is more industry-centered than patient-centered.

Organisational Structure of Hospital Pharmacy



HOSPITAL PHARMACIST

- Hospital pharmacists are engaged in hospital pharmacy services in public sector.
- They are skilled in practice of medicines and dispense prescriptions, purchase, manufactures, and performs quality test of all medicines used in a hospital.
- Being the members of healthcare team, they coordinate with medical and nursing staff for better treatment of patient.
- They help and refer knowledge to patients on their medicines.

Professional Responsibilities of a Hospital Pharmacist

- To follow the hospital's policies and covey other for that.
- To maintain accuracy of dosage are prescribed.
- To provide drug information and way of administration to new staff or of new drugs to all staffs.
- To remain updated about new drugs (effect , side effect etc).
- To give instructions to the patients for self administrated drugs.
- To take parts in new research and development.
- To educate and make trained the Pharmacists and pharmacy students are taking practical training .

Qualifications & Experience Required for a Hospital Pharmacist

- The chief Pharmacist must have minimum postgraduate degree in pharmacy , especially in Pharmacology or Hospital Pharmacy .
- Manufacturing chemist should have graduate degree in pharmacy with minimum 18 month experience in drug manufacturing .
- dispensing pharmacist should have minimum diploma in pharmacy .
- Ph.D degree holder is preferred in all categories .

A Chief Pharmacist must have these qualities

→ **Administrative and Management Ability :**

a) A pharmacist should have the abi lity of planning , implementing the pharmacy policies and ability of making budget , stock control .
b) He / she should have ability to interview and select staff for pharmacies .
c) He / she should have ability to manage staffs and distribute works betwe en them .

→ **Manufacturing Ability :** He should be able to manufacture drug in case of shortage or high cost of drugs than normal .

→ **Knowledge :** He / she must have complete knowledge about drug action , side effect , routes of administration , and quality control .

→ **Research ability :** He should have ability to research and develop new drugs .

→ **Teaching Ability :** He should have ability to give lecture to the nursing staff and students are under training .

Job Specifications for a Hospital Pharmacist

- Hospital pharmacists are employed by both the MOH and the private sector's hospital pharmacy services.
- They are responsible for dipensing drugs, performing quality checks, formulating and re-formulating dosage forms, monitoring and reporting drug safety, creating medications budgets, storing medication, and in planning of drug quantities for hospitals

Hence, hospital pharmacists perform the following tasks per days

- Constantly supervising pharmacy-related services and logistics
- Writing prescriptions and assuring the effectiveness and safety of drugs
- Preparing each drug and adapting dosage forms to the specific circumstances
- Reporting all the possible Drug Related Problems (DRPs) to the Saudi Food & Drug Authority (SFDA)
- Communicating to healthcare providers regarding DRPs.
- Attending pharmacy-managed clinics and clinical rounds led by each healthcare provider.
- Providing sufficient data on drug consumption.
- Keeping a track of drug inventories and creating medication budgets.
- Offering services for drug information
- Offering pharmacy-related training to under- and post-graduate students

Work-load Requirement for a hospital pharmacist

- → Work load means how much work can a person do in a specific time .
- → The work-load of pharmacist is observed / analyzed by work characteristic .

Some characteristics are following :

- Working hours per week .
- Numbers of hours that a person spent working alone in his or her department .
- Numbers of prescription filled by a pharmacist daily .

The number of pharmacist needed for a hospital is determined using the number of beds .

BED Strength	No of Pharmacist Required
Up to 50 beds	3
Up to 100 beds	5
Up to 200 beds	8
Up to 300 beds	10
Up to 500 beds	15

Note : Pharmacists They may be increased and reduced as required .

Inter-professional Relationships of a Hospital Pharmacist

- ➢ The relationship between two or more professionals is called Interprofessional relationship .
- ➢ To get good result it is necessary to maintain positive relationship between various professionals , as doctor prescribed drugs , pharmacist dispenses , and nurses give to patients .

Following are the three commonly used techniques

- ◈ Initially, the issue should be discussed with the pharmacy and therapeutics committee and then advice should be given to the medical staff.
- ◈ Requesting the administrator to inform the medical staff about the issue.
- ◈ Informal discussion with the medical staff about the issue.

GOOD PHARMACY PRACTICE (GPP), IN HOSPITAL

→ It is a pharmacy Practice that responds to the need of people who use the pharmacist 's services , to provide them optimal (best) and evidence based care at standard level.

Aim

❖ The goal of pharmacy practice is to offer drags and other healthcart goods and services and guide people and society about the effective method of using them.

Good Pharmacy Practice Requirements

The main Important part of pharmacy activity to help patients through :

- The supply of medicines and healthcare products.
- The provision of appropriate information and advices to the patients.
- The administration of medicines.

Role of Pharmacist in Satisfying GPP Requirements

→ Roles of pharmacists in GPP are to prepare , obtain , secure , distribute , administer , dispense and dispose of medical products at the standard level .

HOSPITAL PHARMACY STANDARDS

FIP (International Pharmaceutical Federation) Basel Statements

⇨ The International Pharmaceutical Federation (FIP) is a global organisation that represents pharmacy, pharmaceutical sciences, and pharmaceutical education. It was established in 1912 in The Hague, Netherlands, with its headquarters in The Hague.

⇨ The main aim of FIP is to represent and assist pharmacy and pharmaceutical sciences worldwide

⇨ In 2008, a conference was conducted in Basel, Switzerland by the FIP which included hospital pharmacists from all over the world to talk about the future of hospital pharmacy.

⇨ In 2014, again a conference was held in Bangkok to launch revised Basel statement that included 65 statements.

These statements cover the following 6 areas of hospital pharmacy (FIP Basel Statement)

1. Procurement
2. Influences on prescribing
3. Preparation and delivery of medicines
4. Administration of medicines
5. Monitoring of medicines use
6. Human resources, training and development

AHSP (American Society of Health-System Pharmacy)

→ The American Society of Health-System Pharmacists (ASHP) represents all pharmacists who provide patient care in hospitals, health systems, ambulatory clinics, and other healthcare settings covering complete drug use.
→ This orgnisation is made up of more than 60,000 members, including pharmacy technicians, pharmacists in training, and professional pharmacists.

Purpose

- Improve Medication use and enchance patient Safety.
- Provide Good Pharmacy Service
- Effective Treatment
- Reduce Drug Adverse Effect

Minimum Standards Required

✓ Knowledge of the abbreviation and symbols used in prescription.
✓ Knowledge of all medications handled in pharmacy department.
✓ Knowledge of Production.
✓ Knowledge of Dispensing, labeling, Packaging.
✓ Knowledge of Dosage Calculation.
✓ Knowledge of administration.

NQAS (National Quality Assurance Standards) Guidelines

→ The NQAS programme was initiated by the Ministry of Health and Family Welfare with the goal of highlighting top-performing facilities and enhancing the public hospitals reliability in the community.
→ While establishing National Quality Assurance Standards (NQAS), the requirements for public health facilities and international best practices are considered.

Organisational Structure

1) **The State Quality Assurance Committee (SQAC)** is a state-level organisation responsible for policy decision, providing guidance, and also for QA initiatives, including their successes and failures. At the state level, the committees' main responsibility is to regulate, guide, and monitor the districts' QA initiatives.
2) **District Quality Assurance Committer (DQAC)** is a districy level organisation having District Quality Assurance Unit (DQAU) as a functional body that performs various duties according to the units TORs.

Some Area where they focus

- Service Provision , Patient right , infection control , quality management ,
- hand washing Facilities .
- Postpartum care (hormonal level and uterus size return to a non pregnant state after 6 weeks of childbirth)
- oxytocin administration within 6o seconds of childbirth .
- Availability of curtains etc .

NABH (National Accreditation Board for Hospitals & Healthcare Providers) Accreditation

→ National Accreditation Board for Hospitals and Healthcare Providers (NABH) is a constituent board of Quality Council of India (QCI) that has been established to create and operate Hospital Accreditation Program for healthcare organisations.

→ The board is designed to meet consumers highly wanted needs and to provide benchmarks for health industry development.

→ The board has complete operational autonomy in its operation while receiving support from all stakeholders, including business, consumers, and the government.

Aim

- To operate accreditation and allied programs along with stakeholders focusing on patient safety and quality of healthcare, based upon national/international standards, through process of self and external evaluation

Benefits of Accreditation

✓ High-quality medical care and patient safety are the results of accreditation. The patients receive services from licensed medical personnel.

✓ Patients' rights are valued and protected.

✓ It is possible to assess patient satisfaction.

✓ The team is contented because it encourages constant learning

✓ A healthcare organisation's accreditation encourages ongoing development.

✓ It helps the organisation show its dedication to providing high-quality treatment.

✓ It also gives healthcare organisations the chance to compare themselves to the best

NABH Standards for Hospitals

1. **Legal requirements :**
    - Qualified Pharmacists should have their certificate displayed in the pharmacy.
    - Schedule H and X drug should only be sold by retailer , when they prescribed by a licenced medical professional.
    - The pharmacy should not sold the physician samples.
    - the NDPS medications should be kept in locked container and a register should be available to keep record of every issue of NDPS medications.
    - All the legal document should be updated during valid time.
2. **Access to Medications :**
    - The pharmacy should stock only those medicines which are listed on the hospital's formulary (list of medicines)
    - The pharmacy in-charge should be aware of the procedure for obtaining medications
    - the room and area where the medications are kept should be clean and free from vermin and bugs.
    - the proper security like CCTV and entry restriction should be available in pharmacy.
3. **Medicine Safety :**
    - Refrigerator should be available for the drugs are not stable i n room temperature.
    - personal items like food drinks should not be kept in the refrigerator is used for drugs
    - LASA drugs should be stored separately or colour - coded.
    - A list of high risk drugs should be identified and made easy available.
4. **Other safety :**
    - Fire safety like fire extinguisher should be available.

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Chapter 2 : Different Committees in the Hospital

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Hospital Formulary – Definition, procedure for development and use of hospital formulary	4
Infection Control Committee – Role of Pharmacist in preventing Antimicrobial Resistance	6

Chapter 2

Different Committees in the Hospital

PHARMACY AND THERAPEUTICS COMMITTEE

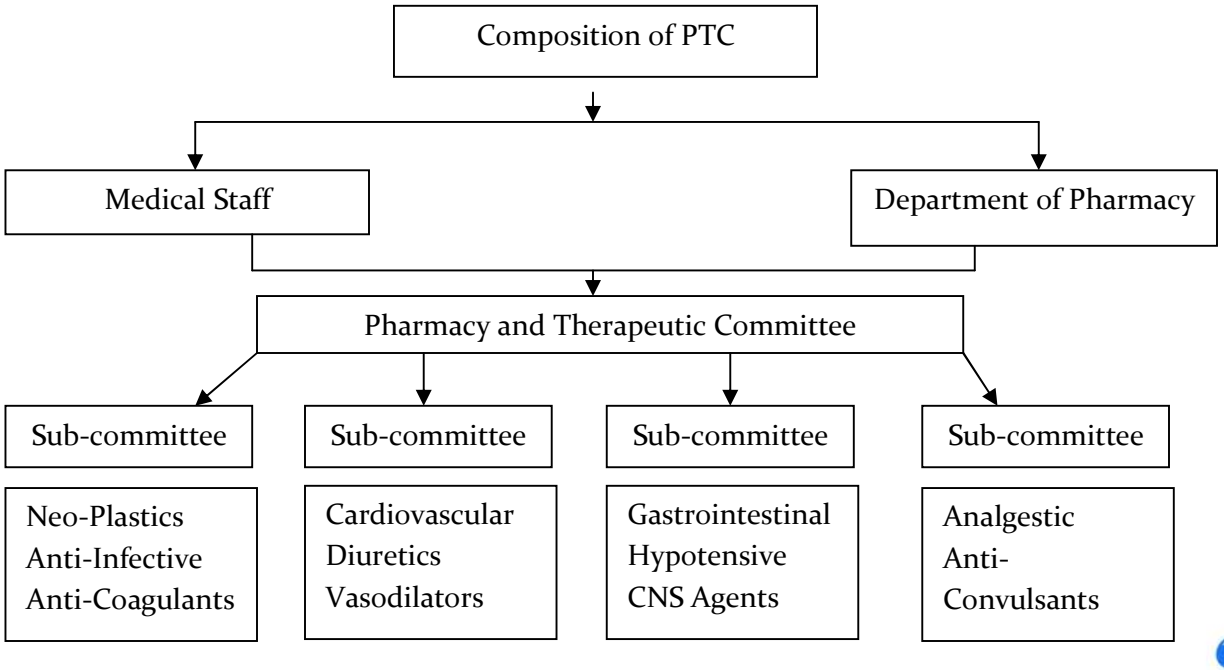
→ The Pharmacy and Therapeutics Committee (PTC) comprises of a group of Individuals (physicians, pharmacists, and other health personnel including the medical staff)

→ They make policies regarding the drug used in hospital.

Objectives of PTC

1. **Advisory Objectives**
   - To make policies regarding drugs to evaluate and select the best drugs for therapeutic usage in hospital.
   - To provide guidance to Pharmacists about drug distribution in an efficient way (without mistake and wasting time and energy)
   - To aware the hospital administration and medical staff about the problems are related drug usage , especially experimental drugs.
2. **Educational Objectives**
   - To examine adverse effects of the drugs and offer new formulary system.
   - To provide up-to dated information about drugs and their usage to satisfy the demand of policy maker professionals.
   - To plan training program for staff regarding the drug usage.

Composition of PTC



Functions of PTC

- ❖ It acts as an advisory council to the medical staff and hospital administration regarding the therapeutic use of drugs.
- ❖ It develops a formulary of drugs and prescriptions to be used in hospitals.
- ❖ It suggests written policies and procedures regarding the selection, procurement, storage, distribution, and therapeutic use of drugs.
- ❖ It establishes suitable educational schemes for the hospital staff regarding the therapeutic use of drugs.
- ❖ It studies the problems related to drug distribution and administration.
- ❖ It advises the pharmacy to implement effective drug distribution and control procedures.

Role of Pharmacist in PTC

- ⅄ Pharmacists are important to make the formulary, because they can ensure safe, effective, and affordable drug use.
- ⅄ They examine scientific , clinical , and economical data.
- ⅄ They convey the staff to obey the decision taken.
- ⅄ They create a schedule for committee meeting.

HOSPITAL FORMULARY

→ The Formulary System is a method by which Physicians & Pharmacists Working through a Pharmacy & Therapeutics Committee of medical staff, evaluate and select medications for use in a hospital.

Or

→ The Hospital Formulary is a list of evaluated and selected drugs with their important information to use or distribute in a hospital.

Procedure for development of Hospital Formulary

⇨ To make a hospital formulary the first step is to form a good PTC . The PTC develop a formulary in written form .

⇨ This committee take decision on

1. The type of publication of formulary (Hospital's won formulary or purchased formulary services).
2. Fixation of rules which the PTC required during evaluating and selecting the drug for formulary.
3. Addition of other content like,
   - Prescription writing
   - Uses of drug

- Table of metric weight (1g = 1000 mg)
- table of common laboratory values (BP 120/80)
- Calculation of dosage (for children)

4. Type of format of formulary (size , loose leaf , bounded)

Addition and Deletion of Drugs from Hospital Formulary

- It is a important step in maintenance of Hospital formulary . Criteria For addition and deletion are :
  - The medical staff should approved the drug to be added in formulary.
  - The drug should be reccognised by the Pharmacopoeias.
  - The drug manufacturer should hold a license , and he should not have been punished for any serious offence under any law of Drug and medicine.
  - There should not be used secret ingredient in drug which is not labeled.
  - The drug containing multiple ingredients should not be added in formulary , if the same therapeutic effect can be obtained by a single ingredient drug.

Guiding Principle for use of Hospital Formulary

- The Following Principle act as a guide for those who utilize the hospital formulary
  - The hospital's medical staff should appoint PTC and outline its scope, purpose, organisation, and function
  - The medical staff should sponsor the formulary system based on the recommendations of PTC.
  - The medical staff should adopt the written policies and procedures of the formulary system.
  - Pharmacist should be responsible for specifications as to the quality, quantity, and source of supply of drugs used for diagnosis and treatment.

Role of Pharmacist in Hospital Formulary

- The PTC pharmacist has an important role in creating the rules and regulations governing the hospital formulary.
- The chief pharmacist is primarily in-charge of creating the hospital formulary.
- He/she should make sure that economic aspects do not affect the drug quality.
- He/she will evaluate several drugs in accordance with PTC recommendations.

INFECTION CONTROL COMMITTEE (ICC)

- → It is a committee to prevent and control healthcare related infections by making infection control policies and monitoring practices to reduce these risks.
- → Nosocomial In fection = Patient get infection inside the hospital

Objectives of ICC

- To understand the methods of infection control.
- To understand the reason of nosocomial infection.
- To reduce the danger of infection for patients , medical personnel , and gests.
- To conduct antimicrobial program and instruct the medical staff , patients , and gests.

Antimicrobial Resistance

- Anti-Microbial Resistance is a ability of microorganisms to protect them from the effect of antimicrobial drugs.
- This resistance ability they develop themselves or developed naturally . overuse of antibiotics is the main reason of AMR .(Anti-Microbial Resistance).

Role of Pharmacist in preventing AMR .

- He / she should distribute medicine in safe and appropriate manner.
- He / she raises awareness on the risk of inappropriate drug use.
- He control the infection by decreasing the infection transmission.
- He guide hospitals on the selection and use of suitable antibiotics , disinfectants , and sterilants.

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Diploma in Pharmacy 2nd Year
Hospital & Clinical Pharmacy
Chapter 3 : Supply Chain and Inventory Control

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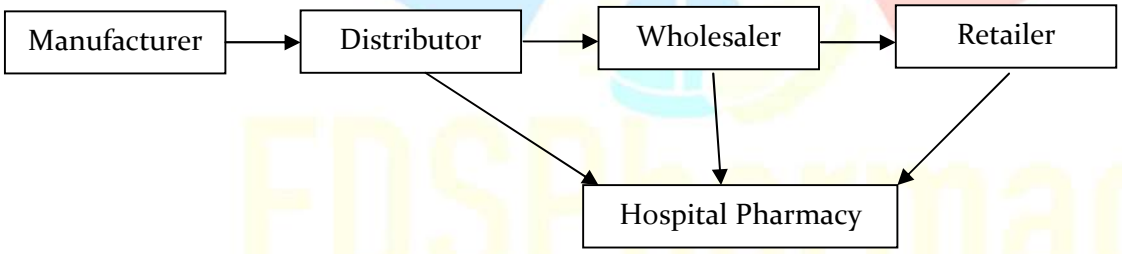
Chapter 3

Supply Chain and Inventory Control

SUPPLY CHAIN

- → Pharmaceutical supply chain is the link through which prescription medicines are manufactured and delivered to patients.
- → Supply chain network is highly complex, requiring a number of steps that need to be taken to make medications available for and accessible to patients.
- → Multiple government agencies, hospitals, clinics, drug manufacturers, drug distributors, pharmacy chains, retailers, research organisations, and the FDA are involved in the pharmaceutical supply chain.
- → This very supply chain is responsible for distributing prescription drugs, OTC medicines, generic drugs, and biologics with different handling requirements and operational objectives.

Following Chart can help to understand the supply chain of drug to hospital Pharmacy



PREPARATION OF DRUG LISTS

- ➢ It is a process to categories the drug with their generic names , strength and form.
- ➢ It is prepared by country's pharmacist , chemical and pharmaceutical staff.

Some Drug lists :

- High Risk drugs
- Emergency drugs ,
- Schedule H1 Drugs ,
- NDPS (narcotic drugs and psychotropic substances .
- Reserve Antibiotics .

High Risk Drugs

- High risk drugs have an increased risk of causing significant harm to the patient if used incorrectly.
- These medicines include :
  - Medicines with a low therapeutic index.
  - Medicines posing a high risk when administered through the wrong route or when errors occur in other system

High Risk Drugs list

1) adrenergic agonists IV (Epinephrine , norepinephrine ,)
2) adrenergic antagonists IV (propranolol , prazosin , atenolol)
3) anaesthetic agents (general) inhaled and IV ,(Ketamine , propofol
4) anti Arrhythmic agents (lidocaine , procainamide) .
5) antithrombotic agent (anticoagulants) : heparin , argatroban
6) Hypoglycemic Agents (metfomin .)
7) sedative agents (alprazolam , diazepam)
8) narcotic drugs : Codeine , morphine
9) neuromuscular blocking agents : succinylcholine
10) Insulin IV and subcutaneous .

Emergency Drugs

- Emergency drugs are essential to meet the immediate therapeutic needs of patients and which are not available from any other approved source in required time to prevent risk or harm to patients.

Or

- These are the drugs which may be required immediately in emergency conditions to prevent the risk or harm to patients and can save their life,
- These drugs have onset of action , and are administered by such route which facilitate onset of action like : Epinephrine in cardiac arrest.

1) Inj. Adrenaline	2) Inj. Lidocaine	3) Inj. Dexamethasone
4) Inj. Atropine	5) inj. Adenosine	6) Inj. Deriphyllin
7) Inj. Nor-adrenaline	8) Inj. Hydrocortisone	9) Inj. Avil
10) Inj. Calcium gluconate	11) Inj. Vasopressin	12) Inj. Diclofenac
13) Inj. Sodium bicarbonate	14) Inj. Midazolam	15) Inj. Ethamsylate
16) Inj. Amiodarone 25% Dextrose	17) Inj. Naloxone	18) Inj. Flumazenil
19) Inj. Nitroglycerin	20) Inj. Diazepam	21) Inj. Potassium chloride
22) Inj. Succinyl choline	23) Inj. Paracetamol	24) Inj. Digoxin
25) Inj. Dopamine	26) Inj. Methylprednisolone	27) Inj. PAM
28) Inj. Dobutamine	29) Inj. Heparin	30) Inj. Mephentermine
31) Inj. Lasix	32) Inj. Aminophylline	33) Inj. Phenergan

Schedule H, Drugs

→ Schedule H, drugs comprise of sensitive antibiotics, habit-forming medications, and drugs with severe side effects if used without supervision and prescription of a registered medical practitioner.

Or

→ These are the sensitive antibiotics and habit forming drugs , which are not allowed to sale or distribute without a prescription of a registered Physician or pharmacist.

→ This Schedule was implemented to rigorously regulate the medications that were included for the general public welfare.

1) Alprazolam	2) Ceftibuten	3) Feropenam
4) Balofloxacin	5) Ceftizoxime	6) Gemifloxacin
7) Buprenorphine	8) Ceftriaxone	9) Imipenem
10) Capreomycin	11) Chlordiazepoxide	12) Isoniazid
13) Cefdinir	14) Clofazimine	15) Levofloxacin
16) Cefditoren	17) Sodium codeine	18) Meropenem
19) Cefepime	20) Cycloserine	21) Midazolam
22) Cefetamet	23) Diazepam	24) Moxifloxacin
25) Cefixime	26) Diphenoxylate	27) Nitrazepam
28) Cefoperazone	29) Doripenem	30) Para-aminosalicylat
31) Cefotaxime	32) Ertapenem	33) Pentazocine
34) Cefpirome	35) Ethambutol	36) Prulifloxacin
37) Cefpodoxime	38) Hydrochloride	39) Pyrazinamide
40) Ceftazidime	41) Ethionamide	42) Rifabutin
43) Rifampicin	44) Sparfloxacin	45) Thiacetazonedol
46) Tramadol	47) Zolpidem	

NDPS (Narcotic drugs And Psychotropic substances)

→ Narcotic Drugs : The opioids and their derivatives are called narcotic drugs .

→ Psychotropic substances : psychotropic substances are chemical substances which change the function of nervous system , and alter the mood , perception , consciousness like alcohol , marijuana , nicotine .

→ The NDPS Act, 1985 forbids cultivation, production, possession, sale, purchase, trade, use and consumption of narcotic drugs and psychotropic substances, except for medical and scientific purposes under license.

NDPS Drugs

- Alprazolam,
- Amfepramone,
- Barbital,
- Benzphetamine,
- Bromazepam,
- Camazepam,
- Chlordiazepoxide,
- Clobazam.
- Clonazepam,
- Clorazepate,
- Clotiazepam,
- Cloxazolam,
- Delorazepam,
- Diazepam,
- Estazolam,
- Ethchlorvynol,
- Ethinamate,
- Ethyloflazepate,
- Fludiazepam,
- Flunitrazepam,
- Flurazepam,
- Halazepam,
- Haloxazolam,
- Ketazolam,
- Lefetamine,
- Loprazolam,
- Lorazepam,
- Mazindol, etc

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

Procedure of Drug Purchases

→ **Drug Purchase :** means to obtain or get different types of medicines from external network.

→ Or

→ Purchasing means to gain different types of medicines from the external network.

→ It is a routine function of any pharmaceutical company, and it also represents as one of the tactical avenues of the company.

→ It is very essential for a pharmaceutical company to maintain a proper inventory of different medicines in the drug store and it should also ensure that these medicines are available to the pharmacists at affordable prices.

Purchase Procedure

Following steps are involved in the purchase procedure:

1) purchase request form / Purchase requisition :

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

2) Quotation Invitation :

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

3) Purchase form :

- The purchasing officer check 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 product miss the desired quality , quantity ,or price they should retuned to supplier.

5) Payment :

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

Tender/e-Tender Process

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

→ Or

- → Tender is the process in which hospital invites bids for drugs that should be submitted within the given time limit.
- → Tenders are advertised to offer opportunities to a different supplier, facilitate competition, and ensure availability of greater offers to select forms.

Tender process includes the following steps :

1. Tenders are invited from various suppliers.
2. Suppliers send the tenders in sealed envelope before the due date.
3. Tenders are opened on due date and time in the presence of representatives of suppliers.
4. Purchase officers from the received tenders prepare a comparative statement.
5. Order is placed to the supplier which has quoted lowest rate. However, quality, supply period, other expenses like freight, sale tax, packaging and forwarding charges should also be considered.

E-Tender

- ➢ E-tender is the process in which tenders are sent and received by electronic means, instead of old paper-based technique.

INVENTORY CONTROL

- → **Inventory :** All the items , goods , materials and manufactured product a company have for sell is called Inventory.
- → inventory Control : Inventory control is a process of maintaining a business stock level to fulfill the customer 's demand and to minimize cost.

Inventory control techniques

1) **ABC analysis :** It is a inventory management technique that determine the value of inventory items on the basis of their importance to the business .

2) **VED Analysis :** It is also an inventory management strategy that classifies the materials according to their importance

		No. Goods	Expenses	Rs	Need of care
V. Vital	A	10%	70%	70 Rs	Good care, Good Storage, Evaluation
E.Essensial	B	20%	20%	20 Rs	General care ,general storage no evaluation
D . Desirable	C	70%	10%	10 Rs	No care, no storage , no evaluation

ABC = Always Better Good

3) Economy Order Quantity (EOQ) : It is a method to purchase appropriate quantity of row material for manufacturing at one time , to minimize ordering and caring cost .

Ordering Cost : It includes all those expenses are related to ordering , like traveling cost expenses during traveling etc .

Caring Cost : It includes all those expenses are related to goods like transportation charge , insurance , room rent , storage expenses etc.

Formula $EOQ = \sqrt{\frac{2 \times A.D. \times O.C.}{C.C.}}$ A. D. = annual demand , O.C.= ordering cost

C.C . = Caring Cost

Key Points of inventory Control :

- Minimum level of stock
- Maximum level of Stock
- Average requirement
- Dangerous level of stock
- Re-ordering Quantity .

Lead Time

- It denote the time gap up between placement of an order and its delivered time .

Reorder Quantity Level :

- ❖ It is a process of inventory control , when the level of stock material reach at specific level , then new order is placed to maintain stock level .
- ❖ Reordering Level = maximum consumption x maximum reorder period

Inventory Turnover :

- → It means how many times an inventory of a company is sold or used in a particular time period.
- → It is calculated to see if a business has an excessive inventory in comparison to its sales.

$$\text{Inventory Turnover} \quad \frac{\text{cost of goods sold}}{\text{average inventory}}$$

Cost of goods sold :

- It is the value of goods sold during a particular time period.
- Average Inventory : It is a estimated value of goods used in a specific time periods . it includes total amount of raw material and products are manufactured.

$$\text{Average Turnover} \quad \frac{\text{beginning inventory + Ending inventory}}{2}$$

$$\text{Inventory Turnover} \quad \frac{\text{cost of goods sold (50 cr)}}{\text{average inventory (3 cr)}}$$

$$\frac{50 \text{ cr}}{3 \text{ cr}} = 16.66 \text{ times}$$

It means a company has sold its inventory 16.66 times in last year .

INVENTORY MANAGEMENT OF CENTRAL DRUG STORE

Inventory Management :

- → It is a process in which different types of actions are taken place like ordering , storing , using , and selling a company 's inventory.
- → It has a record of each new and returned product enters in warehouse or out from here.

Some key points of Inventory management :

- ◈ Storage conditions
- ◈ FIFO , FEFO methods
- ◈ Expiry drug removal
- ◈ Documentation

Storage Conditions

Considering protection , drugs are kept in the storage room under different conditions like in different temperature , darkness , dryness . various Storage conditions on the basis of temperature :

1) Room Temperature :

- Majority of pharmaceuticals are stored at room temperature , room temperature is considered between 20-25 ° C

2) Cool Storage Condition :

- It defined between 8-15 ° C , Antibiotics and hormone etc are stored in this temperature .

3) Cold Storage condition :

- It is defined between 2-8 ° C , Vitamins , Vaccines etc are stored in this temperature .

4) Fridge Storage condition :

- It is defined between - 4 to 2 ° C , Insulin and some types of eye drops etc. are stored in this temperature .

Methods of Storage

→ All the medicines must be stored according to the guidelines are provided on the label . like that storage instructions should be provided on label .

Storage of Tablets

- Store in a cool and dry place , protected from light and moisture .

Storage of Capsule

- Store in a cool and dry place , protected from light and moisture

Storage of Emulsion

- It needs to be protected from light , stored in cool and well closed container .

Storage of Suspension

- Store in cool and dry place protect from heat and light .

Storage of Ointment

- It needs to be protected from light and heat , stored in cool and well closed container .

Storage of Syrup

- Store in cool and dry place protect from heat and light .

Storage of Injection

- Store below 25 ° C , protect from light .

Distribution of Drug

→ It means providing drugs to the patients , they may of two types in hospital .

- Indoor or In- patients,
- Outdoor or Out-patients.

Maintaining Cold chain

➢ It means to provide 2-8 ° C temperature to any product like vaccines , during manufacturing , storing , transporting ,and distribution , to maintain their potency .

Devices Used for Cold Storage :

- ❖ Refrigerator
- ❖ Thermometer which indicate the temperature level .
- ❖ Cold boxes for storage and transportation .
- ❖ Ice packs

ILRs (Ice lined Refrigerator)

➢ Ice lined refrigerator is a type of refrigerator which has an extra function where cold ice water , or ice packs are filled . they maintain the inside temperature at a safe level in case of electricity fails.

Walk In Cold Rooms (WIC)

➢ Walk- in cold room is a cold storage condition on a large scale and it provide a constant an comfortable temperature throughout the space.

FIFO and FEFO

➢ **FIFO :** Means First In, First Out It is a method in which the product came first in the warehouse is taken out first , to avoid expiration.

➢ **FEFO :** It means First Expire, First Out . In this method the products whose expiry is closest are out first , to avoid expiration.

Expiry Drug Removal and Handling and Disposal

Expiry

- There is a time period and condition in which a drug is good for use , and ending this time period or missing the specific condition (temperature , darkness) in which a drug is good , called Expiry .

Removal and Handling of expired Drugs

- It is a process of store management to remove the expired drugs from store and to handle properly so that they should not be given to use .
- Following actions can be taken for handling expired drugs
  - The expired drugs must be separated from usable drugs .
  - Where these drugs are kept , there should be a notice like " out of Use "
  - The expired drugs must be destroyed as recommendation of local waste management .

Disposal of Expiry

- Drugs Disposal of expiry drugs means destroying the expired drugs so they can not used .
- Disposal methods recommended by the International Authorities

1. **Returning to the Manufacturing :** The Manufacturer has good disposal method at its disposal .
2. **landfill :** This is the oldest and best way for disposal of solid waste ,In this method the waste materials are placed into land . The municipal waste should be used to cover this site .
3. **Waste Immobilisation (Encapsulation) :** In this method , the pharmaceuticals are packed in a plastic or steel drum , solid and semi solid materials are filled 75 % of drum , then mixture of lime , cement and water in 15: 15: 5 ratio is filled , then mouth of drum sealed and placed in landfill and cover with municipal solid waste .
4. **Sewer :** Syrups and IV fluids are diluted with water and flushed into sewer , in small quantity , over a time period .
5. **Incineration :** In this methods the waste material are given high temperature heat to be destroyed .
6. **Chemical Disposal :** In this chemicals are used to destroy the expired drugs .

Disposal of Narcotics

- Narcotics drugs should be disposed in supervision of a pharmacist or the police , and public should not be allowed to prevent abuse .

Narcotic Drug Disposal Methods

- Waste encapsulation
- Waste inertisation
- Incineration

Disposal of Cytotoxic Drugs

→ Cytotoxic waste is associated with cytotoxic drugs, containing chemicals that are toxic to cells. This includes materials, equipment, and residue contaminated with cytotoxic drugs. Cytotoxic drugs (or anti-neoplastics) are administered to cancer and multiple sclerosis patients to prevent cell multiplication and growth.

Types of Cytotoxic Wastes

- Syringes
- Vials
- Needles
- Gloves
- Personal clothing and equipment
- Respirator masks
- Air filters

Disposal Methods for Cytotoxic Drugs

- Return to supplier
- Incineration at high temperature
- Waste encapsulation

Documents for Inventory Control

Inventory Control includes the following documents

- Stock Requisition (SR)
- Pick and Issue (PI)
- Issue Confirmation (CI)
- Over the Counter (OC)
- Stock Return (SN)
- Inventory Adjustment (IA)
- Physical Inventory Purchase Input (IP)
- Stock Transfer Issue (TI)

Stock Requisition (SR)

- Reserves quantities of stock items from an on-hand supply for later delivery.
- This reduces the available quantity.
- If items are not immediately available, they may be backordered and later filled by having the Backorder Servicing program run.

Pick and Issue (PI)

- ◈ Schedules previously reserved items to be picked up for delivery and releases them from a reserved status. This function is performed by creating a Pick Ticket Report (IN80).
- ◈ From this report, the warehouse can determine the stock item, the quantity, and the bin number of the items that are to be picked up.
- ◈ It also creates the corresponding Issue Confirmation (CI) document.

Stock Issue Confirmation (CI)

- Confirms to the system that previously reserved and released items have been issued from the warehouse to the buyer.
- The on-hand quantity of the warehouse for this item is reduced by the amount issued.

Over the Counter (OC)

- ➢ Issues requested items directly from the on-hand quantity. As the items are issued immediately upon request, in effect, "over-the-counter," backordering is not allowed.
- ➢ Once an "Over the Counter" transaction is successfully completed, an Over the Counter Issued Report will be produced, identifying the requestor and the stock items issued.

Stock Return (SN)

- ⇨ Allows the original buyer to return previously issued items. At the option of the issuing warehouse, a return charge may be imposed.

Inventory Adjustment (IA)

- ❖ Allows warehouse management to adjust quantities or unit values of on-hand items due to a change in on-hand quantities or unit costs.
- ❖ These adjustments alter inventory and cost of goods expense balances.

Physical Inventory Purchase Input (IP)

- ⭘ Allows warehouse management to adjust quantities of on-hand items due to a change in on-hand quantities at a specified unit costs.
- ⭘ These adjustments alter inventory and cost of goods expense balances.

Stock Transfer Issue (TI)

- ◈ Initiates the transfer of items from one warehouse to another.

Stock Transfer Receipt (TR)

- ○ Recognizes the receipt of transfer items by the receiving warehouse. On-hand quantities of receiving/issuing warehouses are adjusted

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Diploma in Pharmacy 2nd Year
Hospital & Clinical Pharmacy
Chapter 4 : Drug Distribution

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Chapter 4
Drug Distribution

→ Drug distribution is a process to provide drugs to the patient or patient's attendant.

Or

→ Physical transfer of drugs from storage area in the hospital to the patient's bedside.

This involves two types of drug distribution.

1. In-patient distribution
2. Out-patient distribution

In-patient distribution : In this type of drug distribution , drugs are provided to those patients who are admitted in hospital.

In patient Distribution Method

- Individual prescription order method ,
- Floor stock method
- Unit dose drug distribution method
- Drug Basket Method

Out-patient distribution : In this type of drug distribution , drugs are provided to the patients are not admitted in hospital and are given general or emergency treatment.

Out – Patient Distribution Method

- Retail pharmacies
- Mail-order pharmacies

Steps for dispensing drugs to out-patients

- The patient name is registered by registration staff and patient is send to the physician with registration form
- The Physician Checks the patient and write a prescription.
- The patient takes the prescription to the pharmacy.
- The pharmacist reviews the prescription carefully and records the prescription and provides the drugs.

Methods of drug distribution to in patients

- ⇨ Individual prescription order method ,
- ⇨ Floor stock method
- ⇨ Unit dose drug distribution method
- ⇨ Drug Basket Method

1) Individual prescription order method

- → Individual Prescription Order Method Individual prescription order system, though old is still followed in small private hospitals.
- → In this system, doctors write a prescription and ask the patient to get the medicines from licensed medical stores.
- → Medications should be dispensed in properly labelled individual prescription containers.
- → Medication for administration should be labelled with :
    - Patient's name and location.
    - Drug's name and strength.
    - Drug dose,
    - Administration route,
    - Accessory and cautionary statements,
    - Dispensed date,
    - Hospital's name,

Advantages

- ✓ All the prescribed medicines are directly revived by a pharmacist .
- ✓ Less number of staff required in hospital .
- ✓ It may be cheaper than hospital pharmacy .

Disadvantages

- ⅄ chances for increasing medication errors due to
    - wrong scheduling .
    - wrong administration
- ⅄ Greater chances for drug interaction .
- ⅄ there may be delay in obtaining required drugs .

2) Floor Stock Method In this method

- → The drugs are stored in the chief stock room , and are supplied to the wards at nursing station (which may at every floor) and stored there , and from there administered to a patient by a nurse according to the chart order of physicians.

It is divided in two types

- **Charge Drugs :** These are costly drugs obtained from the pharmacy store when the pharmacist receives the prescription for patients. Cost of these drugs is billed in the patient's account for charging.
- **Non-charge Drugs :** These are cheaper and commonly used drugs. Their cost is not directly entered in the patients account but included into the per day cost of hospital ward.

Advantages

- ✓ Drugs are readily available for use
- ✓ Reduced the number of staffs .
- ✓ The number of drug order by nurses is also reduced
- ✓ Reduced the number of drug returned to the pharmacy .

Disadvantages

- Medicine errors may increase .
- Degradation of drugs may increase .
- There is need of extra investment to maintain storage facilities in every ward or floor .

3) Drug Basket Method

- → It is a type of floor drug distribution method , in this method , nurses verify the availability of medicines in all rooms and refrigerators with the help of master list of pharmacy , then fill demand form for the delivery of drugs to floors.
- → If they found any empty container , they put it in the drug basket.
- → After completing the round in all rooms , they send the demand form and container to the pharmacy.

Advantages

- ✓ Drugs are readily available for use
- ✓ Reduced the number of staffs.
- ✓ The number of drug order by nurses is also reduced
- ✓ Reduced the number of drug returned to the pharmacy.

Disadvantages

- Medicine errors may increase.
- Degradation of drugs may increase.
- There is need of extra investment to maintain storage facilities in every ward or floor.

4) Unit Dose Drug Distribution Method

- → In this method drugs are prepared and distributed in a single dose to use once
- → Unit dose system means a drug distribution system in which each dose of medication is contained in, and administered from, single unit or unit dose packages.

Types of Unit Dose Drug Distribution Method

- **Centralised Unit Dose Dispensing (CUDD) :** In this method the drugs are stored in the main pharmacy and dispensed when any dose is required to give a patient (by dumb waiter) with medication card.
- **Decentralised Unit Dose Dispensing (DUDD) :** In this method a small pharmacy is made on each floor of the hospital , and drugs are supplied to this pharmacy from main pharmacy on receiving the demand . from this small pharmacy drugs are dispensed in unit dose when required to give a patient.

Advantages

- ✓ Pharmacist checks the physician 's prescription before administration of drugs by a nurse.
- ✓ Less chances for stolen of drugs.
- ✓ Low investment , because storage facility is not required at each floor or ward.
- ✓ Nurses have more time to care patients because all doses are prepared in pharmacy.

Disadvantages

- **Time consuming :** A Pharmacist has to give more time in handling each dose individually than sending the bulk drugs to a ward .
- **Increased staff :** This system requires a large number of staff to manage the system .
- **Increased Cost :** This system additional equipments to deliver drugs like dumb waiter .

Distribution of Drugs to ICCU/ ICU /NICU / Emergency Wards

- → There are some specialised units (department) in hospital which are reserved for those patients are in serious condition and require close monitoring and extensive (big) treatment.

some specialized units are given below :

- **ICU (Intensive Care unit) :** It is also called Intensive treatment unit ,ICU is a specific department for critically ill patients who require intensive and constant care.
- **ICCU (Intensive coronary Care Unit) :** It is also called Intensive Cardiac care Unit . ICCU department is reserved for patients having Heart related problems like heart failure, coronary heart diseases etc.

- **NICU (Neonatal Or Newborn Intensive Care Unit) :** it is also called ICN (Intensive Care Nursery) NICU Department is reserved for care of sick or preterm newborn babies.
- **Emergency Ward :** This department provides emergency medication for patients arrive without an appointment.

Drug Distribution to these Departments

→ In Intensive care Units drugs are available already . Only some certain , limited quantity of drugs stored there . They are packed in single unit container . And location are fixed for storage of IV solution for certain drugs.

Automated drug dispensing systems and devices

→ Automated drug dispensing systems and devices are computerized systems that can accurately dispense medications to patients. These systems can be found in hospitals, pharmacies, and other healthcare facilities.

There are several types of automated drug dispensing systems and devices, including :

- **Robotic dispensing systems :** These systems use robots to dispense medications. They can be programmed to dispense a specific dose of a medication, and can handle multiple medications at once.
- **Bar code scanning systems :** These systems use bar code technology to ensure that the correct medication is dispensed to the right patient. The bar code on the patient's wristband is scanned, and then the medication is scanned to ensure that it matches the medication prescribed for the patient.
- **Automated medication cabinets :** These systems are similar to vending machines and are often used in hospitals. The medications are stored in individual drawers, and the system dispenses the medication based on a prescription order.
- **Pharmacy dispensing systems :** These systems are used in pharmacies to fill prescriptions. The system can accurately count and dispense pills, and can also label and package the medications.

Advantages

- ✓ Reduced Pharmacy staff and work load.
- ✓ It Provides Automatic Inventory facility.
- ✓ It saves a lots of time.
- ✓ Decreased mistake.
- ✓ It provides safety.

Disadvantages

- It Requires Extra training and technical knowledge.
- Dispensing may be stopped in case of failure of any part of automatic system.
- It requires extra budget and space.

Distribution of Narcotics and Psychotropic Substances and Storage

- → According to Drugs and Cosmetics Act 1945 , Narcotics and Psychotropic substances are can't be sold without a valid prescription for non ward and , and can 't be dispensed without a requisition form for wards in hospital.
- → These are also called controlled Substances.
- → So It is the responsibilities of Hospitals and Pharmacies to control their use without a valid prescription.

Hospital Control procedures

These Procedures are developed by American Government Authorities and can apply in India also :

1. **Responsibilities for Controlled Substances in a hospital :**
   - ⇨ The administrator of hospital should properly handle the controlled substances .
   - ⇨ The Medical superintendent should manage properly.
   - ⇨ The Chief Pharmacist : He should Look After the purchase , storage and dispensing of controlled substances.
   - ⇨ the Head Nurse should look after the storage and use of Controlled substances in nursing unit.
   - ⇨ While Ordering Demand of controlled substances for ward stock the nurse should fill a requisition for and should mention the name , desired strength and quantity of controlled substances.

Requisition form for ward stock controlled substance

ABC Hospital, Delhi

Ward_____ **Code** _____ **Date**_____

Each floor is entitled to contain each of the following tablets and units of injectables. Empty bottles, except tubes along with narcotics or barbiturate accounting, sheets must be returned. All other narcotics and barbiturates must be ordered for and charged to the patient. These special narcotics and barbiturates orders must be accompanied by a prescription.

No. of Tablets Capsules	Check Item Needed	Price
20	Codeine sulphate tabs. 15mg.	
25	Codeine sulphate tabs. 20mg.	
20	Morphine sulphate H.T.	
25	Morphine sulphate ampoules	
10	Pethidine hydrochloride injection.	
1	Pentobarbitone injection 50mg/ml. 20ml.	
20	Phenobarbitone tablets I.P.	
25	Secobarbitone capsules 50mg.	

The Nurses should also record the use of controlled substances on daily basis

ABC Hospital, New Delhi

Daily Controlled Drugs Administration Form Part-I

Date _____ **Ward No.** _____ **Floor** _____

Patient's Name	Specific Description of Drug	No. of Tablets or Injections	Strength Used	Ordered by Doctor	Adm. by Nurse	Time Given

Signature of Nurse _____

ABC Hospital, New Delhi					
Part-2					
Daily Controlled Drugs Administration Form Summary of Daily Report					
Name of the Tablets or Injections	Opening Day Record	Received	Total	Drugs Used	Balance

Signature of Nurse _____

2. Prescribing Controlled drugs for out patient department :

The prescription prescribed for out patient pharmacy , the prescription should have following information :

- Full name of patient
- Hospital number or address
- Date
- Name and strength of prescribed controlled drugs.
- Quantity of drug
- Frequency and rout of administration
- Signature of Physician.

3. Procedure In Case of Waste , Destruction , contamination etc.

- **Aliquot part of narcotic solution unused :** The remaining part of solution in ampoule which is not used should be thrown into sink by nurse.
- **Prepared dose refuse by patient or cancelled by doctor :** In this case the solution should be discarded into sink , and record the reason for drug not being administrated.
- **Accidental destruction of drugs :** In case of accidental destruction of drug in nursing unit , the responsible person should inform the head nurse about that.

4. Control of Narcotics on the ward by nurses :

- When Controlled drugs dispensed to nursing unit , Now it is responsibility of nurses for administration , looking after , and documentation.

5. Delivery of Controlled drugs to ward :

- The narcotics drugs from main pharmacy should be delivered to ward / nursing station by a faithful person working in hospital

6. Storage of narcotics and psychotropic drugs :

- These substances should be under lock and key all the times.
- There should be a different register to register them.
- No other objects should be kept with Narcotics.
- They should not be bought and sold to unauthorised person.

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Diploma in Pharmacy 2nd Year
Hospital & Clinical Pharmacy
Chapter 5 : Compounding In Hospital

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Chapter 5
Compounding In Hospital

- → Compounding is a process of combining , mixing or altering in drug ingredients for developing a drug to fulfill the specific need of a patient . It is done when no approved drug is appropriate for patient .
- → Compounding is typically done under the supervision of a licensed pharmacist and must adhere to strict guidelines to ensure the safety and effectiveness of the compounded medications.
- → Due to the compounding, we make the suitable doses and formulation according to the patient/disease conditions.
- → Now a days, compounding is very easy because many combinations drugs are already present in the market.

Ideal requirement for the compounding

- Compounding platform.
- Lab coat and gloves.
- Sterile equipment's like mortar and pestle.
- Sterile container and closers.
- Packing material etc

Objectives

- ➢ To convert solid form to liquid.
- ➢ to avoid an allergic ingredient like coloured dyes.
- ➢ To provide an exact dose that is not available in market.
- ➢ To mask an unpleasant taste.
- ➢ Two minimize multiple dosing.

Bulk Compound

- → When any drug compounded in bulk (big amount) it is called bulk compounding it is required when same medication are prescribed more and more in a specific are.
- → Involves the preparation of large quantities of a medication for use in the hospital.
- → This can include creating new formulations of medications, adjusting the strength of medications, or combining multiple medications into a single dose.

Control Systems In Compounding

- **Compounding process control :** During compounding the standard process should be applied to obtain good strength , quality and purity of drug .
- **Quality control :** It is a process to check the quality , purity or strength of a developed product .
- **Budgetary control :** The budget of hospital should also be considered during making a program for bulk compounding .

Requirements for bulk compounding in hospital

- **Manufacturing facilities :** The place where drug are being compound should be clean at high degree . it should be smooth construction specially walls and floor which are easy to clean .
- **Raw Materials :** After deciding the drug to be compounded , its raw materials should be bought of good quality and in sufficient quantity .
- **Equipments :** The equipments are required for specific drugs should be available .
- Staff : there should be enough staff according to workload

I V Admixture Services

→ IV admixture is the combination of one or more sterile products added to an IV fluid for administration.

→ It is also defined as a pharmaceutical mixture of two or more drugs into a large bag or bottle of IV fluid.

Preparation of IV Admixture

1) The admixture should be prepared according to the directions of physician .
2) According to the physicians order a label should be prepared including
    - Name and address of patient and location
    - Name of physician .
    - Name of drug with quantities.
    - Date of compounding and expiry date
    - Name of pharmacist who prepared Admixture .
3) The admixture should be prepared under laminar flow hood / cabinet using sterile needles and syringe .
4) After adding the drugs the solution should be mixed properly .
5) Before using the admixture solution , it should be checked carefully to satisfy that there is no incompatibility
6) Before dispensing the final admixture preparation to use ,the pharmacist should inspect the label and calculation etc .

Advantages of IV Admixtures

- ✓ IV admixtures extend the expiration period.
- ✓ Their preparation process is time saving.
- ✓ They provide large amount of nutritive fluids (glucose and electrolytes) and nutrients to the body.
- ✓ They have a quick onset of action.
- ✓ They can be administered to patients who are vomiting and are unconscious.
- ✓ They provide effective, safe and high quality of patient care.

Disadvantages IV Admixtures

- ⅄ IV admixtures have a high risk of incompatibility.
- ⅄ They need skill and time.
- ⅄ They need aseptic area, special storage equipment. like refrigerator.
- ⅄ They need trained pharmacists.
- ⅄ They have a risk of bacterial contamination.
- ⅄ They have a higher risk for adverse reactions.

Incompatibility of IV Admixture

→ Incompatibility is an unwanted reaction that occurs between the drug to drug , fluid or containers . and unable to show required effect. like :

- Synergism (increase in drug efficiency)
- Antagonism
- New effects like toxic effect.

Types of Incompatibility of IV Admixture

- ➢ Physical Incompatibility
- ➢ Chemical Incompatibility
- ➢ Therapeutic Incompatibility

- ❖ **Physical incompatibility :** When visible changes occurs after mixing two or more drugs , it is called physical incompatibility for example change in colour , formation of precipitate etc
- ❖ **Chemical incompatibility :** When chemical degradation occurs after mixing true or more products , it is called chemical incompatibility e. g. oxidation ,reduction ,decomposition ,complexation .
- ❖ **Therapeutic Incompatibility :** When drugs are administered and show unwanted effect like antagonism ,synergistic or toxic effect , it is called therapeutic incompatibility.

Preventing Incompatibility of IV Admixture

- Preparing admixture under strict indications of Physician.
- Separating the drug dose by time and place and by rinsing the IV setup / system with a natural solution
- Proper mixing of drugs added in IV fluid.
- Reducing the number of drugs in a single IV bag.
- Avoiding the administration of Admixture just after the mixing.
- Observing the running of IV fluid to detect the physical change.

Role of Pharmacist in IV admixture Administration

- ✓ Pharmacist should provide proper supervision during preparation of IV admixture
- ✓ He should provide proper guidance for staff to avoid incompatibility.
- ✓ He should use latest research information to avoid incompatibility.
- ✓ He should use colour coding to avoid incompatibility
- ✓ He should provide labelling on bags

Total Parental Nutrition (TPN)

- → A method of providing nutrients to a patient through intravenous means, rather than through the gastrointestinal tract
- → This method is used when someone unable to take nutrients orally . or in an emergency condition .
- → Examples of patients who may receive TPN include critically ill patients, burn victims, or patients recovering from surgery.
- → Total parenteral nutrition (TPN) is a method of delivering nutrients directly into the bloodstream via a vein. It is used when a patient is unable to consume food or absorb nutrients through the gastrointestinal tract due to a medical condition or surgical procedure. TPN solutions are typically made up of a combination of glucose, amino acids, lipids, vitamins, and minerals.

Types of TPN

- **Central Parental Nutrition (CPN) :** In this method fluids are delivered through a central vein ., Mainly through the superior vena cava , It is present beneath the collarbone and directly goes to the heart .
- **Peripheral Parental Nutrition (PPN) :** In this method fluids are delivered through a smaller vein .

Composition of TPN

→ TPN is a mixture of all the essential nutritional components , which are required for normal body functions like carbohydrates , proteins , fat and minerals .

Macronutrients provided by TPN

- Proteins
- Calories (carbohydrates)
- Fat

Micronutrients provided by TPN

- Vitamins
- Minerals

Indications of TPN

- TPN is administered if the digestive system is not working properly .
- If GIT needs a complete rest .
- Abdominal surgery
- Chemotherapy
- Intestinal Ischemia
- GIT bleeding
- Extremely Premature Birth

Complication of TPN

- Bacterial Infection Through the IV Catheter .
- Blood Clots can form at catheter .
- GI atrophy (weakening of GI) after 2 weeks .
- Liver disease can be develop after long term use of TPN .
- Gallbladder problems

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Diploma in Pharmacy 2nd Year
Hospital & Clinical Pharmacy
Chapter 6 : Radio Pharmaceuticals

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Chapter 6
Radio Pharmaceuticals

→ Radio pharmaceuticals, also known as radiopharmaceuticals, are drugs that contain radioactive isotopes. These isotopes emit radiation, which allows them to be used in medical imaging and therapy.

→ They are used to diagnose and treat a variety of conditions, such as cancer, thyroid disorders, and blood flow problems.

→ They can be administered by injection, orally or inhalation.

Handling and Storage of Radiopharmaceuticals

- When Radiopharmaceuticals are not in use , must be kept in sealed container.
- The radioactive materials must not contaminate the working area.
- Unnecessary movement of persons and radioactive materials must be avoided.
- All the radiation workers must wear suitable protective clothing and surgical gloves and should have radiation monitoring device.
- To carry liquid Radiopharmaceuticals , the trays should be used with absorbent tissue paper for absorbing any accidental spillage.
- Smoking , eating , drinking and like that activities are strictly prohibited in the area of radioactive work.

Storage of Radio Pharmaceuticals

- Radio pharmaceuticals should be stored in a secure, designated area that is separated from other drugs and medical equipment. The storage area should be well-ventilated, with a low level of background radiation.
- The storage area should also have limited access, and be clearly labeled to indicate the presence of radioactive materials.
- The temperature and humidity of the storage area should be carefully controlled to ensure the stability of the radio pharmaceuticals.
- It's recommended to store them in a refrigerator or freezer, depending on the specific requirements of the drug.
- It's also important to maintain accurate records of the storage, use and disposal of radiopharmaceuticals, and to ensure that they are handled and disposed of properly to minimize the risk of exposure to radiation.
- Additionally, the storage area should be equipped with radiation detection and alarm systems, as well as emergency response protocols in case of a spill or other accident.

Dispensing of Radiopharmaceuticals

- Dispensing of Radiopharmaceuticals should be safe, simple , and reliable.
- Radiopharmaceuticals should not be dispensed to patients , but dispensed to healthcare providers and from there administered to patients.
- The recommended dose should be determined by the pharmacist on the basis of patients history , age , weight etc.
- These drugs should be dispensed only on the valid prescription.
- Necessary records should be maintained.

Disposal of Radiopharmaceuticals

- Radiopharmaceuticals are not disposed just like other drugs,
- Low level radioactive wastes are disposed into land at 10 meter depth.
- High level radioactive wastes are stored for about 50 years before disposal . and they are disposed into at depth of 500 to 1000 meter

Steps before disposal

- They are put in yellow color plastic in a separate place ,
- Solid should be free from liquids and liquids from solids.
- Radio Active symbol should be labeled on the bags.
- Attach a dangerous tag.
- Seal the bag when it is full
- Sealed it in a clear plastic bag
- Moved it waste storage area

Types of Disposal

- Incineration
- In water
- Burial
- Deep Burial
- Recycle and reuse

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Diploma in Pharmacy 2nd Year
Hospital & Clinical Pharmacy
Chapter 7 : Application of Computers in Hospital Pharmacy Practice

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Chapter 7
Application of Computers in Hospital Pharmacy Practice

- → Computer plays an important role in development of clinical pharmacy practice and basic pharmacy research. The use of computer in hospital administration and medical research become the need of large hospitals
- → Hospital pharmacy is the health care service, which comprises the art, practice, and profession of choosing, preparing, storing, compounding, and dispensing medicines and medical devices, advising healthcare professionals and patients on their safe, effective and efficient use.
- → The computer has become a very common tool in all the areas of science and technology.
- → The field of pharmacy has immensely benefitted by the use of computers and will continue to do so.
- → The complete field of pharmacy requires computers.

Computers have transformed the healthcare industry, including hospital pharmacy practice.

Here are some ways in which computers are used in hospital pharmacy practice :

1. **Medication Management :** Computerized systems are used to manage medication administration, prescription orders, and inventory control. This system can track medication usage, monitor medication errors, and streamline medication distribution.
2. **Clinical Decision Support :** Pharmacists use computer-based tools to help make clinical decisions regarding drug therapy. These tools provide access to patient records, drug interactions, and patient-specific information.
3. **Electronic Medical Records :** Electronic medical records (EMRs) allow pharmacists to access patient records, including medical history, medications, allergies, and laboratory results. EMRs allow pharmacists to quickly access and review patient information, which can help to identify drug interactions and ensure appropriate medication use
4. **Barcode Technology :** Barcoding technology is used to track medication usage and prevent medication errors. Barcodes can be scanned to verify the correct medication, dose, and administration route.
5. **Telepharmacy :** Telepharmacy involves the use of technology to remotely manage pharmacy operations. This technology can be used to remotely verify prescriptions, manage medication orders, and provide medication counseling to patients.
6. **Drug Information Databases :** Computer-based drug information databases provide pharmacists with access to the latest drug information, including dosage guidelines, side effects, and interactions.

Electronic Health record (EHR)

- → It is an electronic health record of patient which maintained by the health care providers, it contain all the essential clinical data related to patient care
- → for example disease , medication , immunization , laboratory reports, radiology reports , disease history .
- → And it can be up-to-dated and shared to patient and to other healthcare providers through electronic medium

Components of EHR

- Patient contact details
- Details of consultation with medical exports
- Allergies
- Insurance information
- Family history
- Vaccination history
- Information regarding any illness
- Medicine list
- Hospitalisation record
- Details regarding any previous surgeries or procedures

Advantages of EHR

- It provides patient's complete , accurate , and up-to-date information during providing health care.
- It shares patient 's data through electronic medium to the patient and other health care providers.
- It helps to prevent medical errors.
- It makes easy to provide health care services.
- It decrease costs by reducing paperwork and repeated laboratory and radiology tests.

Software's used in hospital pharmacy

→ Hospital pharmacies rely on several software programs to manage their operations efficiently.

→ Here are some of the software programs used in hospital pharmacy :

1. **Pharmacy Information Systems (PIS) :**
   - → Pharmacy Information Systems (PIS) are used to manage medication orders, medication dispensing, and inventory control. PIS can track medication usage, monitor medication errors, and streamline medication distribution.
2. **Electronic Health Records (EHR) :**
   - → Electronic Health Records (EHR) are digital versions of patients' medical records that include medication history, allergies, laboratory results, and other relevant medical information. EHRs can improve medication safety by providing healthcare providers with accurate and up-to-date information about patients' medications.
3. **Clinical Decision Support Systems (CDSS) :**
   - → Clinical Decision Support Systems (CDSS) provide healthcare providers with patient-specific information, including drug interactions, contraindications, and dosage guidelines. CDSS can help healthcare providers make informed decisions about medication therapy.
4. **Barcode Medication Administration (BCMA) :**
   - → Barcode Medication Administration (BCMA) is used to track medication administration and prevent medication errors. BCMA uses barcode scanning technology to verify the correct medication, dose, and administration route.
5. **Automated Dispensing Cabinets (ADC) :**
   - → Automated Dispensing Cabinets (ADC) are used to store and manage medication inventory in hospital pharmacies. ADC can help to reduce medication errors, improve medication tracking, and increase efficiency in medication dispensing.
6. **Inventory Management Systems :**
   - → Inventory Management Systems are used to track medication inventory levels, expiration dates, and reorder points. These systems can help to ensure that the pharmacy has the necessary medications on hand to meet patient needs

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Diploma in Pharmacy 2nd Year
Hospital & Clinical Pharmacy
Chapter 8 : Clinical Pharmacy

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Chapter 8
Clinical Pharmacy

- → Clinical pharmacy is a branch of pharmacy that provides patient care by optimizing the medication therapy and promoting health, wellness, and disease prevention by means of pharmaceutical care.
- → Clinical pharmacy is a health science discipline in which pharmacists provide patient care that optimizes medication therapy and promotes health, and disease prevention.
- → Pharmaceutical care comprises of responsible provision of drug therapy for the purpose of achieving positive outcomes that improve a patient's quality of life.

Scope of Clinical Pharmacy

A Clinical pharmacist has many scope some of them are following :

- **Patient monitoring :** A clinical pharmacist monitors the symptoms of a patient if the disease is under control of pharmacist he tries to treat otherwise refer the patient to a senior doctor or physician.
- **Medication history :** The pharmacist interviews the patients and prepares their medication history which helps a doctor in treatment of those patient and save the doctor's time to interview the patient.
- **Treatment of patient :** A clinical pharmacist treats the minor ailments without performing a big surgery procedure.
- **Preparation of IV Admixture :** They prepare the IV admixtures under specific condition.
- **Training :** A clinical pharmacist trains the new pharmacist (fresher) .
- **Retail Pharmacy Store :** A clinical pharmacist can sale drugs after getting license
- **Patient Counselling :** Clinical pharmacist can perform patient counselling service
- **Clinical research and development :** A clinical takes parts in clinical research and development .
- **Drug formulary :** Pharmacist helps in formation of hospital formulary.
- **Drug consultant :** A clinical pharmacist can offer his services as a drug consultant

Development of Clinical Pharmacy

- → The term "clinical pharmacy " is being used from 1953 . Before 1960s the work area of pharmacist was limited to drug relative services only (like production Compounding distribution , sale etc.) , they were not permitted to participate in patient care but in late 1960 the status and function of pharmacist revised and developed and involvement of pharmacist in patient care started .

In India

- Pharmacy education was started after implementation of drug and cosmetic act but these pharmacist were oriented towards production distribution and sale of drugs.
- During 1980s and 1990s many of drug misuse and poor health outcome and economic loss to patient are recorded , due to bad performance by both pharmacy and medical profession and according to population doctors were not sufficient.
- Now it is realized that the pharmacist should given those knowledge and skills that they can contribute in patient care effectively like pathophysiology , therapeutics , pharmacokinetics , patient counsellin etc.
- So in 1991 the education regulation was revised and hospital and clinical pharmacy , community pharmacy , health education and drug store and business management subjects were added in diploma in pharmacy.
- Seeing Lake of teaching personnel for clinical pharmacy first master i n pharmacy practice program started at JSS College of Pharmacy Mysore and Ooty with the support of Overseas academy In 1997 .
- Now there are numbers of institution in India which offer a clinical pharmacy degree .

Technical definitions

→ Clinical pharmacy is a specialized field within pharmacy that focuses on the application of pharmacotherapy and the provision of patient-centered care.

Technical definitions in clinical pharmacy may include:

- **Clinical pharmacy :**
  - A specialized field of pharmacy that focuses on the application of pharmaceutical knowledge, skills, and abilities to optimize patient outcomes. Clinical pharmacists work collaboratively with healthcare providers to ensure the safe and effective use of medication therapy.
- **Medication therapy management (MTM) :**
  - A comprehensive approach to optimizing medication use that involves assessing the patient's medication regimen, identifying any medication-related problems, and developing a plan to resolve them. MTM is typically provided by clinical pharmacists.
- **Pharmacotherapy :**
  - The use of medications to treat and manage disease. Pharmacotherapy involves selecting the appropriate medication, dosing it correctly, monitoring its effects, and adjusting therapy as needed to achieve therapeutic goals.

- **Drug interaction :**
  - The effect that one medication has on another medication when they are taken together. Drug interactions can be beneficial (such as when two medications work together to enhance their therapeutic effects) or harmful (such as when two medications interact to cause side effects or reduce the effectiveness of one or both drugs).
- **Adverse drug event (ADE) :**
  - Any harm that occurs as a result of medication use, including medication errors, side effects, allergic reactions, and other adverse reactions. Clinical pharmacists play a key role in preventing and managing ADEs.
- **Pharmacokinetics :**
  - The study of how medications are absorbed, distributed, metabolized, and excreted by the body. Pharmacokinetics plays an important role in determining the appropriate dose and dosing regimen for a medication.
- **Pharmacodynamics :**
  - The study of how medications produce their therapeutic effects. Pharmacodynamics involves understanding the mechanisms of action of medications and how they interact with the body's physiological processes.
- **Therapeutic drug monitoring (TDM) :**
  - The measurement of medication concentrations in the blood to ensure that they are within a safe and effective range. TDM is commonly used for medications that have a narrow therapeutic index (i.e., a small difference between the therapeutic and toxic doses).
- **Clinical decision support (CDS) :**
  - Computerized tools and systems that provide healthcare providers with information and recommendations to support clinical decision-making. CDS is increasingly used in clinical pharmacy practice to improve medication safety and optimize patient outcomes.
- **Formulary management :**
  - The process of selecting, evaluating, and managing medications that are included on a healthcare organization's formulary (i.e., the list of medications that are approved for use). Formulary management is an important aspect of clinical pharmacy practice, as it helps to ensure that patients have access to safe, effective, and affordable medications.

Pediatrics

- Pediatrics is the branch of medicine dealing with the health and medical care of infants, children, and adolescents from birth up to the age of 18.
- The word “paediatrics” means “healer of children”; they are derived from two Greek words: (pais = child) and (iatros = doctor or healer).

Geriatric

- Geriatrics is the medical specialty dedicated exclusively to providing high-quality, patientcentered care for older adults.
- Older adults have a unique set of issues and concerns which geriatric clinicians are trained to focus upon.
- Illnesses, diseases, and medications may affect older people differently than younger adults, and older patients may have overlapping health problems that require multiple medications.

Antenatal Care

- Antenatal care is the care you get from health professionals during your pregnancy.
- It's sometimes called pregnancy care or maternity care.
- You'll be offered appointments with a midwife, or sometimes a doctor who specialises in pregnancy and birth (an obstetrician).
- This is the care you receive while you're pregnant to make sure you and your baby are as well as possible

Postnatal care

- Providing care to a woman during the 6-week time period beginning immediately after childbirth.
- Postnatal care should be a continuation of the care the woman has received through her pregnancy, labour and birth and take into account the woman's individual needs and preferences.

Daily Activity of Clinical Pharmacist

Flowing activities a pharmacist should perform :

- Ward Round Participation.
- Treatment chart review.
- Adverse drug reaction monitoring.
- Drug Information and poisons information.
- Medication history.
- Patient Counselling.
- Inter - Professional Collaboration.

Ward Round Participation

→ A ward round is a visit of medical practitioner (Alone or with a team of Health care professionals and medical student) to hospital inpatient at their bedside to review and increase the progress in their health.

Goals

- To review the patient and understand the patient condition
- To improve the patient health
- To provide appropriate drug related information on drugs availability , optimum and cost effective or alternate drug.
- To identify the medication compliance.
- For patient discharge planning.

Procedure

- Pre-Ward Round preparation : the doctor / pharmacist should prepare before participating in ward round , they should get up to date information on patient disease , disease management and patient medical history.
- During ward round the physician or pharmacist interview the patient and observe their symptoms and current status.
- The physician also consults the pharmacist regarding the effective and cheap drugs.
- A detailed medication history should be collected from a new inpatient.
- If required the patient existing profile can be updated.

Treatment Chart Review

→ Treatment Chart Review is a process where a pharmacist reviews the patient's drug treatment during his hospital admission and involves evaluation of the therapeutic efficacy of each drug and the progress of the conditions being treated.

Goals

- To minimize the risk of medication errors , that might occur during prescription writing or during drug administration.
- To provide economical and rational drugs.

Procedure

- First of all he should try to get information about patient
- He should verify that the medication order is completed or not or is there any mistake such as in terminologies used , drugs name , administration route.
- He should identify Drug Related Disorders if find he should record them in patient medication profile .
- He should provide medication care information to nurses who take care of the patient.
- When medication therapy supposed to finish , the pharmacist should double check that the order is cancelled in all part of the Drug administration record

Adverse drug reaction monitoring

- → World Health Organization (WHO) defines that adverse drug reactions (ADRs) are noxious and unwanted effects produced by the drug, when it is applied for the ailment of disease or diagnosis (Shukla etal.2012).
- → The most common examples of drugs that produce ADRs include paracetamol and nimesulide (hepatotoxic effects) (Rehan et al.2002).
- → It is a well-known fact that no drug is completely free from side effects

Goals

- To detect adverse drug reaction in a early stage.
- To control the adverse drug reaction.
- To inform the drug regulatory authority to identify the risk factors that can cause severe health damage.

Procedure

- ➢ Information about the patient
- ➢ Continuous monitoring the suspected patient
- ➢ Recording and informing the drug regulatory authority.

Drug information and poisons information

Drug information

- → Drug information means providing clinically relevant information on any aspect of drug use relating to individual patients, or general information on how best to use drugs for populations.
- → Drug information service can be applied to any activity where information about drug use is transferred, and includes patient related aspects of pharmaceutical care.

Poison information:

- → Poison information is a specialised area of drug information which includes information about the toxic effects of chemicals and pesticides, hazardous material spills, household products, overdose, of therapeutic medicines including mushrooms, animal toxins from bites of snakes, spiders and other venomous creature and stings

Goals

- To prevent patient from poisoning effect of drugs or animals
- To provide appropriate and exact drug to patient to increase the therapeutic effect.

Procedure

- ➢ The pharmacist should get information about the drugs are going to be administered.
- ➢ The physician can consult the pharmacist about drug and poisons information.
- ➢ Pharmacist can get these information from manufacturers through leaflet or electronic medium or any other authentic sources.

Medication history

- → Medication history is a detailed, accurate, and complete information of all the prescribed and nonprescribed medications that a patient had taken or currently taking in a hospital, ambulatory, or OP care.
- → It identifies patient's needs and helps to improve the efficiency of medication by rendering medication errors and concerns of illness and treatment.

Goals

- It provides the patient's previous History which helps the physician for choosing appropriate drug therapy.
- It can reduce drug reaction , (if patient is staking a drug before).
- It provides an information about drug related allergies.

Procedure

- ➢ Pharmacist should introduce himself to patient.
- ➢ He should get details on diseases , prescribed and non prescribed treatment. and record all the information.
- ➢ He should notice the duration of therapy.
- ➢ He should understand the patient's behaviour regarding taking drug

Patient counselling

- → Patient counseling is defined to the process of providing information, advice and assistance to help patients use their medications.
- → Counseling patients regarding their medications is an important responsibility for pharmacists and an excellent learning opportunity for students.
- → Pharmacists are often the only health care providers focusing patient education on medication: how to take it, what to expect, and side effects and drug interactions.
- → Many pharmacists have been trained to use a counseling method developed by the Indian Health Service (IHS)

Goals

- To provide a better knowledge to the patient about disease and drugs.
- To make treatment more effective.
- To reduce chances of drug reaction.

Procedure

- ➢ **Preparation for Counselling session :** In this stage pharmacist collects information about patients disease and the drugs prescribed for patients.
- ➢ **Opening Session :** In this stage Pharmacist start taking with patients and ask questions , to know their understanding about disease.
- ➢ **Counselleng Content :** In this session Pharmacist gives information to the patients or their attendant orally or in written form regarding proper use of medications.
- ➢ **Closing Session :** In this session Pharmacist get Feedback , to know if patients have any doubt

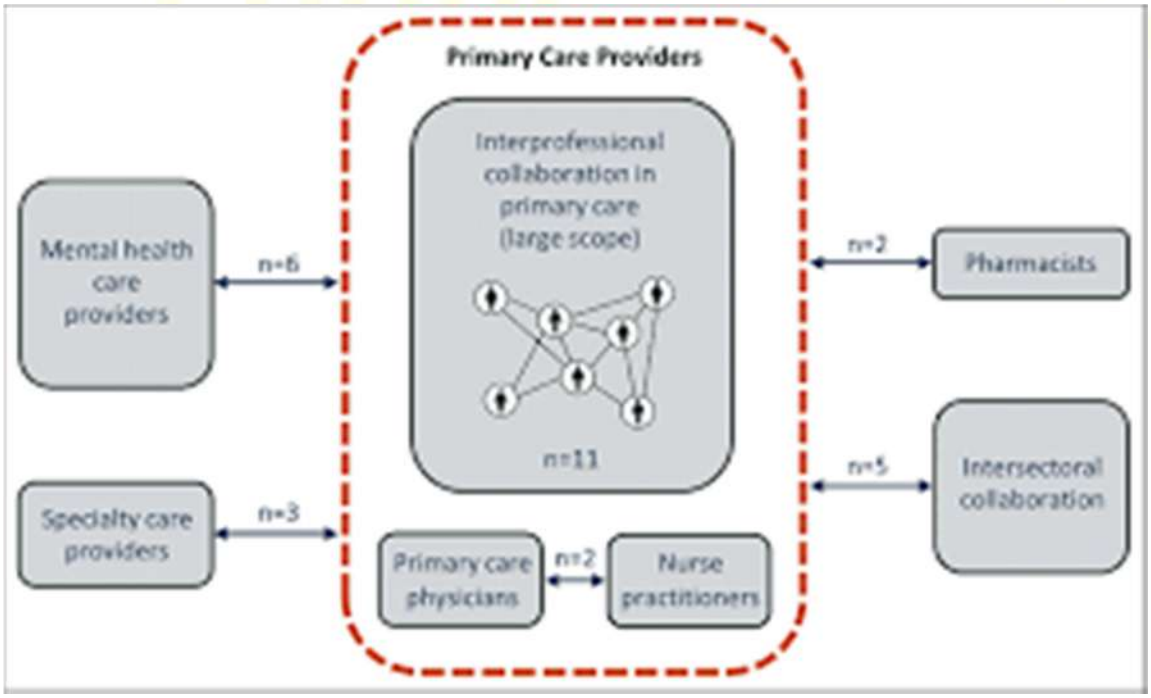
Interprofessional Collaboration

- → Interprofessional collaboration occurs when 2 or more professions work together to achieve common goals and is often used as a means for solving a variety of problems and complex issues.
- → The benefits of collaboration allow participants to achieve together more than they can individually, serve larger groups of people, and grow on individual and organizational levels.

Goal

- The goal of interprofessional collaboration is to improve patient care and outcomes by bringing together healthcare professionals from different disciplines to work together as a team.
- By leveraging the knowledge and expertise of each team member, interprofessional collaboration aims to deliver comprehensive and coordinated care that addresses the physical, emotional, and social needs of the patient.

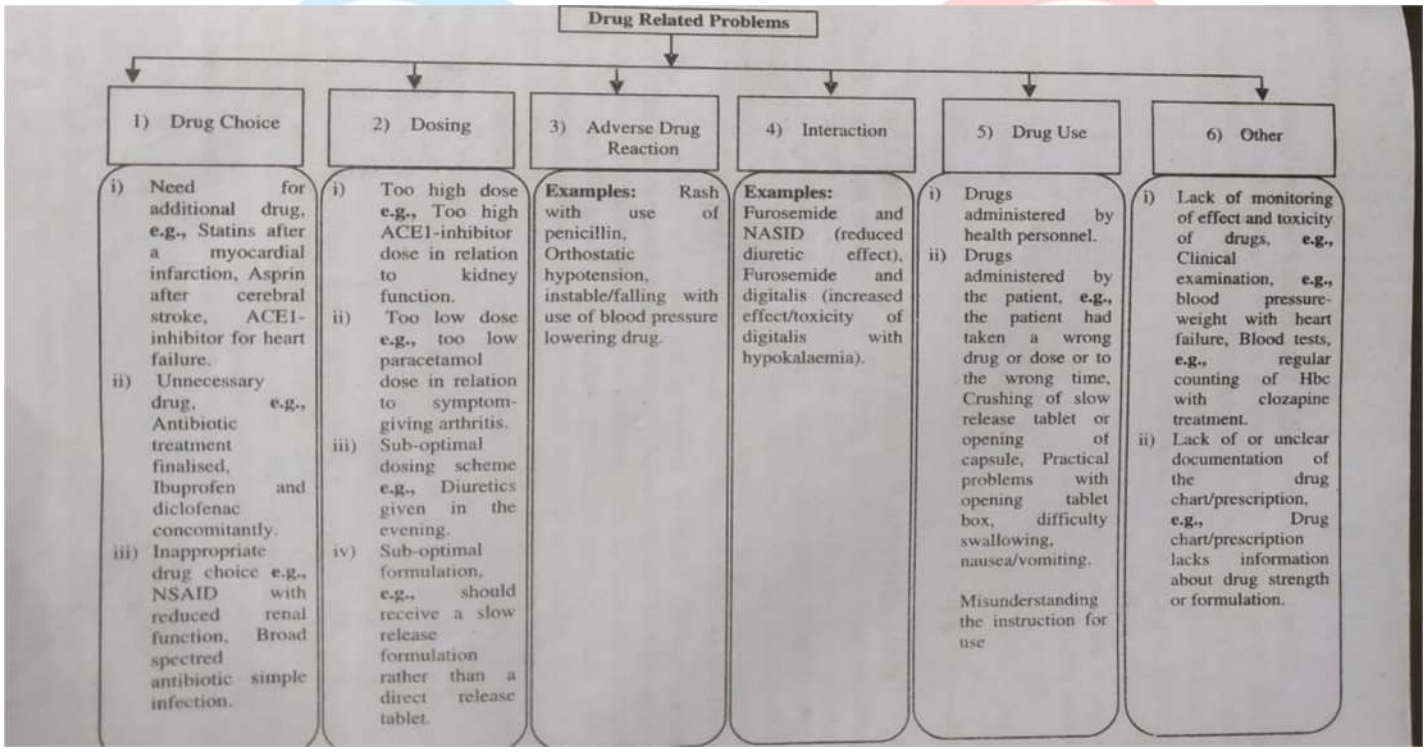
Procedure



Pharmaceutical Care

→ Pharmaceutical care is specific services and activities by which pharmacist Cooperates with a patients and other Healthcare professionals in designing , Implementing , monitoring a therapeutic plan to produce best therapeutic outcomes (results) for patients

Classification of Drug Related Problems (DRPs)



Principles to provide pharmaceutical care

- Knowledge and skillful staffs.
- Equipment and Resources.
- Communication skill
- Proper data collection and documentation system.
- Collaboration with patient and other healthcare Professionals.
- Effective workflow management.

Procedure to Provide Pharmaceutical Care

- Interaction with patient must be maintained to get patient's important information.
- Patient' s medical information should be collected and a record should be maintained.
- Evaluation(Check out) of medical information Collected by patient.
- Formation of Therapeutic Plan.
- Determination of patient' s Consent that patient is ready or not for the therapy planned for him/ her.
- Implementation of Plane.
- Pharmacist Reviews , Monitoring , and modification of therapeutic plan if needs.

Medication therapy Management (MTM)

→ MTM is a set of services provided by a pharmacist which maximizes the therapeutic results for Certain patients , through using safe and effective Medication.

→ MTM promotes Collaboration between the pharmacist , patient and Prescriber for better therapeutic outcomes.

Goals

- To Solve medication related problems.
- To reduce adverse drug effects.
- To help those patients who have multiple healthcare problems , and taking multiple medication and require a close monitoring , and have queries regarding medication.

Home Medication Review

→ A program, called Home Drug Review (HMR), was created to help consumers who live at home make the most of their medication regimen and avoid medication-related issues.

→ It is a customer-focused, organised, and cooperative service provided to customers living at home in the community.

→ HMR takes a collaborative approach, including the patient, their general practitioner, their pharmacist, and other pertinent healthcare professionals in a thorough examination of drugs used at home.

Goals

- To improve patients medication Knowledge.
- To reduce the adverse drug effects.
- To solve the patient's drug related queries.

Need of HMR

✓ Takes maore than five medication per day.

✓ He forgets to take medication or has some confusion.

✓ Requires a close monitoring.

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Hospital & Clinical Pharmacy
Chapter 9 : Clinical Laboratory Tests

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Chapter 9
Clinical Laboratory Tests

- In diagnosis, monitoring and screening, clinical laboratory test results are a very essential parameter, 70-80% of judgements in diagnosis are based on the laboratory results and analyses.
- Hence, various data are delivered, and it is important for patient care and safety that the doctors are aware with the laboratory tests and clarification of results.
- The laboratory test results also have a role in delivering suitable information to the clinicians that can help them in the precise interpretation of the data.

Haematological Tests

- A hematological test is a blood test. Any test that requires blood or blood parts is a hematological test. These tests can offer information to a doctor about what is happening in the blood. The most common hematological tests include :

1. Haemoglobin Test : (Hb test)

- This Test is performed to check Haemoglobine level of the body.

Normal Range

- Male : 13.2 to 16.6 g/dl
- Female : 11.6 to 15 g /dl
- Children 6-12 years : 11.2 to 14.5 g /dl

Significance and Interpretation

- Normal level is necessary for enough oxygen supply to tissues and transport of CO_2 to lungs .
- Low level than normal range indicates Anaemia , Leukemia . and High level of haemoglobin indicates polycythemia .(High concentration of RBCs).

2. RBCs Count

- RBCs Contain Haemoglobin which transports O_2 and CO_2 , it hlps in Blood clotting . This Test is performed to check Count of RBCs in blood.

Normal range Male

- 4.5- 5.5 million/mm3
- Female : 3.5 - 5.5 million /mm3
- Children : 4.0-5.5 Million /mm3

Significance and Interpretation

- Low level of RBCs than normal range in blood indicates Anaemia and leukemia.
- High rage of RBCs indicates Polycythemia.

3. Hematocrit (Hct)

- This test Indicates percentage of RBCs in whole blood sample.
- For example 40% Hct indicates that a 100ml sample has 40ml of red blood cells.

Normal range

- Male : 40-50%
- Female : 37 - 47 %

Significance and Interpretation

- Two small and same quantities of blood samples are compared. One sample is centrifuged and compared to the first sample to obtain a percentage value.
- This comparison is the Hct value. If the Het value is abnormal, the RBC count may also be abnormal.
- If the RBC count is normal, the average size of RBC will possibly be too small. Shock, dehydration, haemorrhage, or excessive IV fluid administration can decrease the value of Hct.

4. White Blood Cell or Total Leucocyte Count (TLC)

- This test is performed to check conditions like : Infection , allergic reaction , Inflammation , Blood cancer (leukemia)

Normal Range

- Male : 4500 to 11000 / ml
- Female : 4500 to 11000 / ml

Significance and Interpretation

- High Level of WBCs indicates Infection like(Appendicitis (inflammation of appendix) , Leukemia , Pneumonia , , meningitis etc.) Allergic reaction , Inflammation , Blood cancer.
- High level may be due to theses reason also : Certain drugs (antibiotics) ,Smoking , Removal of spleen , blood cancer , Inflammation.
- Low level of WBCs is called Leucopenia it indicates typhoid , Hepatitis , influenza , measles , anxiety.
- Low level of WBCs is may be due to these reasons also Bone marrow problems , Cancer treatment , certain viral illness etc.

5. Erythrocyte Sedimentation Rate (ESR)

- It indicates the rate at which eryrocytes sediment (settle) to the bottom , this rate of settlement is called RSR . the distance they cover in 1 hour is recorded.

Normal range

- Male : 0-15 mm/hr
- Female : 0-20 mm/hr

Significance and Interpretation

- This test is performed to estimate inflammation in body , or infection . if it is more than normal range indicates Inflammation in the body.

6. Platelets Count

- They are necessary for blood clotting.

Normal range

- 1.5 lac to 4.5 lac

Significance and Interpretation

- This test is performed to check number of platelets . and before surgery procedure this test is performed
- Low range than normal indicates bone marrow problems , leukemia , or infection such as Hepatitis C , Dengue fever , Chikungunya , HIV . etc a minor reduction occurs in pregnancy.
- High count of Platelets indicates Bleeding , Cancer, iron Deficiency ,bone marrow problems

7. Coagulation or Blood Clotting Time

- This test indicates the time blood takes to clot.

Normal Range

- Slide method : 2-6 minutes
- Capillary method : 2-6 minutes

Significance and Interpretation

- Increased clotting time indicates Haemopholia , Vitamin K Deficiency , increased heparin level and pneumonia.

Liver Function Tests (LFT Test)

- → Liver function test is performed to estimate the dysfunctions of liver
- → Several testes are performed under liver function test.
- → Like
    - Serum Bilirubin ,
    - serum (Plasma) proteins ,
    - Alkaline Phosphatase (ALP) ,
    - Serum Glutamic Oxaloacetic transaminase (SGOT) or Aspartate transaminase (AST),
    - Serum Glutamate Pyruvate Transaminase (ALT) etc.

1. Serum Bilirubin

- ➢ It is the breakdown product of haemoglobin and is the major pigment in bile.

Normal Range

- Total serum bilirubin is 0.3-1.3 mg/dL.
- and that of direct bilirubin 0.1-0.4 mg/dL..

Significance and Interpretation

- ⮝ Increased level of bilirubin indicates jaundice
- ⮝ Increased level of total bilirubin indicates haemolysis.

2. Serum (plasma) Protein

- ➢ Albumins and globulins proteins are major protein of plasma and produced by Liver.

Normal Range

- Albumins : 3.5-5.1 gm/dl
- Globulins : 1.8-3.1 gm /dl

Significance and Interpretation

- ⮝ Increased level indicates dehydration Liver problems .
- ⮝ Deceased level Indicate Oedema, haemorrhage , Increased protein break down .

3. Alkaline Phosphatase (ALP)

- ➢ This enzyme produced in liver , bones , small intestine and kidneys , It catalyses splitting of phosphate group from monophosphoric ester.

Normal range

- 29-92 IU/L

Significance and Interpretation

- ⮝ High level indicates Rikets , Osteomlacia , abnormal absorption of vitamin D .
- ⮝ Low level indicates Hypophosphatacia .

4. Serum Glutamic Oxaloacetic transaminase (SGOT) or Aspartate transaminase (AST)

- This enzyme is produced by liver and it helps in energy production.

Normal range

- 0.40 U/L

Significance and Interpretation

- Increased level of SGOT indicates liver disease (hepatitis , cirrhosis)

5. Serum Glutamate Pyruvate Transaminase (ALT)

- This enzyme produced by liver and helps in formation of alanine.

Normal Range

- 5-36 U/L

Significance and Interpretation

- Its increased level indicates Liver cell damage.

6. Serum Cholesterol test(Lipid Profile)

- This test is performed to check triglyceride and Cholesterol level in blood.

Normal Range

- Total cholesterol level is < 200 mg /dl
- LDL cholesterol level < 100 mg/dl
- HDL Cholesterol level is equal or more than 60 mg/dl
- Triglycerides level is < 150 mg/dl

Significance and Interpretation

- Increased level of LDL and triglyceride indicates the risk of heart diseases , blockage of arteries.

Renal Function Tests (KFT Test)

→ Kidney or renal function tests are performed using urine (and some test a re performed using blood like urea clearance test) , and the presence of different substances in abnormal amount in urine or in blood indicates the kidney problems .

Physical examination of urine

- Colour
- Odour
- pH (4.5-8)
- Turbidity

Chemical examination of Urine

1. **Proteins :** Globulin less than 5 mg/dl and albuline less than 30 mg/dl .
2. **Abnormal Glucose level :** Normal is 0-0.8 mmol /L .
3. **Ketone Bodies :** Under normal condition , < 1 mg of Ketone Bodies is excreted in 24 hours .
4. **Blood :** blood in urine indicates Sore of kidneys , UTI and nephritis .
5. **Urine Osmolality Test :** Urine osmolality is the number of dissolved particles in urine(creatinine , urea, potassium , sodium etc.) . Normal Range : 500-850 mOsm/kg . Significance : Increased level indicates Kidney problems and congestive heart failure . and cause dehydration.
6. **Urine Concentration Test :** kidneys maintain the osmolarity of body fluid (290-300 mOsmol/L) , and excrete urine with average 500-850 mOsm/l normally

Some blood sample test are performed to Evaluate kidney function.

1) Blood Urea nitrogen test (BUN)

➢ Urea is obtained as a by-Product of protein metabolism . It is formed in liver and excreted out in urine through filtration of blood by kidneys.

Normal range

- 10-12mg /dl

Significance and Interpretation

➢ Increased level of Blood urea nitrogen indicates kidney problems.

2) Creatinine Test

➢ Creatinine is a waste product of body metabolism which present in blood excreted out by Kidneys.

Normal Range

- Creatinine in blood 1-2mg/dl or 0.6-1.2 mg/dl

Significance and Interpretation

➢ Increased level in blood and low level in urine indicates kidneys dysfunction.

3) Creatinine Clearance Test

- This test shows the ability of kidneys to clear(Excrete out) creatinine from blood through urine. In this test 24 hours collected urine sample is taken. along this test blood creatinine level also examined.

Normal Range

- of Creatinine clearance /min in urine in
- adult men : 90-139 ml/min In adult
- women : 80- 125 ml / min

Significance and Interpretation

- Lower than normal creatinine excretion indicates the kidney problems.

4) Urea Clearance test

- This test is also performed to check the kidneys functions . In this test using blood , the amount of urea in blood Checked , and along with two urine sample are collected with a gap of one hour to determine the amount of urea filtered by the kidneys into urine.

Normal Range

- of urea clearance
- 12-20 gm/24 hours

Significance and Interpretation

- Low level of urea than normal range indicates kidney problems , Protein deficiency in diet.
- High level than normal range indicates excessive protein metabolism , or too much protein intake in diet.

Thyroid Function Tests (TFT test)

→ There are many different blood tests which are performed to check thyroid gland functioning .

→ some of them are following

1) TSH (thyroid stimulating Hormone) test

- This test is performed using blood to check Level of TSH pituitary gland makes this hormone which stimulates the thyroid gland to produce thyroid hormones

Normal range

- of TSH in blood 0.5 - 5.0 mU/L

Significance and Interpretation

- High level than normal indicates low production of thyroid hormone (primary Hypothyrodism),
- low level of TSH indicates too much thyroid hormone production (Hyperthyrodism).

2) T3 or Triiodothyronine test

- This test is used to check production level of thyroid hormone T3 in blood.

Normal range

- 100- 200 ng /dl

Significance and Interpretation

- High level indicates Hyperthyrodism , when low level indicates Hypothyrodism.

3) T4 or thyroxine Test

- It is also a Thyroid hormone , it is found in two forms free and bounded with proteins,

Normal range

- of T4 (free and bounded with protein) for
- adult 5.0-11.0 ng/dl

Significance and Interpretation

- High TSH and low T4 indicates the Hypothyrodism (due to problems in thyroid gland) ,
- Normal TSH and High T4 indicates Hyperthyrodism (due to problems in thyroid gland)

Tests associated with Cardiac Disorders

→ Many different tests are used to diagnose heart disease. Besides blood tests and a chest X-ray, tests to diagnose heart disease can include :

- **Electrocardiogram (ECG or EKG) :** This test measures the electrical activity of the heart and can detect abnormal heart rhythms, damage to the heart muscle, and other problems.
- **Echocardiogram :** This is an ultrasound test that uses sound waves to create images of the heart. It can be used to evaluate the size and shape of the heart, the thickness of the heart muscle, and the function of the heart valves.
- **Stress test :** This test involves exercising the heart to see how it responds. It can be done on a treadmill or with medication. It can be used to detect problems with blood flow to the heart or abnormal heart rhythms.
- **Cardiac catheterization :** This test involves inserting a thin, flexible tube (catheter) into a blood vessel in the arm or leg and guiding it to the heart. It can be used to diagnose blockages in the coronary arteries or to measure pressures within the heart.
- **Holter monitor :** This is a portable device that records the heart's electrical activity over a period of 24-48 hours. It can be used to detect abnormal heart rhythms that may not show up on a regular ECG.
- **Cardiac MRI :** This test uses a powerful magnetic field and radio waves to create detailed images of the heart. It can be used to evaluate the size and function of the heart and to detect problems such as blockages or damage to the heart muscle.
- **CT scan :** This test uses X-rays to create detailed images of the heart and blood vessels. It can be used to detect blockages in the coronary arteries or to evaluate the size and function of the heart

Fluid and Electrolyte Balance

- About 56% of adult human body is fluid. Although most of this fluid is inside the cells and is called intracellular fluid; about one-third is in the space outside the cells and is called extracellular fluid.
- The extracellular fluid has ions and nutrients needed by the cells for maintenance of life. Therefore, all the cells essentially live in the same environment. i.e.. extracellular fluid. This is the reason that extracellular fluid is called internal environment of the body.
- Around 60-70% of the volume of body is water. Fluids in the body are solutions of organic and inorganic solutes which undergo distribution in the following
- Major fluid compartments :
    - Interstitial fluid,
    - Vascular fluid or plasma fluid, and
    - Intracellular fluid.

1. Osmolarity of Body Fluids

- This test is performed to check level of Water in Body fluid or fluid balance.

Normal Range

- 275 - 300 mmole /Kg

Significance and Interpretation

- High Osmolarity than normal range of body fluid Indicates dehydration which causes many of body function problems .
- Low Osmolarity than normal range of body fluid indicates water intoxication (Nausea , fatigue , Headache , seizure)

2. Serum Electrolyte test

- This test is performed to check the amount of electrolytes of blood . They are important to balance water in body fluids.

Normal range

- Sodium : 136 - 145 m moles /L
- Potassium : 3.5 to 5 m moles/L
- Chloride : 98 to 106 m moles/L

Significance and Interpretation

- High level than normal range indicates
- Sodium : Hypernatremia
- Potassium : Hyperkalemia
- Chloride : Hyperchloremia
-

Pulmonary Function Tests

- Pulmonary Function Tests (PFTs) are a group of diagnostic tests used to evaluate the function of the lungs. These tests can help diagnose a range of respiratory conditions and can help monitor the progression of lung disease.
- The most common types of PFTs include :
  - **Spirometry :** This test measures the amount of air a person can inhale and exhale, and how quickly they can do it. It can help diagnose conditions such as asthma and chronic obstructive pulmonary disease (COPD).
  - **Lung volume measurements :** These tests measure the amount of air in the lungs, both when they are full and when they are empty. They can help diagnose conditions such as interstitial lung disease and sarcoidosis.
  - **Diffusion capacity :** This test measures how easily oxygen passes from the lungs into the bloodstream. It can help diagnose conditions such as pulmonary fibrosis and emphysema.
  - **Exercise testing :** This test measures how well the lungs function during physical activity. It can help diagnose conditions such as exercise-induced asthma and evaluate the effectiveness of treatments

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Chapter 10 : Poisoning

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Chapter 10
Poisoning

- → Poison: Poison is a substance which when consumed , Inhaled , applied to skin , injected or created within body and produces a harm effect to the body . It may be heavy metals, Drugs , animal poisons and Bacterial Contaminated food or drink .
- → A Poison change the cellular metabolism and chemical activity and damage the cell from functioning and then diseases and death occurs .
- → Poisoning : injury or death of cell due to poison is called poisoning It may be acute or chronic .
- → Antidotes : antidote is a substance which neutralise the poison and reduce its harm effects to the body .

Types

- **Physiological Antidote :** It Counteracts the poison effects by Producing opposite Effects For example caffeine is used in morphine Poisoning .
- **Chemical antidotes :** It change the chemical nature of Poison For example Sodium Thiosulphate is used in Cyanide Poisoning .
- **Mechanical Antidote :** It prevents the absorption of poison in the body , For example Kaolin and Charcoal absorb the poison and prevent absorption into body , albumin of eggs , it makes a layer on intestine lining and prevent absorption .

General Principles of Poisoning treatment

1) Removal of Unabsorbed Poison
2) Removal of Absorbed poison
3) Antidotes

Removal of Unabsorbed Poison

1) **Emetics :** 15 g of Sodium Chloride (salt) dissolved in a glass of wa ter and given to patient to produce Vomiting . and this process should be repeated till vomiting .
   - If it fails 1-2 g of ipecacunha powder is given , if it does not work Apomorphine hydrochloride injection is given but it does not given in morphine Poisoning .
2) **Diarrhoea :** this method is used to remove the poison from GIT through stool Sodium Bicarbonate solution 5% w/v , other purgatives can be used .

Removal of absorbed Poisoning

- Diuretics are used to remove absorbed poison.

Removal of Gaseous Poison (Carbon monoxide)

- Fresh air and O_2 is used to remove gaseous poison , Ventilator can be used.

Types of Poisoning : Clinical Manifestation & Antidotes

1) Food Poisoning

→ This type of poisoning Occurs due to microorganism which are enter in the body with food or Beverages .

Clinical Manifestation

- Cramping in stomach
- Vomiting
- Loss of appetite
- Fever
- Fatigue
- Headache

Antidotes

- Antibiotics are used according to specific microorganism .

2) Insecticide Poisoning

→ Insecticides are substances used for destroying insects like :

- Organochlorine insecticides e.g. Chlordane , Heptachlore , DDT (Dichlorodiphenyltrichloroethane)
- Organophosphorus
- Carbamate

Clinical manifestation

- Abnormal sensation in tongue , lips , face
- Dizziness and tremor
- Convulsion

Antidotes

- Atropine
- Parlidoxime

3) Snake Bites

→ Snakes have Poisonous gland on both side of Head , their saliva is venom (poison) which is a complex mixture of proteins and enzymes :

→ Which are following

- Neurotoxin-A (it affects cardiac and respiratory center and central nervous system .
- Neurotoxin-B (it causes paralysis)
- Enzymes (Cholinestrase , Phosphatase etc.

Clinical Manifestation

- Two puncture Wounds
- loss of sensation of face .
- Increased heart rate
- Blurred vision and headache
- Excessive sweating
- Vomiting
- Unconsciousness
- Diarrhoea
- Fever
- Convulsion

Antidotes

- Antibiotics : Q6H IV ampicillin , Doxacillin and me tronidazole should be given
- Atropine 1.2 mg and neostigmine are given to remove Paralysis .
- Snake Venom Antiserum I.P.

4) Narcotic Drug Poisoning

→ The poisoning occurs due to overdoes of opioid Drugs is called Opium Poisoning.

Clinical Manifestation

- Excitation : restlessness , Redness of face , heart rate Increased .
- Stupor : starts unconscious , headache , Fatigue , Contraction of eye pupils
- Coma : muscles becomes relaxed , reflexes stopped , respiration depressed and pulse becomes very slow

Antidotes

- If it is confirm that the poisoning is due to opiates Nalorphine injection is given I.V . route.
- The patient's body be kept warm .
- CNS stimulant should be given like Nikethamide (Coramine)

Drugs and Poison Information Centre and their services

→ Drug Information and Poison Control Center is a source of authentic accurate unbiased and reliable source of information about drugs and poisons to health case professionals and common masses.

→ A Drugs and Poison Information Centre (DPIC) is a specialized facility that provides information about drugs and poisons to healthcare professionals, patients, and the general public. These centers serve as a valuable resource for education, prevention, and treatment of drug-related problems.

Objectives

- To provide independent, unbiased, authentic, accurate and objective drug information to assist health professionals in rational prescribing to optimize patient care.
- To advise general public regarding safe. effective and economic use of medicines.

Requirements

- Requirements for a Drugs and Poison Information Centre may vary depending on the country, but generally, it should have a team of experts, including pharmacists, toxicologists, and healthcare professionals with expertise in drug-related issues.
- The center should also have access to a comprehensive database of information on drugs and poisons, as well as the ability to perform research on drug-related issues.

Information resources

- Databases: DPICs often maintain their own databases of information on drugs and poisons. These databases may include information on the pharmacology of drugs, their toxicology, interactions, side effects, and dosing guidelines.
- Online resources: DPICs may also offer online resources, such as websites, apps, or chatbots, where people can access information about drugs and poisons.
- Phone helplines: Many DPICs offer phone helplines that people can call to speak with a healthcare professional or pharmacist about drug-related issues

Advantages

- ✓ **Increased patient safety :** DPICs can provide healthcare professionals with up-to-date information about drug-related issues, including drug interactions and adverse effects, which can help to prevent adverse drug reactions and improve patient safety.
- ✓ **Improved education :** DPICs can provide education and training to healthcare professionals and patients, helping to improve their understanding of drug-related issues.
- ✓ **Timely information :** DPICs can provide information quickly in the event of a drug or poisonrelated emergency.

Disadvantages

- **Cost:** Setting up and maintaining a DPIC can be expensive.
- **Limited availability :** DPICs may not be available in all areas, which can limit access to information about drugs and poisons for some people.
- **Limited scope :** DPICs may not have the resources to cover all drugs and poisons, which can limit the scope of their services.

Services

- Services offered by the DIPCC at Department of Pharmacy, University of Peshawar
- Choice of Therapy.
- Medicine Dose.
- Duration of Therapy.
- Drug Identification.
- Therapeutic Alternatives.
- Drug Interactions & Their Management.
- Drug Contraindicated in Pregnancy, During Lactation.
- Dose Adjustment in Hepatic and Renal Impairment.
- Drug Updates, Withdrawals, ADRs, Antibiotic Resistance, Novel Dosage Forms and Delivery Systems.
- Information on Reconstitution, Dilution, Stabilities and Rate Calculations of Parenterals.
- Mode of Drug Administration.
- Special Drug Related Precautions/Warnings.
- Poisoning Prevention Strategies.
- Poison Management Information (Identification, Diagnostic Tests, Absorption Minimizing Techniques, Elimination Enhancement Techniques, Antidotes Availability and Administration

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Diploma in Pharmacy 2nd Year
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Chapter 11 : Pharmacovigilance

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Chapter 11
Pharmacovigilance

- → Pharmacovigilance is made up of Two words one Greek word
- → " Pharmcon " = Drug or medical substance , and
- → second Latin word " Vigilare "= To keep watch
- → According to WHO Pharmacovigilance is defined as " the science and activities relating to the detection, assessment, understanding, and prevention of adverse effect or any other drug related problem".

Aim

- To make the treatment of a patient effective.
- To improve the patient care and safety related with the use of medicine and all medical and Paramedical intervention (The activities done by a non fully qualified doctor to support medical treatment like ultrasound CBC).
- To improve the public health and safety related to use of medicine.
- For early detection of adverse drug reaction.
- For Identification of risk factors.

Scope of Pharmacovigilance

- ➢ **Patient Monitoring :** The person has knowledge of pharmacovigilance can provide his services in hospital for monitoring the patients
- ➢ **Immunization(vaccination) :** Pharmacovigilance plays an important role in vaccination because there are some certain vaccines which show serious adverse reaction so a person has knowledge of pharmacovigilance , required to monitor and control the adverse reactions
- ➢ **Herbal Medicine :** Safety and efficacy of herbal medicine is necessary so pharmacovigilance required in herbal medicine practice
- ➢ **Disease Control Public Health Program :** The person has knowledge of pharmacovigilance can take a part in disease control programs to aware the public about safety and proper use of medicine to prevent adverse drug reaction
- ➢ **Academy :** A person has pharmacovigilance knowledge can go in academic field

Pharmacovigilance in India

- In India pharmacovigilance was introduced in 1986 with the formal introduction of adverse drug reaction monitoring system , under the guidance of drug controller
- At that time there was only 12 main centre and district and primary Health care hospitals were affiliated to these main centres.
- In 1997 India become a part of WHO program for international drug monitoring
- On first January 2005 WHO sponsored and World Bank funded and National Pharmacovigilance Program of India, was started .

Overview of Pharmacovigilance

- The overall objective as per the National Pharmacovigilance Programme will be:
- To monitor safety of the drugs and provide structured inputs for appropriate regulatory interventions
- To create awareness about ADR monitoring in India
- Regional centres will be the secondary pharmacovigilance centres under the National Pharmacovigilance Programme.
- To carry out the functions as envisaged in the "Protocol for the National Pharmacovigilance Programme" a Coordinator will have to be designated who will be in-charge of the pharmacovigilance activities at the designated regional centre.
- By accepting to participate in the National Pharmacovigilance Programme all centres explicitly agree that all pharmacovigilance activities at their institutions shall be performed in strict consonance with the National Pharmacovigilance Programme appended here (Coordinators of the centres and heads of the institutions are advised to carefully go through the Protocol prior to joining the programme).

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Chapter 12 : Medication Errors and Drug Interaction

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Chapter 12
Medication Errors and Drug Interaction

Medication errors

→ A medication error is any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer.

→ Such events may be related to professional practice, health care products, procedures, and systems, including prescribing, order communication, product labeling, packaging, and nomenclature, compounding, dispensing, distribution, administration, education, monitoring, and use.

Types of Medication Errors

- **Prescribing Error :** This error occurs when due to mistake of prescriber (Doctor) , such as wrong drug , dosage , administration route etc.
- **Omission Error :** This error occurs when patient is not given a scheduled prescribed drug in health care control , like hospit al , nursing home etc.
- **Improper Dose Error :** This error occurs when a patient is given a higher or lower dose in comparison to prescribed dose.
- **Deteriorated (Expired) Drug error :** This error occurs when expired drug is administrated .
- **Prescription Filling(Dispensing) Error :** This error occurs when drugs are not dispensed properly according to the prescription.
- **Unauthorised Drug error :** This error occurs when patient is given a medication without consent(willing) of prescriber.
- **Wrong Time Error :** This error occurs when drug is not administered at appropriate time . (too soon or too late)
- **Wrong dosage Error**
- **Wrong drug preparation error**
- **Wrong administration technique error**
- **Monitoring Error**
- **Compliance Error :** This error occurs when patient do not complete a prescribed medication course.

Consequences

→ Medical errors can have serious consequences for patients, their families, and healthcare providers. Here are some of the consequences of medical errors:

- **Patient harm or death :** Medical errors can cause physical harm, emotional trauma, or even death to patients.
- **Longer hospital stays :** Medical errors can result in extended hospital stays, increasing healthcare costs, and delaying the recovery process.
- **Increased healthcare costs :** Medical errors can lead to additional medical interventions, prolonged hospital stays, and increased healthcare costs.
- **Loss of trust :** Patients may lose trust in their healthcare providers or the healthcare system as a whole due to medical errors.
- **Legal consequences :** Medical errors can result in malpractice claims, lawsuits, and legal actions against healthcare providers or institutions.
- **Psychological impact :** Medical errors can cause emotional trauma, stress, anxiety, or depression for patients, their families, and healthcare providers.
- **Reputation damage :** Medical errors can damage the reputation of healthcare providers or institutions, leading to loss of business or negative publicity

Strategies to Minimize Medication Error

- ✓ Separate prescription should be written for each medication
- ✓ Before signing the prescription the prescriber should recheck every parts of the prescription
- ✓ Abbreviation of drug names should be avoided
- ✓ The patient age should be mentioned in the prescription
- ✓ The pharmacist should read the prescription carefully and should follow every steps of dispensing of the drugs
- ✓ The pharmacist should check, if the doges are adequate or not , according to patient age
- ✓ The nurses Should administered the right drug to the right patient in right dose at right time.
- ✓ Multitask should be avoided during prescribing dispensing and administrating the drug.
- ✓ The health care professional should be stress free
- ✓ The workload of healthcare professionals should be in limit
- ✓ LASA drugs should be handled carefully
- ✓ Prescriber should write the prescription himself and should avoid dictation

LASA drugs

- → LASA" stands for "Look-Alike-Sound-Alike" drugs, which are medications that have similar names or packaging but differ in their active ingredients or dosages.
- → Look Alike Sound Alike (LASA) medications involve medications that are visually similar in physical appearance or packaging and names of medications that have spelling similarities and/or similar phonetics
- → This can lead to medication errors if healthcare providers or patients mistake one drug for another.
- → To prevent medication errors with LASA drugs, healthcare providers should always double-check the medication name and dosage before administering or prescribing it, and patients should always confirm with their healthcare provider or pharmacist that they have received the correct medication.
- → In addition, it's important to store medications in their original packaging and to keep a current list of all medications, including their names, dosages, and purposes.
- → Common Risk Factors Common risk factors associated with LASA medications includes:
    - Illegible handwriting
    - Incomplete knowledge of drug names
    - Newly available products
    - Similar packaging or labelling
    - Similar strengths, dosage forms, frequency of administration
    - Similar clinical use

Strategies to avoid errors with Look Alike Sound Alike Medications

- Procurement
- Storage
- Prescribing
- Dispensing/ Supply
- Administration
- Monitoring
- Information
- Patient Education
- Evaluation

Tallman lettering as per ISMP

- → The term " Tall Man Lettering " is discovered by the Institute for Safe Medication Practices (ISMP).
- → Tall Man Lettering is a technique to differentiate (distinguish) the similar drug names and cause mistake during dispensing , handling administrating.
- → In this technique the main part of the drug names is written in Upper Case Lettering (In Capital letter) and the parts of the drug names similar to the other drug names are written in Lower Case (Small letter).
- → This technique highlights the distinctive part of the drug names and reduces the chances of mistake.

Examples Drug

Name with Tall Man Letters	Confused with
chloproMAZINE	chlorproPAMIDE
DOPamine	DOBUTamine
cycloSPORINE	cycloSERINE
vinBLAStine	vinCRIStine

Drug Interactions

- → A drug interaction is a reaction between two (or more) drugs or between a drug and a food, beverage, or supplement.

Or

- → Drug Interaction is a condition in which an another drug or food affects the drug action (Increases or decreases the effect)
- → Taking a drug while having certain medical conditions can also cause a drug interaction. For example, taking a nasal decongestant if you have high blood pressure may cause an unwanted reaction

Types

1) Drug-Drug interaction
2) Drug-food Interaction Examples of Drug to drug Interaction

1) Drug-Drug interaction

Table 12.3: Analgesics

Analgesics	Interacting Drugs	Possible Effects
1) Opioids	Phenoxybenzamine	The depressor effect of opioids is exaggerated.
2) Salicylates	Alkalinisers and antacids	The serum levels of salicylate decreases as the renal reabsorption of salicylate from alkaline urine reduces.
3) Salicylates	Indomethacin	The serum level of indomethacin decreases due to inhibition of gastrointestinal absorption.
4) Salicylates	Acidifiers, ascorbic acid, and ammonium chloride	The serum levels of salicylate increases due to enhancement in the renal absorption of salicylate from acidic urine.
5) Salicylates	Heparin and warfarin	Aspirin inhibits platelet aggregation, thus giving rise to additive effect which causes bleeding.
6) Salicylates	Probenecid	The uricosuric activity of probenecid decreases as both compete for the same binding site (albumin molecule) on plasma.
7) Phenylbutazone	Tolbutamide	The hypoglycaemic response increases as tolbutamide metabolism is inhibited.

Table 12.8: Hypoglycaemic Drugs

Hypoglycaemic Drugs	Interacting Drugs	Possible Effects
1) Hypoglycaemic drug	Alcohol	The hypoglycaemic effect of alcohol causes hypoglycaemia.
2) Hypoglycaemic drug	Oral contraceptives	Glucose tolerance impairs.
3) Insulin	Propranolol	The insulin activity increases.
4) Sulfonylureas	Anticoagulant	The hypoglycaemic activity increases.
5) Sulfonylureas	Rifampin	Hypoglycaemia occurs due to increase in metabolism.

Table 12.4: Diuretics		
Diuretics	**Interacting Drugs**	**Possible Effects**
1) Furosemide, thiazides, and ethacrynic acid	Sulfonylureas	The effect of sulfonylureas antagonises due to depression of islets of Langerhans.
2) Thiazides	Methyldopa, guanethidine, and reserpine	The antihypertensive effects are increased by thiazides and this may cause hypotension.
3) Furosemide, thiazides, and ethacrynic acid	Digoxin	The cardiac effect and toxicity due to potassium depletion enhances.
4) Furosemide	Phenytoin	Response of furosemide decreases due to increase in sodium absorption.
5) Acetazolamide	Quinidine	The serum level of quinidine increases.
6) Spironolactone	Potassium chloride	Hyperkalaemia occurs as spironolactone is a potassium sparing diuretic.

Table 12.6: Gastrointestinal Drugs		
Gastrointestinal Drugs	**Interacting Drugs**	**Possible Effects**
1) Antacids	Aspirin	The absorption of aspirin decreases.
2) Magnesium carbonate and magnesium trisilicate	Digitalis glycoside	The absorption of cardiac glycosides decreases.
3) Aluminium hydroxide gel	Isoniazid	The absorption of isoniazid decreases.
4) Metoclopramide (antiemetic)	Levodopa	The absorption rate of levodopa decreases due to decrease in GIT motility.
5) Kaolin-pectin mixture	Digoxin	The absorption of digoxin decreases.

2) Drug-food Interaction Examples of Drug to drug Interaction

→ Drug-Food Interactions When a food/nutrient alters the effects of a drug, the alteration is considered a food-drug interaction. It can occur with prescription drugs, OTC drugs, herbal products, and dietary supplements

Table 12.9: Some Commonly Occurring Drug-Food Interactions

Drugs	Food/Nutrient	Interactions
Allopurinol	1) Avoid low protein diet de 2) Avoid low fluid content	1) A low protein diet will result in higher blood levels of this drug. 2) The individual should drink plenty of fluids while taking this drug.
Antacids: 1) Aluminium/Magnesium hydroxide/Simethicone 2) Aluminium carbonate basic 3) Aluminium hydroxide	Avoid high protein meals	High protein meals decrease the neutralising capacity of the antacid.
Calcium channel blockers: 1) Felodipine 2) Nifedipine 3) Amlodipine	Avoid grapefruit juice	Drinking grapefruit juice with this drug will result in higher than desired blood levels of the drug. These higher levels may be harmful and cause adverse effects.
Carbamazepine	Avoid grapefruit juice	Drinking grapefruit juice with this drug will result in higher than desired blood levels of the drug. These higher levels may be harmful and cause adverse effects.
Cephalosporins: 1) Cefotetan 2) Cefoperazone 3) Cefamandole 4) Cefmetazole 5) Moxalactam	Avoid alcoholic beverages	Drinking alcohol with these drugs can develop disulfiram reaction characterised by flushing, vomiting, rapid breathing, and rapid heart rate.
Disulfiram	Avoid alcoholic beverages	Drinking alcohol with this drug can develop disulfiram reaction characterised by flushing, vomiting, rapid breathing and heart rate.
Iron: 1) Ferrous sulphate 2) Ferrous gluconate	1) Consume foods rich in Vitamin C 2) Avoid dairy products with iron	1) These food items enhance the amount of iron the body absorbs. 2) Taking this drug with food reduces the amount of iron the body absorbs.
Fluoroquinolones: 1) Ciprofloxacin 2) Levofloxacin 3) Gatifloxacin 4) Sparfloxacin	Avoid calcium-rich foods, mineral supplements, and caffeine	These food items decrease the amount of drug the body absorbs, as they bind to form insoluble complexes.

Clinical significance of drug interactions

- **Decreased effectiveness :** When two drugs interact, the effectiveness of one or both medications may be reduced. This can result in a decreased therapeutic effect, which can lead to inadequate treatment of the underlying condition.
- **Increased toxicity :** Drug interactions can also result in an increased risk of adverse effects or toxicity. For example, when two drugs that are metabolized by the same enzyme are taken together, they may compete for the enzyme, leading to an accumulation of one or both drugs and an increased risk of toxicity.
- **Altered pharmacokinetics :** Drug interactions can also alter the pharmacokinetics (i.e., the way the drug is absorbed, distributed, metabolized, and eliminated) of one or both medications. This can result in changes in the blood levels of the drugs, which can affect their effectiveness and toxicity.
- **Potentiation :** Drug interactions can also result in a potentiation of the effects of one or both drugs. For example, when two drugs that have a similar effect on the central nervous system (such as two sedatives) are taken together, they may have a greater effect than when taken alone.

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